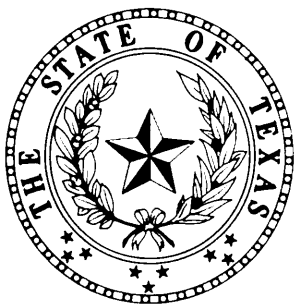
PLAN SUMMARY REPORT
for the
LOWER COLORADO BASIN
WATER QUALITY MANAGEMENT PLAN



Prepared by

LOWER COLORADO RIVER AUTHORITY

for

TEXAS DEPARTMENT OF WATER RESOURCES

June, 1978

Reprinted June, 1981 (with FY 1980 revisions)
as LP-167

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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.

LOWER COLORADO 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	
Austin (Williamson/Onion Creek Plant)	City of Austin (C/T)	45,000 (1979)		90,000 (1990)		X				X	X	
Bay City	City of Bay City (C/T)	21,500 (1978)	21,293 (1980)	27,290 (1990)	34,635 (2000)		X			X		
Carmine	City of Carmine (C/T)	225 (1977)	228 (1980)	260 (1990)	300 (2000)	X			X			
Goldthwaite	City of Goldthwaite (C/T)	1,740 (1975)	1,870 (1980)	2,176 (1990)	2,525 (2000)	X					X	
Lost Creek MUD	Lost Creek MUD (C/T)	620 (1977)	1,200 (1980)	3,761 (1990)	6,540 (2000)		X			X		
Marble Falls	City of Marble Falls (C/T)	3,226 (1978)	3,589 (1980)	4,316 (1990)	5,224 (2000)		X			X	X	
Palacios	City of Palacios (C/T)	3,700 (1975)	4,000 (1980)	5,000 (1990)	8,900 (2000)		X		X		X	
San Saba	City of San Saba (C/T)	2,555 (1970)	2,682 (1980)	2,940 (1990)	3,200 (2000)	X			X			
Tuscola	City of Tuscola (C/T)	596 (1970)	687 (1980)	771 (1990)	866 (2000)	X			X			

EXCERPT FROM

FISCAL YEAR 1980 REVISIONS

TO THE

STATE OF TEXAS WATER QUALITY MANAGEMENT PLANS

LOWER COLORADO BASIN

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

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.

PLAN SUMMARY REPORT

FOR THE

LOWER COLORADO BASIN

WATER QUALITY MANAGEMENT PLAN

Developed to satisfy the requirements of Section 208 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

LOWER COLORADO RIVER AUTHORITY

for

TEXAS DEPARTMENT OF WATER RESOURCES

June 1978

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CHAPTER A

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 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 consists of two primary documents:

1. Volume I. Basic Data Report includes information on existing wastewater treatment facilities; existing water quality; existing land-use patterns; existing population; and 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 Lower Colorado Basin, including Tres Palacios Creek and Tres Palacios Bay. It was developed through the efforts of the Lower Colorado River Authority, 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 content 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.

CHAPTER B

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.

1. 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.

Dissolved oxygen (DO) deficits are the most common water quality problem in the Colorado Basin. Only one stream segment (Pecan Bayou) has exhibited extensive DO problems. The following discussion will present in numerical order the water quality problems exhibited by each segment.

a. Segment 1401. The portion of the Colorado River which is tidally influenced (Segment 1401) exhibited a single water quality violation during water year 1973. On December 13, 1972, monitoring station 1401.01 located at FM 521 north of Matagorda exhibited a DO concentration of 4.7 mg/l. It was visually observed that the sample was collected under normal flow conditions, and the analysis of the water sample indicated that the other measured chemical parameters were within the normal range of ambient conditions. There were no noncompliant measurements recorded during water year 1972 or water years 1974 through 1977.

b. Segment 1403. Lake Austin (Segment 1403) exhibited one water quality violation during water years 1972 through 1975. On July 11, 1975, monitoring station 1403.03 located near the lake's headwaters at Lakeland Park exhibited a DO concentration of 3.6 mg/l. This same station recorded a noncompliant DO measurement of 3.8 mg/l in 1976 and two noncompliant DO measurements during 1977 of 4.8 mg/l and 1.8 mg/l.

c. Segment 1408. Segment 1408 consists of Lake Buchanan. During Water Year 1976, station 1408.03 located near the headwater exhibited an annual average chloride concentration of 110 mg/l. The stream standards for Segment 1408 specify a maximum annual average concentration of 100 mg/l. No noncompliant measurements had been recorded prior to water year 1976 and none were recorded during water year 1977.

d. Segment 1410. Segment 1410 of the Colorado River, located between the San Saba River confluence and E. V. Spence Reservoir, generally exhibited pH values that ranged from 7.0 to 8.5. However, on February 14, 1974, monitoring station 1410.01 located at SH 16 north of San Saba exhibited a noncompliant pH value of 8.8. No noncompliant pH values were recorded in this segment during water years 1975 through 1977, but on August 1, 1977, station 1410.03 recorded a noncompliant DO measurement of 4.8 mg/l.

e. Segment 1411. Segment 1411 consists of E. V. Spence Reservoir. During water years 1976 and 1977, station 1411.01 exhibited annual average chloride concentrations of 510 mg/l

and 605 mg/l, respectively. The stream standards for segment 1411 specify a maximum annual average chloride concentration of 500 mg/l. No noncompliant measurements had been recorded prior to water year 1976.

f. Segment 1412. Segment 1412 is the Colorado River between FM 2059 near Silver to Lake J. B. Thomas (Colorado River Dam). On July 6, 1976, station 1412.01 recorded a noncompliant DO measurement of 1.2 mg/l. There were no noncompliant measurements during water years 1972 through 1975 or in water year 1977.

g. Segment 1417. Pecan Bayou (Segment 1417) has exhibited extensive DO problems beginning as early as water year 1972. This segment exhibited fifteen DO violations prior to water year 1976 which ranged from 2.8 mg/l to 4.5 mg/l. Twelve of the fifteen DO violations were recorded at station 1417.01 located at FM 2126 southeast of Brownwood. The other three DO violations were exhibited by station 1417.02 located at US 77 at Brownwood. Station 1417.01 exhibited two low DO measurements of 4.3 mg/l and 2.5 mg/l during water year 1976, and another low DO measurement of 4.2 mg/l during water year 1977. Station 1417.02 exhibited a noncompliant pH value of 8.7 in water year 1977.

h. Segment 1418. Segment 1418 consists of Lake Brownwood. No noncompliant measurements were recorded in the segment during water years 1972 through 1975. During water year 1976, however, station 1418.03 recorded low DO measurements of 4.6 mg/l and 4.4 mg/l. This station also recorded a high annual average of chloride concentrations of 187 mg/l and a high annual average of total dissolved solids concentrations of 556 mg/l during water year 1976. No noncompliant measurements were recorded in the segment during water year 1977.

i. Segment 1419. Segment 1419 consists of Lake Coleman. The segment exhibited no noncompliant measurements during water years 1972 through 1975. However, during water years 1976 and 1977 annual chloride averages of 112 mg/l and 119 mg/l, respectively, were recorded. The stream standards for this segment specify a maximum annual average chloride concentration of 100 mg/l.

j. Segment 1501. The tidal portion of Tres Palacios Creek (Segment 1501) has only one monitoring station. In water years 1973 and 1974, station 1501.01 located at FM 521

east of Palacios exhibited DO concentrations of 3.7 mg/l and 4.5 mg/l, respectively. No noncompliant DO measurements were recorded during water years 1975 through 1977.

k. Segment 1502. The portion of Tres Palacios Creek above tidal influences (Segment 1502) generally did not exhibit DO concentrations less than 5.5 mg/l. However, in 1973 monitoring station 1502.01 exhibited noncompliant DO concentrations of 4.3 mg/l and 2.7 mg/l. No noncompliant DO measurements were recorded after water year 1973, but station 1502.01 recorded a total dissolved solids annual average concentration of 2786 mg/l in water year 1976 and an annual average chloride concentration of 257 mg/l in water year 1977. The annual average for total dissolved solids was derived from four samples with individual values of 320 mg/l, 325 mg/l, 375 mg/l and 10,125 mg/l. The stream standards for total dissolved solids and chlorides for this segment are annual averages of 600 mg/l and 250 mg/l, respectively.

l. Segment 2452. Tres Palacios Bay including Turtle Bay exhibited no DO violations in water year 1972. In water year 1973, both of the monitoring stations located on this segment exhibited DO violations. On December 13, 1972 monitoring station 2452.01 exhibited a DO measurement of 4.7 mg/l and on September 13, 1973, when flood conditions were observed in Tres Palacios Creek, a DO violation of 4.1 mg/l was recorded at monitoring station 2452.02. There were no noncompliant DO measurements recorded during water years 1974 through 1977.

2. FACILITY NEEDS

The discussion of facility needs is grouped by stream segments. A brief physical description as well as a summary of the type of discharger is also provided for each segment. A "Discharge Source" is one that is currently discharging treated effluent. A "Nondischarge Source" is one which either has a No Discharge WCO, has not been constructed, or is not currently in operation.

SEGMENT 1401

There are no facility needs identified in the Colorado River Tidal area.

SEGMENT 1402

Five municipalities within this segment require improvement of their existing facilities, or initial construction of either collection or treatment facilities.

The City of Carmine does not operate collection and treatment facilities at this time. However, a need was identified during a preliminary stage of the 201 federal grant process. The need was not identified in time for planning to be done as part of this project. However, the specific need will be documented and alternative solutions developed during the 208 plan update or the 201 facility planning process, whichever occurs first.

The City of Elgin operates a 0.375 mgd trickling filter plant which has been in operation since 1962. Expansion of the treatment facility and the collection system to serve future needs of the city is necessary. The city, therefore, has been designated as a sewerage planning area.

The City of Round Top does not operate collection and treatment facilities at this time. However, a need was identified during a preliminary stage of the 201 federal grant process. The need was not identified in time for planning to be done as part of this project. However, the specific need will be documented and alternative solutions developed during the 208 plan update or the 201 facility planning process, whichever occurs first.

The City of Sunset Valley has had a need identified late in this project for which planning will be accomplished

as part of the 208 plan update or the 201 facility planning process, whichever occurs first.

The City of Weimar operates a 0.48 mgd oxidation pond system which has been in operation since 1950. Expansion of the collection system and modernization of treatment facilities are necessary to serve future needs. The city, therefore, has been designated as a sewerage planning area.

SEGMENT 1403

There are no facility needs identified in the Lake Austin drainage area.

SEGMENT 1404

The City of Burnet has been identified as having facility needs within the next 5 years. Information provided by the city estimates plant capacity at 0.400 mgd rather than the permit value of 0.475 mgd. Therefore, in order to serve the projected population and present septic tank areas, an expansion of the collection and treatment system will be necessary. These needs resulted in the City of Burnet being identified as a sewerage planning area.

SEGMENT 1405

One facility has been identified as needing improvement in this segment. The City of Marble Falls has a 0.24 mgd trickling filter plant and the present plant is not adequate to serve the needs of 1983 projected population. In addition, the current permit will expire in 1979, when treatment requirements for the city will become more stringent. Also, continued growth will require future expansion of the collection system. However, it may be possible to defer sewer line construction as a result of recent additions to meet the most urgent needs. As a result, the City of Marble Falls is identified as a sewerage planning area.

SEGMENT 1406

One special district has been identified late in the planning process as having a need. Lake LBJ MUD No. 2 is currently applying for a federal grant. There are no collection and treatment facilities that exist at this time. There is a strong possibility that advanced waste treatment will be required. Planning will be accomplished

as part of the 208 plan update or the 201 facility plan, whichever occurs first.

SEGMENT 1407

There are no facility needs identifed in the Inks Lake drainage area.

SEGMENT 1408

There are no facility needs identified in the Lake Buchanan drainage area.

SEGMENT 1409

There are no facility needs identifed in the portion of Colorado River between Lake Buchanan headwaters and San Saba River confluence.

SEGMENT 1410

There are no facility needs identified in the portion of the Colorado River between San Saba River confluence and E. V. Spence Reservoir (Robert Lee Dam).

SEGMENT 1414

Two facility improvements are necessary within this segment. The City of Fredericksburg operates a 1.0 mgd contact stabilization plant. The city has encountered high TSS concentrations in the effluent. A step 1 facility planning grant has been awarded to the City; therefore, no sewerage planning has been done for this area.

The City of Johnson City utilizes an Imhoff tank for sewage treatment. The plant, built in 1952 with a design capacity of 0.126 mgd, has encountered problems with effluent quality, according to the self-reporting data for 1976. The city has been awarded a step 2 (plans and specifications) construction grant and, as such, has not been designated as a sewerage planning area.

SEGMENT 1415

There are two facilities in the Llano River region that have improvement needs.

The City of Mason operates a 0.14 mgd capacity sewage treatment plant, utilizing an Imhoff tank and oxidation pond combination to serve its residents. The self-reporting data indicate that the plant is hydraulically overloaded and is inadequate to serve the existing population. The plant needs improvement and expansion. Therefore, the City of Mason has been included as a sewerage planning area.

The City of Junction also operates an Imhoff tank and stabilization pond combination. It has a design capacity of 0.21 mgd. Based on the population projections, there appears a need for expanding the capacity of the plant to meet the future requirements. The collection system for the city will also require expansion and extension to serve the projected population. The city has therefore been designated as a sewerage planning area.

SEGMENT 1416

Facility needs have been identified within this segment for one municipality.

The City of San Saba operates a 0.125 mgd treatment plant utilizing an Imhoff tank with a stabilization pond. The plant was put into operation in 1928 and is presently overloaded. There is a need for expansion of its capacity to serve its present population. The city therefore has been designated as a sewerage planning area.

SEGMENT 1417

One facility within the segment has been identified as needing improvement. The City of Brownwood operates a 2.0 mgd capacity treatment facility which utilizes the trickling filter process. Brownwood has received a step 1 construction grant to plan for the expansion of and improvement to its existing treatment plant. Therefore, no further planning is provided as part of this study.

SEGMENT 1418

There are no facility needs identified in the Lake Brownwood drainage area.

SEGMENT 1419

There are no facility needs identified in the Lake Coleman drainage area.

SEGMENT 1420

The City of Cross Plains operates a collection system, Imhoff tank, oxidations ponds, and irrigation fields. A need was identified too late in the planning process to be evaluated as a sewerage planning area. However, a specific plan will be developed as part of the 208 plan update or the 201 facility planning process, whichever occurs first.

SEGMENT 1501

There are no facility needs identified in the Tres Palacios Creek tidal.

SEGMENT 1502

There are no facility needs identified in the Tres Palacios Creek drainage area.

SEGMENT 2452

The City of Palacios operates a collection system and contact stabilization plant. A need was identified too late in the process to be evaluated as a sewerage planning area. However, the necessary planning will be completed as part of the 208 plan update or the 201 facility planning process, whichever occurs first.

Listing of 201 Entities

The following list of political entities have facility needs but are already in the 201 Construction Grants program.

Austin
Brownwood
Cross Plains
Eagle Lake
El Campo
Fredericksburg
Goldthwaite
Johnson City
Kingsland MUD
Lake LBJ MUD No. 2
Menard
Palacios

CHAPTER C

SUMMARY OF PLAN

The 208 planning process for the Lower Colorado Basin consists of a series of steps which enable evaluation and selection of alternative abatement measures and the means to implement the measures. These planning steps include identifying problems, constraints, and priorities in meeting the 1983 goals of the Act, identifying possible solutions to problems, developing alternative plans to meet statutory requirements, analyzing alternative plans, and selecting an areawide plan.

This chapter summarizes the management and technical findings and recommendations developed from this planning process. Presented below are the 1983, 1990, and 2000 areawide management plans for the Lower Colorado Basin, wasteload allocation for the water quality segments, the schedule to implement the plan, the institutional, legal, and financial requirements of the plan, stream standards, and plan update information requirements.

1. WASTELOAD ALLOCATIONS FOR WATER QUALITY SEGMENTS

Segment 1417, Pecan Bayou from Colorado River confluence to Lake Brownwood, is the only segment currently classified as "Water Quality" in the Lower Colorado Basin Planning Area. Water quality problems in the segment have largely been attributed to the effluent from the Brownwood wastewater treatment plant. The effluent imposes a significant organic loading to the bayou, whose assimilative capacity is often severely restricted by the existence of low streamflow conditions.

A Wasteload Evaluation was prepared by the Texas Department of Water Resources (TDWR) for the segment in March 1974. The report concluded that "due to the downstream water uses (irrigation withdrawal) and the lack of dependable release volumes from Lake Brownwood, the improvement of the stream to a dissolved oxygen (DO) level of 3.0-4.0 mg/l may be all that can be accomplished." The report recommended that the City of Brownwood be required to provide a treatment process with the following effluent quality limits for monthly averages:

BOD_5 = 5 mg/l
TSS = 10 mg/l
NH_3-N = 5 mg/l

The report indicates these effluent limits are necessary to maintain a 2.0 mg/l DO level in the bayou under effluent-dominated conditions.

In 1978, the TDWR conducted additional analyses for the segment using the QUAL-IIQ mathematical model and the data developed in this study. The results indicate that due to the low assimilative capacity of the segment, best available treatment with supplemental aeration will be necessary for compliance with the 5.0 mg/l DO standard.

2. 1983 Plan

The development of the areawide water quality management plan for the Lower Colorado Basin involves a systematic evaluation of alternative means to achieve the 1983 water quality goals as prescribed in the Federal Water Pollution Control Act Amendments of 1972. The planning process has integrated both technical needs for pollution abatement and management arrangements capable of implementing measures. The framework under which technical planning is carried out consists primarily of the point source subplan and nonpoint source subplan elements of the areawide plan. Management planning is conducted concurrently with the technical planning and involves selecting management agencies and developing appropriate institutional arrangements through which the plan can be implemented.

The federal requirements contained in Section 208 of P.L. 92-500 are the basis for this water quality management plan. Ten particular powers and functions derived from the listing contained in the Act are necessary in order to have an effective and approvable 208 plan. These ten powers and functions include planning, operating and maintenance of facilities, design and construction of facilities, finance, permitting and regulation of nonpoint sources, standard setting, enforcement, monitoring, and management and coordination. Because of the natural interaction among these functions, they can generally be grouped into three major categories consisting of (a) general management and regulatory, (b) treatment works management, and (c) nonpoint source control. Presented below

are the management and technical requirements and features of the 1983 plan by these three major categories.

a. General Management and Regulatory.

Findings.

(1) The functions and powers assigned to this group are planning, standard setting, permitting and regulation of point sources, monitoring, enforcement, and management and coordination.

(2) The TDWR is the only agency that meets all criteria and is presently performing these functions with participation of the EPA and regional and local governments. Existing statutes and policy have assigned most of these functions to the TDWR.

(3) The TDWR presently does the 208 planning for non-designated areas and contracts with local agencies to perform certain tasks.

Recommendations.

(1) Statewide water quality and wastewater planning shall remain a function assigned to the TDWR. Detailed planning for wastewater treatment facilities shall remain with those local entities responsible for treatment.

(2) Standard setting regarding water and wastewater shall remain federal and State responsibilities. The standard setting function of the TDWR is generally patterned after and has the approval of the EPA which retains ultimate authority for program operation through periodic review and certification.

(3) Permitting and regulation of point sources shall be the responsibility of the TDWR in concert with EPA rules and regulations. The State shall continue to issue discharge permits in the Lower Colorado Basin Planning Area based on review and evaluations of existing stream quality and the waste allocations necessary to meet stream standards.

(4) Primary monitoring of stream quality, monitoring of effluent quality, and the identification of permit violations shall be a State responsibility. Routine effluent monitoring shall be carried out by the permit holder as part of a statewide self-reporting system.

Although the prime responsibility for monitoring rests with the TDWR, there are many other entities involved in data collection, analysis, and evaluation.

(5) The TDWR shall have the prime responsiblity for enforcement action under normal conditions. The EPA, however, retains ultimate authority in this area under P.L. 92-500, Title III, Standards and Enforcement.

(6) To insure that all of the functions described in the Act are allocated and performed, selected management and coordination activities must be carried out. The TDWR shall have the prime responsibility for this function. The Planning Advisory Committee will make important input regarding policy formulation.

b. Treatment Works Management.

Findings.

(1) The functions assigned to this group include design and construction, operation and maintenance, and finance of the treatment facilities. The activities performed in this category are generally intensive and highly localized. State statutes and local governmental activities have traditionally recognized and assigned these functions and required their administration by local entities. In the Lower Colorado Basin planning area, the agencies which currently perform these functions include Lower Colorado River Authority, local governments (cities and counties), and special districts.

(2) In order to carry out the structural control measures for point source pollution abatement, the Treatment Works Management Agencies (TWMA) must be designated in the plan. P.L. 92-500 requires that such agencies must have adequate authority to perform the functions assigned to this category.

(3) No significant water quality problems related to the treatment works management functions have been identified in the Lower Colorado Basin planning area. With existing and proposed municipal wastewater treatment facilities operated to produce the required effluent quality and industrial wastewater treatment facilities operated at federally mandated standards, all segments in the basin are expected to meet the 1983 water quality goals under the low-flow critical conditions.

(4) Two segments in the basin are suspected to have potential point source related water quality problems within the planning period. Substantial increases of point source wasteloads have been projected for Segment 1401 (Colorado River Tidal) and Segment 1406 (Lake LBJ). However, future water quality problems in these segments cannot be predicted with certainty at this time, because of the qualitative nature of the analyses performed in this study.

(5) Dissolved oxygen problems have long been recognized in Segment 1417. Based on the results of the recent modeling analysis performed by the TDWR, the segment will meet the 1983 goal if best available treatment with supplemental aeration can be provided by the Brownwood wastewater treatment plant. However, the City of Brownwood has questioned through the review process, whether the cost of such treatment can be justified by the benefits to be derived. This question can be addressed under Section 302 (b) of The Clean Water Act of 1977 which calls for the affected entity (the City of Brownwood) to demonstrate the lack of a reasonable relationship between the economic and social costs and the benefits to be obtained by imposition of the projected effluent set 4NA treatment level. If unreasonableness is demonstrated, then granting of a variance to current water quality standards will be required.

(6) Most of the point source dischargers in the basin will be able to comply with their respective permits through 1983, when properly operated. Seven municipal wastewater treatment facilities in the planning area, however, are projected to have potential problems in meeting their permit requirements by 1983, if additional capacities and/or improvements are not provided. As a result, the cities of Elgin, Weimar, Burnet, Marble Falls, Mason, Junction, and San Saba have been identified as sewerage planning areas. Both technical and management alternative subplans were developed for these areas. These alternative plans are presented in the following chapter.

(7) Five municipalities and one special district in the Lower Colorado Basin planning area have been identified late in the planning process as having sewerage needs. Four of these entities, including Carmine, Round Top, Sunset Valley, and Lake LBJ MUD No. 2, do not have existing collection and treatment facilities. The cities of Cross Plains and Palacios,

however, have existing sewerage systems. Since these areas were identified late in the process, the necessary planning will be completed as part of the 208 plan update or the 201 facility planning process, whichever occurs first.

Recommendations.

(1) The 1983 plan recommends continuation of the treatment works management functions by local government. Upon designation as a TWMA, an entity will be obligated to provide sufficient manpower, fiscal resources, and administrative expertise to assure that the customary tasks of facility management are properly discharged in accordance with the plan.

(2) The entities in the planning area which are recommended as designated TWMA for performing the functions assigned in the group are listed under Institutional and Legal Requirements as given in this chapter. The eligibility of designated TWMA to receive future federal construction grants will be evaluated by the planning agency and local clearing house at preapplication stage.

(3) Existing and proposed municipal and industrial dischargers in the Lower Colorado Basin nondesignated area shall ensure proper operation and maintenance of their wastewater treatment facilities to conform with the permit requirements. Existing practices for disposition of residual wastes shall continue.

(4) Sampling programs to monitoring changing conditions in Segments 1401 and 1406 are recommended to be carried out in the continuing update process. Development of dry-weather water quality model for these tidal and lake segments is recommended. Control measures will be developed only when problems are confirmed.

(5) The City of Brownwood should take into consideration the results of the recent Texas Department of Water Resources modeling analysis in completing their 201 facility planning project. If the cost of providing 4NA treatment can be demonstrated to exceed the benefits to be derived, the City should petition the Texas Department of Water Resources for a variance to the required treatment level and water quality standards for Pecan Bayou.

(6) Based on the results of a public participation program conducted for this project and inputs from local governments, a final sewerage improvement plan has been developed for each of the seven sewerage planning areas in the Lower Colorado Basin planning area. These sewerage planning areas have evolved from the detailed review of the preliminary SPA designations presented in Volume I. Subsequent to public input and visits to each candidate SPA, the City of Llano was deleted as local inputs revealed no waste treatment need within the 5-year planning period. The cities of Weimar and Burnet were added to the list as local inputs revealed a facility need within the planning period which was not readily apparent during Volume I preparation. These plans are presented below.

City of Elgin. Future growth in the city will create needs for additional collection and treatment capacity to serve 4,800 people by 1983, 5,300 in 1990, and 6,100 people in the year 2000. For planning purposes, single-stage expansion of the facilities by 1983 is considered. Based on the statewide planning methodology, the required collection system improvement is estimated to include two lift stations and approximately 90 inch-miles of sewer lines. Construction of a new 0.6 mgd contact stabilization package plant to replace the existing trickling filter plant is considered to be one of the more cost-effective alternatives. Construction of a new treatment plant at a different site to accomodate the projected flow increase is also a viable alternative which could reduce the cost of collection lines. Preliminary engineering information must be developed, however, to allow meaningful consideration of this alternative. Since the city has demonstrated adequate management competence in the past, the city is designated as the TWMA for this facility. Capital costs for the collection system improvement and construction of the 0.6 mgd package plant is approximately $1,424,000. Annual operation and maintenance cost for the proposed improvements has been estimated to be about $97,000.

City of Weimar. Additional collection and treatment capacity is needed for the city to serve 3,100 people by 1983 and 4,500 people by the year 2000. The collection system needs over the next twenty years have been estimated to

include approximately two lift stations and 143 inch-miles of gravity lines. Expansion of the existing pond system with the addition of more mechanical aerators and more pond area is considered most cost effective and will enable the city to meet the effluent BOD requirements within the planning period. Due to algae problem, however, administrative relief on TSS requirements will be required before the alternative can be adopted. If the relief on TSS requirements is not available, construction of a new package plant is recommended. Total capital cost for the collection system improvement and pond expansion is estimated to be about $1,881,000. Operation and maintenance cost for the proposed improvement will be approximately $99,700 per year. The city is designated as the TWMA to carry out the finance, design and construction, and operation and maintenance of this facility.

City of Burnet. To serve the existing septic tank areas and to accommodate the needs created from the projected population increase, the existing sewerage system of the city will need expansion within the next five years. The system will have to serve a total of 6,000 people by the year 2000. Approximately 144 inch-miles of gravity lines will be required to handle the projected flow increase. Although construction of a new 0.2 mgd prefabricated contact stabilization package plant to treat and discharge the additional flow appears to be most cost effective, this alternative would require a revision to the existing permit to allow a discharge into Hamilton Creek. The city is currently utilizing the irrigation practice to dispose of the treated effluent and has approximately 230 acres of land available for irrigation. According to the criteria prescribed in the planning methodology, only 20 acres of additional land is needed for spray irrigation of the 0.6 mgd flow. The slightly higher cost of land application alternative, which is within 15 percent of the cost for treatment and discharge alternative, can be justified by the resulting improved water quality in the segment. Land application is therefore recommended in this plan. Total capital cost for this alternative (including collection system improvement) will be approximately $1,589,000. Annual operation and maintenance cost is estimated to be about $59,600. The city is recommended as the TWMA for this facility.

City of Marble Falls. Population in the city has been projected to increase from the existing 2,555 people to 3,050 people in 1983 and to 4,000 people in the year 2000. Based on these projections, no additional collection system

improvements have been considered in this study. The proposed Effluent Set 4P requirements (5 mg/l BOD, 5 mg/l TSS, and 1 mg/l P) for the city will require a substantial upgrading of the existing treatment plant. Based on the criteria prescribed in the planning methodology, installation of a new 0.4 mgd extended aeration package treatment plant with polymer feed, tertiary lime treatment, filtration units, and sludge drying beds to replace the existing trickling filter plant appears to be the most cost-effective process to achieve the Set 4P requirements. Total capital cost for this improvement is estimated to be about $754,000. Annual operation and maintenance cost will be approximately $51,000. The City is recommended as the TWMA for the facility. Local officials have indicated the expected population growth in the city can be double the amount projected above. Due to the potential for change in the predicted population to be served, further expansion of the collection system might be needed. The actual capacity of the sewerage system should be based on the most current information at the time of engineering design.

City of Mason. Based on the criteria prescribed in the planning methodology, modification and expansion of the existing treatment plant is considered necessary for the city to adequately serve the existing population of 1,800 people, which is projected to decrease to 1,700 in the year 2000. The existing collection system is generally adequate for the need, although city officials indicate certain line segments have experienced high flow and there may be need for minor extensions in the future. No collection system improvements have been considered in this study; however, the need for collection system work should be reviewed as part of the next plan update study. One of the most cost-effective alternatives to expand the existing plant to 0.18 mgd is to provide more oxidation pond area, add primary treatment and chlorination facilities, convert the Imhoff tank to an aerobic digester, and install additional sludge drying beds. The expansion will enable the city to meet effluent BOD requirements; however, due to an effluent-algae problem, administrative relief on TSS requirements will be required. If the relief on TSS requirements is not granted, installation of a new package plant may be necessary. Capital cost for the pond system expansion is estimated to be approximately $314,000. Annual operation and maintenance cost will be approximately $24,600. The city is designated as the TWMA to carry out the finance, operation and maintenance, and design and construction of this facility.

City of Junction. No significant population growth is projected for the city in the next twenty years. The existing population of 2,700 is projected to increase to 2,800 by 1983 and remain at 2,800 through the year 2000. Based on this projection, approximately 7,000 feet of gravity line, 5,500 feet of pressure line, two lift stations, and two river crossings are needed to provide the service to two septic tank areas. Installation of a new 0.28 mgd package treatment plant at a different site to replace the obsolete existing plant is considered most cost effective. Since the existing plant is on the banks of the Llano River, relocation of the plant to a new site is necessary. Capital cost for these sewerage improvements has been estimated to be about $601,000. Operation and maintenance cost will be approximately $46,000 per year. The city is designated as the TWMA for the facility. Although the populations projected in this study have shown no significant increase within the next twenty years, city officials do indicate that an increase in tourism will add an additional 10 to 20 percent to the effective population in the near future. Significant growth in the permanent population also appears possible over the planning period. Due to the potential for change in the predicted population to be served, the actual capacity of the system required should be based on the most current information at the time of engineering design.

City of San Saba. No significant population growth is projected for the city. Collection system needs are to serve the existing septic tank area in the west portion of the city. A new treatment plant located outside the San Saba River flood plain with 0.27 mgd capacity is needed to adequately serve the population and meet the permit requirements. It is estimated approximately 500 feet of pressure line, 6,000 feet of gravity line, and one lift station are needed. Abandonment of the existing plant and installation of a new 0.27 mgd package treatment plant beyond the limits of the 100-year flood plain on an adjacent 80-acre site is recommended. Total capital cost for the sewerage system improvements is estimated to be about $762,000. Annual operation and maintenance cost will be approximately $64,000. The city is recommended as the TWMA for the facility.

c. Nonpoint Source Control.

Findings.

(1) P.L. 92-500 requires that nonpoint sources of water pollution be addressed as specific water quality concerns.

However, at the present time the water quality effects of nonpoint sources are not well documented nor is the effectiveness of the control strategies proven.

(2) Although the State has authority to regulate the nonpoint sources activities, it has been the State's preference for the local government to carry out the nonpoint source control program.

(3) Based on the limited data and analytical technology currently available, no significant water quality problems related to nonpoint sources have been identified in the Lower Colorado Basin planning area. All but two of the segments in the basin are projected to meet the 1983 goal under wet-weather conditions. Segments 1501 (Tres Palacios Creek Tidal) and 1502 (Tres Palacios Creek above Tidal) are the only two segments in the basin identified as having potential water quality problems resulting from nonpoint source activities. However, it should be emphasized that the water quality model used to project the problem was developed by the EPA for dry-weather condition only and relates particularly to point sources. There is no wet-weather (non-steady state) model available for the segments at the present time.

(4) During the public review of Volume II, commercial fishermen in the coastal area voiced concerns over the impacts of toxic compounds entering streams in the Tres Palacios area. Public input indicated that return flows have had a detrimental effect on the commercial fishing industry evidenced by reduced shrimp catches. The problems, if any, and the appropriate control strategy need to be documented and defined.

Recommendations.

(1) The management system of the 1983 plan for nonpoint source control shall be retained by applicable local entities with the TDWR responsible for review and reporting technical study plans, problems, and progress toward solutions. (See Appendix E, pages E-8 to E-28.)

(2) Should the extent and causes of nonpoint sources of water pollution become defined before 1983, the plan shall be modified to allow the most effective governmental entity to become responsible for nonpoint source control. Local and State governments shall continue to

respond to and comply with EPA regulations involving nonpoint sources such as urban runoff, major stormwater outfalls, and agricultural sources.

(3) Local and State governmental activities should encourage water quality improvement if causes and effects of nonpoint become known. These activities could include the following:

Texas Department of Water Resources
- Evaluate areas of nonpoint source concern and conduct sampling and special studies to verify problems and identify solutions.
- Develop, calibrate, and certify nonsteady state stream models.
- Provide assistance to communities and districts in developing nonpoint source control programs.
- Share technical and operational expertise and experience.

Local Governments
- Encourage improved enforcement of any existing ordinances or development of new ordinances regarding erosion control, anti-litter, leash laws, and building permits.
- Expand level of subdivision plat approval to include forms of nonpoint source control provisions.
- Perform required maintenance of sewer lines, storm sewers, drains, and drainage ditches.

(4) It is recommended that a wet-weather water quality monitoring program be initiated and a stormwater simulation (nonsteady state) model be developed for every segment in the basin to better define the nonpoint source problems in the planning area. Top priority should be assigned to Segments 1501 and 1502. An initial task for this special program will be to define the scope and assess the costs for sampling and analytical work as well as for model development. When sufficient field data become available through the monitoring program, these stormwater models shall be calibrated and verified. Should the verified model indicate any water quality problems in the segment, structural and/or nonstructural control measures then will be developed. Since the TDWR is presently performing the regulatory and monitoring functions, it is recommended that the State carry out this special study program.

3. 1990 Plan

The 1990 plan, when put into effect, will have resulted from annual updates of the 1983 plan. The 1983 plan allows for refinements and revisions to be made on an annual basis. In addition, the 1983 plan provides for flexibility and adjustments based upon technical, financial, and management needs, capabilities, and limitations. It is envisioned that the basic framework of the 1990 plan will retain many of the same characteristics of the 1983 plan. For planning purposes, the 1990 plan will be discussed in accordance with the three major groupings that exist in the 1983 plan.

a. General Management and Regulatory.

Little if any change is expected to occur in this functional group in the 1990 plan. It is envisioned that the State will upgrade stream standards and discharge permits to comply with more rigorous enforcement and regulatory activity at the federal level. This plan shall enable adjustment in treatment capacity and requirements for the local districts and treatment entities. The basic functions of permitting a point source, standard setting, monitoring, and enforcement will continue to be a primary function of the TDWR or its successor entity. For purposes of the current 1990 plan, the TDWR shall provide the management coordination function. However, it is envisioned that this management coordination function may gradually evolve towards a local management and coordinating committee. This coordination function on a local basis will augment and provide input to the State management and coordinating process.

In summary, the 1990 plan should be implemented using entities that exist at the time of plan formation and subsequent updates. The 1990 plan will make maximum use of the annual updates to the initial plan as it evolves.

b. Treatment Works Management.

The design and construction, operation and maintenance, and finance of the wastewater treatment facilities shall continue to be retained as local responsibilities in the 1990 plan. These activities shall be in compliance and be updated to be consistent with local, state, and federal laws in force at the time of planned development. Annual revisions shall compensate for changes in law, requirements and technical management alternatives. The

interface with the management and coordination agencies shall be increased and made more sensitive to the local participation and review process in its evolution from the 1983 plan to the 1990 plan.

c. Nonpoint Source Control

The 1990 plan will be adjusted to react to nonpoint source control problems identified between now and the completion of the 1983 plan. Presently, the clarity of nonpoint source problems is lacking. As the cause and effect of nonpoint source water pollution problems become identified, annual updates to this plan will reflect control strategies and requirements to effectively treat, minimize, and control their effects. The management of nonpoint source problems, however, shall be retained on a local basis primarily dealing with local laws and ordinances (see Appendix E, pages E-8 to E-28(until such time as the scope of the cause of nonpoint source problems can be identified as regional or statewide in nature. Should that occur, the plan for 1990 should reflect the level of government that can best accomodate resolution and control of these problems. In addition, the 1990 plan may require State control strategies and regulations to insure a full response to nonpoint source problems.

4. 2000 Plan

The year 2000 plan, when put into effect, will have resulted from annual updates of the 1990 plan. The 1990 plan allows for refinements and revisions on an annual basis. In addition, the 1990 plan will provide for flexibility and adjustments based upon technical, financial, and management needs, capabilities, and limitations. It is envisioned that the basic framework of the 2000 plan will retain many of the same characteristics as the 1990 plan.

5. SCHEDULE OF IMPLEMENTATION

This section presents the implementation schedule of the major actions which must be taken by the designated management agencies to bring about implementation of the recommended technical and management plans. Table II-C-1 summarizes the schedule to carry out the activities recommended under each of these functional groups. Table II-C-2 summarizes the schedule of construction for the seven sewerage planning areas.

TABLE II-C-1

Implementation Schedule for Lower Colorado Basin Management Plan

PROGRAM	PROPOSED SCHEDULE	PRIME RESPONSIBILITY
GENERAL MANAGEMENT AND REGULATORY		
Permitting	1978-2000	TDWR
Standard Setting	1978-2000	TDWR
Monitoring	1978-2000	TDWR
Enforcement	1978-2000	TDWR
Data Base Update	1978-2000	TDWR
Public Participation Program	1978-2000	TDWR
Assistance to Local Governments	1978-2000	TDWR
Policy Decisions	1978-2000	TDWR
Coordination Assistance	1978-2000	TDWR
Fiscal Management	1978-2000	TDWR
Development of Dry Weather Stream Model for Segments 1401 and 1406	1980-1982	TDWR
TREATMENT WORKS MANAGEMENT		
Operation and Maintenance	1978-2000	Designated Agencies
Financial Needs	1978-2000	Designated Agencies
Facility Construction Needs	See Table II-C-2	
NONPOINT SOURCE CONTROL		
Wet Weather Water Quality Monitoring		
Segments 1501 and 1502	1979-1980	TDWR
All Other Segments	1980-1982	TDWR

TABLE II-C-1 (Cont'd)

PROGRAM	PROPOSED SCHEDULE	PRIME RESPONSIBILITY
Development of Wet Weather Stream Model		
Segments 1501 and 1502	1979-1980	TDWR
All Other Segments	1980-1982	TDWR
Calibration and Verification of Model		
Segments 1501 and 1502	1980-1981	TDWR
All Other Segments	1982-1983	TDWR

TABLE II-C-2

Schedule of Construction for the Sewerage Planning Areas

Name	Proposed Action	Initiation Dates			
		Facility Planning	Detailed Design	Construction	Operation
City of Elgin	Collection System Expansion	1980	1981	1982	1984
	*STP Expansion	1980	1981	1982	1983
City of Weimar	Collection System Expansion	1978	1979	1980	1982
	STP Expansion	1978	1979	1980	1981
City of Burnet	Collection System Expansion	1980	1981	1982	1984
	STP Expansion	1980	1981	1982	1983
City of Marble Falls	STP Expansion	1980	1981	1982	1983
City of Mason	STP Expansion	1979	1980	1981	1983
City of Junction	Collection System Expansion	1979	1980	1981	1983
	STP Expansion	1979	1980	1981	1983
City of San Saba	Collection System Expansion	1979	1980	1981	1983
	STP Expansion	1979	1980	1981	1983

*Sewage Treatment Plant.

6. INSTITUTIONAL AND LEGAL REQUIREMENTS

This section identifies the distribution of responsibilities among the principal agencies involved in implementing the plan. The distribution represents the institutional arrangments necessary to meet federal, state, and local requirements regarding wastewater managment. If there had been a need, this section would also have identified new legislation, ordinances, and agreements required to implement the plan. However, after review of existing law relating to wastewater management, it is clear that adequate authority is available for the various institutional arrangements to be carried out. For a detailed development of requirements, existing arrangements and alternatives refer to Appendix E, Inventory of Existing Agencies and Practices; Appendix F, Financial Management Experience; and Appendix G, Intergovernmental Cooperation in the LCRA 208 Planning Area.

a. Federal Requirements.

The federal requirements contained in Section 208 of P.L. 92-500 are the basis for the Lower Colorado Basin management plan. These requirements state that particular powers are necessary in order to have an effective and approvable 208 plan. The list of powers and functions noted below is derived from the listing contained in the Federal Water Pollution Control Act Amendments Section 208 (b) (1) (A) - (I) as well as Section 208 (b) (2) and 204 (b) (1) (A) - (B). The powers and functions are as follows:

(1) Planning
(2) Operation and Maintenance of Facilities
(3) Design and Construction of Facilities
(4) Finance
(5) Permitting and Regulation of Point Sources
(6) Permitting and Regulation of Nonpoint Sources
(7) Standard Setting
(8) Enforcement
(9) Monitoring
(10) Management and Coordination

A series of guidance memoranda and regulations have been issued by EPA which further clarify the requirements and provide the framework for the management plan.

b. State Requirements.

The Office of the Governor issued guidelines for management plan development and implementation. The guidelines of the Governor were designed to be compatible with federal requirements. The guidelines, as set forth for the most part in Executive Order Number 18-A, are summarized as follows:

(1) Overall responsibility for review and certification of 208 plans rests with the Governor.

(2) The 208 planning function in nondesignated areas such as the Lower Colorado Basin is delegated to the Texas Department of Water Resources (TDWR).

(3) Participation of locally elected officials is through appointment by the Governor to a Planning Advisory Committee for each 208 planning area.

(4) The general management and coordination of 208 plans in nondesignated areas rests with the TDWR. Tasks within these functions consist of establishing the requirements, guidelines, and review for planning; providing liaison and coordination between the EPA and planning agencies; giving technical advice to planning agencies; insuring consistency of plans from one area to another; monitoring and reporting planning progress to the Governor; and submission of plans, designations, and other recommendations to the Governor for certification.

(5) Existing agencies and entities shall be used to the fullest extent that is consistent with legal authority in performing 208 management functions.

(6) Possible duplication of effort or jurisdictional conflicts must be minimized in attempting to meet requirements of 208 management functions.

(7) A major role will be played by the State in implementation of the 208 plans.

c. Local Requirements.

Federal and State requirements are reflected in the characteristics given the greatest attention at the local level. Each of the ten wastewater management functions were assessed regarding the authority, capability, accountability

and acceptability required at the local level to implement various aspects of the plan. Public participation activities and guidance by the Planning Advisory Committee provided the mechanism for screening alternatives and selecting the plan to be implemented.

d. General Management and Regulation.

The implementation of the 208 plan will depend on the management agencies carrying out a number of related functions involving general management and regulatory tasks. The allocation of functions is summarized as follows:

Planning. All planning aspects regarding wastewater management within the nondesignated area must be analyzed and reviewed on an annual basis. The water quality concerns must be integrated with areawide plans. Detailed planning for wastewater treatment facilites is not included within this function, since it will remain with those local entities responsible for treatment. Statewide water quality and wastewater planning will remain a function assigned to the TDWR. The Lower Colorado Basin Planning Advisory Committee will remain active to assure participation by local officials.

Standard Setting. Standard setting regarding water and wastewater are and will remain federal and State responsibilities. This function of standard setting must comply with EPA requirements and their review process. EPA is responsible for administering Section 303, 306, and 307 of P.L. 92-500 all of which refer to standards. The standard setting function of the TDWR is generally patterned after and has the approval of the EPA which retains ultimate authority for program operation through periodic review and certification.

Permitting and Regulation of Point Sources. State and federal law require each point source of wastewater to be regulated with respect to effluent quality standards and be compatible with water quality goals and the available assimulative capacity of the receiving stream. The State administers a waste control order (permit) program which parallels the federal National Pollutant Discharge Elimination System permitting process. Work is in progress to integrate the two programs into one permitting system.

Permitting and Regulation of Nonpoint Sources. Nonpoint source pollution has not been confirmed as a significant factor in the Lower Colorado Basin nondesignated area.

Consequently, this function will not be specifically allocated until the nature and extent of such pollution is defined. The TDWR will coordinate the efforts to study and define the permitting and regulatory system for nonpoint source pollution.

Monitoring. Stream and effluent quality are monitored by the TDWR to determine whether standards and goals are being met. Routine effluent monitoring is carried out by the permit holder as part of a statewide self-reporting system. When violations are identified, an enforcement action could follow. The prime responsibility for monitoring rests with the TDWR, although there are many other entities involved in data collection, analysis, and evaluation.

Enforcement. When discharge standards are not met, a multiple agency involvement in an enforcement action could result. The various levels of government initiating the action could include municipalities, counties, regional authorities, the State, and the EPA. However, the TDWR is identified as having the prime responsibility for this function under normal conditions. The EPA retains ultimate authority in this area under P.L. 92-500, Title III, Standards and Enforcement.

Management and Coordination. To ensure that all of the functions described above are allocated and performed, selected management and coordination activities must be carried out. The objective is to monitor plan implementation and maintain a responsive position to a variety of inputs as the plan takes effect. The management and coordination function includes the primary responsibility for the policy decisions that impact the operation and coordination among treatment facilities, plans for new capacity, and other related water quality concerns. Prime responsibility for this function will rest with the TDWR. The Planning Advisory Committee will make important input regarding policy formulation.

e. Treatment Works Management.

Pollution abatement and control measures involving structural solutions will depend on management agencies carrying out operational and financial responsibilities. To this end, TWMA must be designated in the plan. P.L. 92-500 requires in Section 208 (c) (2) (C) that such agencies must have adequate authority "directly or by contract, to design

and construct new works, and to operate and maintain new and existing works as required by the plan ...." The law also requires in Section 208 (c) (2) (D) that these agencies shall have adequate authority "to accept and utilize grants, or other funds from any source for waste treatment management purposes." These responsibilities have been discussed in this Chapter and Appendices E, F, and G. These responsibilities also must include adequate authority and effective sanctions as described in P.L. 92-500, Section 208 (c) (2) (A-I). Upon designation as a TWMA, an entity is obligated to provide sufficient manpower, fiscal resources and administrative expertise to assure that the customary tasks of facility management are properly discharged in accordance with the plan.

The experience and capability of jurisdictions responsible for facilities management functions under the plan have been documented. Each existing entity that has demonstrated a need, by either being declared a sewerage planning area, or by participation in the 201 Grant Program; as well as others who have recognized a potential future need are recommended for designation as Treatment Works Management Agencies. A list of existing jurisdictions recommended for designation is as follows:

Austin

Bangs
Bastrop
Brady
Brownwood
Buda
Burnet

Carmine
Clyde
Coleman
Colorado Co. WCID No. 2
Columbus
Cross Plains

Eagle Lake
Eden
El Campo
Elgin

Fayetteville
Fredericksburg

Giddings
Goldthwaite

Johnson City
Junction

Kingsland MUD

La Grange
Lake LBJ MUD No. 1
Lake LBJ MUD No. 2
Lakeway MUD No. 1
Llano
Lost Creek MUD

Manor
Marble Falls
Markham MUD
Mason
Matagorda Co. WCID No. 5
Meadowlakes MUD
Menard

Palacios
Pflugerville

Richland Springs
Round Top

San Saba
Santa Anna
Smithville
Sunset Valley

Taylor County Fresh Water Conservation and Improvement District
Travis Co. MUD No. 1
Travis Co. WCID - Point Venture

Weimar

Even though all these entities have not been listed in this plan summary as having needs at present, each has the potential of future needs. The annual update will review each entity to determine "needs" status each year.

7. FINANCIAL REQUIREMENTS

Water quality management activities require a range of financing capabilities as stated in P.L. 92-500, Section 208 (b) (2) (E). Adequate funding is a prerequisite to undertaking water pollution abatement actions, and therefore is a necessary element of this water quality management plan. The State (TDWR) is the planning agency designated by the Governor and is responsible for plan development and update and the funding thereof. The management agency shall be the TDWR with an emphasis toward increasing local involvement over time.

Financial requirements for water quality management involve three major sections of the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500). Section 208 requires water quality planning, management, and coordination. Section 201 provides for grants for design and construction of publicly owned treatment works and affects the financial planning in a substantial number of communities and states. Section 204 requires the recipients of 201 construction grants to charge all users in proportion to use and to recover the proportional share of capacity cost from industrial users.

Pertinent regulations regarding financing of wastewater treatment facilities are found in 40 Code of Federal Regulations (CFR) B and 40 CFR 35. The more important federal regulations are summarized below:

° Contained in 40 CFR 35.208-2(a) (5) is the requirement that the planning agency must submit a statement that the planning process will become financially self-sustaining.

° In 40 CFR 13/.11(0) (2) the management agency must have adequate authority to:

  - accept or utilize grants from any source for waste treatment management or nonpoint source control;

  - raise revenues including the assessment of user charges;

  - incur short- and long-term indebtedness; and

  - assure that each entity or participating community pays its proportionate share of treatment costs.

- In 40 CFR 13/.11 (h) (1) municipal waste treatment system needs are required to be determined. The code requires that a program be conducted to provide necessary financial arrangements to develop required systems. Elements of this activity include:

  - definition of needs by five-year increments over at least a 20-year period; and

  - analysis of alternative waste treatment systems including total capital funding.

- Code 40 CFR 13/.11 (n) (1) required the maintenance of a regulatory needs program. This activity requires the definition of regulatory approaches to water quality management, the statutory basis for the program, and the specification of relevant administrative and financial program aspects.

- Contained in 40 CFR 13/.11 (1) (3) are requirements to determine needs for urban and industrial stormwater systems. Costs must be determined for needs and the impacts of nonstructural strategies (ordinances) on annual capital and operating expenses determined.

The management entities in the 1983 plan will have adequate financial capability. Each of the local entities involved in treatment will be responsible for generating revenues and budgets for expending resources to implement approved plans. The State shall establish priorities for local entities to become eligible for federal 201 construction grants.

A number of considerations are directly related to financial capabilities. Factors such as legal, institutional, and managerial capability are interrelated with the financial function.

GRANTS

Through the Section 201 Construction Grant Program, federal funds are available for the construction of publicly owned wastewater treatment facilities. The P.L. 92-500 specifies several requirements that must be met prior to receiving a 201 grant. Among the requirements are cost-effectiveness analysis, provisions for reserve capacity, establishment of a user charge and industrial cost recovery system, and the legal, institutional, managerial, and financial adequacy of the entity responsible for design, construction, operation, and maintenance of treatment works.

FINANCING AND DEBT SERVICE

Wastewater treatment systems include the collecting, transmission, treating, and disposal of wastewater or stormwater runoff. All treatment facilities incur costs for capital construction which requires debt service and operation maintenance and repair which requires charges to users proportional to use. In addition, the treatment system incurs administrative costs for planning, engineering, bookkeeping, accounting, and other forms of administrative control.

Capital costs for facility construction can be obtained, as applicable, from 201 federal grants, special state grants, local funds, or bond issues. Only with the federal 201 grants must the portion of capacity used by private industry be recovered. Operating and maintenance costs are covered by general revenues and service changes. The treatment entities shall comply with all local, regional, state, and federal laws regarding the receipt and use of funds.

USER CHARGE/INDUSTRIAL COST RECOVERY (UC/ICF)

To qualify for federal 201 construction grants, the publicly owned treatment facility must establish a user charge and industrial cost recovery system. Present and all future terms regarding financial arrangements shall be adhered to by the requesting local entities. For application, the local entity must:

- Ensure that financial and management arrangements comply with requirements;
- Explore alternative approaches to fulfill treatment requirements.

To ensure the financial and management arrangements comply with requirements, the TDWR shall perform the following:

- Assure that local entities and public officials have a timely plan for compliance with requirements;
- Assist in identifying and evaluating alternative means of complying;
- Provide for area, regional, and statewide actions necessary to achieve compliance, including the development of model ordinances.

Industrial cost recovery, as identified in Section 204, required industrial users of publicly owned treatment works to make annual payment for the portion of the cost of construction which is allocable to the treatment of their industrial wastes. Half of the funds generated through industrial cost recovery shall be retained by the local treatment entity. Of this retained amount, four-fifths must be utilized for future plant expansion and construction and one-fifth is discretionary.

TREATMENT CONSOLIDATION

Where consolidation of treatment system occurs, equitable acquisition and/or transfer of existing facilities and debt must occur. Emphasis shall be placed on timely and accurate resolution of financial areas involving valuation of existing facilities, compensation for facilities, and disposition of outstanding debt.

The creation or consolidation into more regionally oriented treatment facilities, from a financial perspective, must be based on the federal and State requirements in effect at the time of management action.

REGULATORY PROGRAMS

An important element of water quality management is regulatory programs. These programs have a part in non-structural strategies which minimize the likelihood or severity of water quality problems through laws, ordinances, compliance review, and penalties.

Costs of regulatory programs impact the budgets of the imposing agency, the treatment entity, and other participating agencies. Elements of cost include start-up costs, facilities costs, monitoring personnel costs, enforcement costs, and compliance agency assistance costs. Federal grants have been made available for the range of activity necessary to identify problems, define solutions, and implement control strategies. A major program for non-point source control strategies and regularatory programs is operated by the U.S. Department of Agriculture - Soil Conservation Service.

FINANCIAL ADMINISTRATION

Each local treatment entity (TWMA) shall be responsible for the maintenance of adequate financial planning and control activites. All applicable sources of financial

assistance shall be sought by local entities with necessary technical, planning, and administrative assistance provided by the Texas Department of Water Resources.

The general steps involved in financial arrangements for water quality financing in the Lower Colorado Basin non-designated area for the 1983 plan are summarized as follows: (1) produce, implement, and maintain a financial, operational, and physical plan. Annual updates to the Lower Colorado Basin plan shall be made and revisions performed for the issuance of updated 1990 and 2000 plans.

IMPLEMENTATION

Implementation activities, schedules, and resources shall be jointly prepared by the local entities and the TDWR. From a financial perspective, there are two elements in implementation:

- An implementation schedule that relates plan priorities to financial resources; and

- A program budget that commits financial resources that are necessary to effect the plan in accordance with federal, State, and local requirements.

A detailed implementation plan will be prepared to indicate expenditure and revenue characteristics for an integrated program. This implementation plan will concentrate on near-term activities with the level of detail decreasing with time. The plan will identify annual requirements over a twenty-year period.

8. REQUIREMENTS FOR INFORMATION UPDATE

The 208 Water Quality Management Plan for the Lower Colorado Basin Nondesignated Study Area has been developed from current and historical data available at the time of production. Development of the management plan was based on many elements influencing or determining the water quality in the basin. Several of these elements are expected to change, and projections of these factors to the end of the planning period have been used in compiling the Document. In order for the water quality management plan to remain relevant to the end of the planning period, the following five objectives should be accomplished: review of planning area boundaries, update of the data base, review of technical subplans, evaluate the nonpoint source management strategy, and review of stream standards and designations of segments.

Review of Planning Area Boundaries. It is recommended that consideration be given to reviewing the planning area boundaries at the beginning of each planning period. The review should incorporate the feedback from the public participation program and reflect the changes in existing and potential water quality problems.

Update of the Data Base. The elements which have been projected to the end of the planning period are population growth, industrial development, land use changes, and water use requirements. These projections are the basis for development of the 208 Water Quality Management Plan to the year 2000, and their accuracy will determine the usefullness of the plan. Because of the importance of the data base in achieving the goals of the 208 report, the data base should be updated on an annual basis.

Review of Technical Subplans. A review of technical subplans is recommended at the beginning of each planning period. This review should reflect changes in the data base and available technology for wastewater treatment. It is anticipated that plans developed from the best possible projections of information at this time will change before water quality objectives for the year 2000 can be met.

Evaluation of Nonpoint Source Management Strategies. The nonpoint source assessments and water quality data currently available indicate that nonpoint source controls are not

required at this time. As assessment techniques are refined, however, and more extensive water quality data become available, a need for nonpoint source management may become evident. A recommendation is made to continue to evaluate the potential for nonpoint source management strategies and to update the 208 Water Quality Management Plan to reflect any change in the loading estimates from nonpoint sources.

Review of Stream Standards and Designation of Segments. The existing water quality data and waste load projections indicate that the overall water quality in the basin is good, and the stream standards will not be violated during the planning period. No changes in stream standards or stream designations are recommended at this time. The stream standards and segment designations should be reviewed periodically, however, to determine whether water quality standards continue to be consistent with uses.

An update of the 208 Water Quality Management Plan may be required as information becomes available from citizen input, municipal census, or special study projects. Data from 201 facility plans, public hearings, environmental impact statements and information on the cost of treatment should be included in the updates. Much of this data will be developed for purposes other than water quality management, and updating of the plan will require monitoring of the information developed by other public or private agencies.

In addition to the basic data, special studies are recommended to develop particular information necessary to a management plan. The following is an inventory of information gaps for those segments where additional studies are considered necessary.

Segment 1401

The portion of the Colorado River which is tidally influenced has recently been reclassified from "Water Quality" to "Effluent Limiting." The reclassification indicates an improvement of water quality in the segment. Point source wasteload to the segment is projected to increase to 590 lbs/day of total oxygen demand by the year 2000. Based on the information currently available, no need can be substantiated at this time to change treatment requirements. Additional sampling, however, is recommended to be carried out in the continual updating program to better determine the effect of the projected load on water quality.

Segment 1402

The sampling program initiated in 1977 for the Austin Intensive Planning Area as part of the present 208 plan preparation has established a starting point to further quantify loadings associated with urban stormwater. The continuation of this program includes the addition of several sampling stations and an effects evaluation of the loadings determined from the sampling program.

Segment 1406

Point source wasteload to Lake Lyndon B. Johnson is projected to increase significantly by the year 2000. The magnitude of this projected load may cause some water quality problems in the future; however, such problems cannot be predicted based on the qualitative analysis performed in this study. Therefore, close monitoring for changing conditions in the lake is recommended. If a potential problem is indicated, special studies will be initiated.

Segment 1417

Pecan Bayou has exhibited extensive dissolved oxygen problems, beginning as early as water year 1972. Violations of chloride and total dissolved solids have also been recorded. An intensive study has been conducted to define these water quality problems in the segment. Results and recommendations for the study are discussed in Appendix D, Results of Special Studies in Intensive Study Areas.

Segment 1501

Two DO violations were recorded in the tidally influenced portion of Tres Palacios Creek in 1973 and 1974. Since there are no point source dischargers in the segment, these violations could be attributed to nonpoint sources. However, no specific sources can be identified with the presently available data. Two vacuum truck disposal sites are suspected as contributing to the problem. In addition, the quantitative analysis of Segment 1502 for high flow conditions indicated the possibility of DO violations in this segment due to nonpoint source wasteload carried over from Segment 1502. A more extensive study to define the source and significance of the problem is deemed necessary before any control techniques can be developed.

Segment 1502

No water quality problems related to point sources have been projected for the portion of Tres Palacios Creek above tidal influences. Nonpoint source wasteload analysis, however, indicates the possibility of a DO problem downstream in Segment 1501 when the total load from Wilson Creek is applied at its confluence with the main stem of Segment 1502. It is quite likely that if the extremely large nonpoint source load from Wilson Creek is distributed along the length of the creek, a DO problem might also be predicted in the lower portion of Wilson Creek as well as the last mile of Segment 1502 below the confluence of Wilson Creek. It should be emphasized, however, that the water quality model used in projecting the problem was developed by the EPA for dry-weather conditions only and relates particularly to point sources. There is no wet-weather (nonsteady state) model available at the present time to predict the impact of nonpoint source wastes on the segment. Development of a stormwater simulation model for the segment is therefore recommended so that the nonpoint source problem can be better defined. Should a calibrated and verified model indicate any water problems in the segment, structure and/or nonstructural control measures then will be developed.

9. STREAM STANDARDS

The Texas Water Quality Standards report is the current revision of a document, Water Quality Requirements, which the Texas Department of Water Resources staff developed in early 1967. In order to comply with the requirements of the Federal Water Pollution Control Act Amendments of 1972, the requirements were revised and approved by the Environmental Protection Agency on October 25, 1973. The Standards were amended in part of three occasions: in October 1974 and October 1975. The Environmental Protection Agency approved these revisions on February 9, 1976. A complete listing of the current standards set for the segments in the Lower Colorado Basin planning area is included in Volume I, Chapter C, of this Plan.

Based on the existing water quality data, wasteload projections, and analyses performed in this study, it is recommended that no changes in stream standards be made at this time. However, the standards should be periodically reviewed to determine whether the water quality standards continue to be consistent with uses and statutory requirements.

CHAPTER D

SEGMENT SUMMARIES

1. SEGMENT 1401

a. Summary of Existing Agencies and Water Quality Control Programs.

(1) Introduction. This section summarizes the existing management agencies and water quality programs in the Colorado River Basin Segment 1401. Additional detailed information is provided in Appendix E, Inventory of Existing Agencies and Practices, Appendix F, Financial Management Experience, Appendix G, Intergovernmental Cooperation in the LCRA 208 Planning Area and Appendix H, Areawide Plans and Programs. This section contains three major topics: description of boundaries, identification of major management agencies, and the definition of water quality control programs in Segment 1401.

(2) Physical Boundaries and Description. Segment 1401, which lies in Matagorda County, consists of the Colorado River from its mouth at Matagorda Bay to the upper portion of tidal influence, extending approximately 23 miles along the river.

(3) Existing Management Agencies. All federal and state agencies, primarily the Environmental Protection Agency and the Texas Department of Water Resources, are involved in segment management functions. The segment is completely within the management jurisdiction of the regional agencies that follow: Houston-Galveston Area Council, Port of Bay City Authority, and Lower Colorado River Authority. Intergovernmental devices allow for contracting of wastewater management functions between or among agencies within or outside the segment boundaries.

Segment 1401 is completely within Matagorda County. Only one city is within the segment boundary, and two waste control orders are in existence.

(4) Water Quality Control Programs. Segment 1401 is completely within the planning boundaries of the Houston-Galveston Area Council. The segment does not contain any

Section 201 facility planning areas nor does it contain any sewerage planning areas. The segment is within the TDWR and TDH water quality monitoring networks but is not presently within the monitoring networks of the USGS.

b. Nonpoint Source Assessment.

(1) Introduction. This section presents an assessment of the impact of nonpoint source pollutants in the Colorado River Basin Segment 1401. Additional detailed information is provided in Appendix I, Inventory and Methodology - Nonpoint Source Assessment and Appendix J, Segment Layouts with Nonpoint Source Inventory.

(2) Assessment. Segment 1401, that portion of the Colorado River which is tidally influenced, has exhibited a single water quality violation for the period of record. In 1973, a dissolved oxygen standard violation was recorded by the Texas Department of Water Resources. Any potentially significant nonpoint source pollution could be attributed to the three oil and gas fields in the segment area. Oil field brine can increase the concentration of dissolved solids in streams. The sediment loading from agricultural/ silvicultural activity poses little water quality problem for the segment. Further, it has been stated by the County health department during the review process that septic tank areas and vacuum truck disposal points have been problems in Matagorda County. These latter two pollution sources should be studied in greater depth during the continual updating program for the basin plan.

c. Wasteload Projections. This segment is classified as a Category II segment.

(1) Point Sources. This segment consists of one municipal and three industrial point source dischargers. The existing wasteload contribution from the municipal discharge is approximately 6 lbs/day of BOD and TSS and is projected to double by the year 2000. The industrial point sources, on the other hand, presently contribute 189 lbs/day of BOD and 560 lbs/day of TSS, and the load is projected to increase to 355 lbs/day of BOD and 710 lbs/day of TSS by the year 2000. The existing and projected wasteloads to the segment are summarized as follows:

	BOD lbs/day			TSS lbs/day		
Planning Year	Mun.	Indus.	Total	Mun.	Indus.	Total
Existing	6	184	190	6	559	565
1983	12	211	223	12	421	433
1990	12	310	322	12	624	636
2000	13	355	368	13	707	720

d. Wasteload Analysis. This segment, the tidal portion of the Colorado River, has been recently reclassified as an 'Effluent Limiting' segment. Its waters are deemed desireable for contact and noncontact recreation and for progagation of fish and wildlife. The following standards have been set for the segment.

Dissolved Oxygen (not less than)	5.0 mg/l
pH Range	6.5-8.5
Coliform (Log. avg. not more than)	200 FECAL/100 ml
Temperature	95°F

The existing total oxygen demand from the point source discharges to the segment is 300 lbs/day. One municipal facility discharges to the Gulf Intracoastal Waterway and the three industrial point sources discharge directly into the Colorado River. Possible nonpoint sources of pollution for this segment have been identified as brine from the three existing oil and gas fields. A review of Chapter F of Basic Data Report indicates no existing water quality problem in this segment. There was one instance of DO violation during December 1972, when a DO of 4.7 mg/l was recorded. At the time of the violation, other measured parameters were within the permissible range. There have been no further violations of standards since December 1972. The segment was recently reclassified from 'Water Quality' to 'Effluent Limiting' indicating an improvement in the water quality of the segment.

Total wasteloads from point sources are projected to increase to approximately 590 lbs/day in terms of oxygen demand by the year 2000. Although the wasteload to the segment is projected to increase, it is not expected that future water quality in this segment will be a problem in light of the present water quality of the segment and the magnitude of the total wasteload. Based on these data, no need can be substantiated at this time to change treatment requirements. However, additional sampling data would enable better judgements to be made and should be considered for inclusion in studies conducted as part of the continual updating program for the basin plan.

e. Sewerage Planning Area Alternative Plans. There are no sewerage planning areas located in this segment; thus, no alternative plans were developed.

2. SEGMENT 1402

a. Summary of Existing Agencies and Water Quality Control Programs.

(1) Introduction. This section summarizes the existing management agencies and water quality programs in the Colorado River Basin Segment 1402. Additional detailed information is provided in Appendix E, Inventory of Existing Agencies and Practices, Appendix F, Financial Management Experience, Appendix G, Intergovernmental Cooperation in the LCRA 208 Planning Area, and Appendix H, Areawide Plans and Programs. This section contains three major topics: description of boundaries, identification of major management agencies, and the definition of water quality control programs in Segment 1402.

(2) Physical Boundaries and Description. Segment 1402 includes a large portion if not all of Travis, Bastrop, and Fayette counties and portions of Hays, Caldwell, Colorado, and Wharton counties. This segment consists of a part of the Colorado River from the tidal portion (approximately to river mile 23) up to and including Town Lake in Austin. The upper portion of the segment is included in the Capital Area Planning Council planning area and the remaining portion of the segment is included in the Houston-Galveston Area Council planning area. All of Segment 1402 is also within the jurisdictional boundaries of the Lower Colorado River Authority (LCRA) and includes 17 cities - Austin, Bastrop, Buda, Carmine, Columbus, Eagle Lake, Elgin, Fayetteville, Giddings, LaGrange, Manor, Pflugerville, Rollingwood, Round Top, Smithville, Sunset Valley and Wharton.

(3) Existing Management Agencies. All federal and state agencies, primarily the Environmental Protection Agency and the Texas Department of Water Resources, are involved in segment management functions. Other agencies within Segment 1402 include the previously mentioned Capital Area Planning Council, Houston-Galveston Area Council, and Lower Colorado River Authority. Each of these agencies has specific authority to perform planning and/or management functions. Intergovernmental devices allow for contracting for wastewater management functions between or among agencies within or outside the segment boundaries.

Segment 1402 is partially or wholly within seven counties: Travis, Bastrop, Fayette, Hays, Caldwell, Colorado, and Wharton. There are 17 cities and 8 special districts within the segment boundaries, and 13 waste control orders are in existance. Presented below is a tabulation of municipalities and special districts within the segment:

Municipalities		Special Districts
Austin	Manor	Bastrop County WCID #1
Bastrop	Pflugerville	Colorado County WCID #2
Buda	Rollingwood	Fayette County WCID
Carmine	Round Top	Glidden FWSD
Columbus	Smithville	Lee-Fayette Co. Cummins Creek WCID #1
Eagle Lake	Sunset Valley	Lost Creek MUD
Elgin	Wharton	Travis County WCID #12
Fayetteville		Travis County WCID #18
Giddings		
LaGrange		

(4) Water Quality Control Programs. Segment 1402 contains two Section 201 facility planning areas, #0966 and #1241, and two sewerage planning areas, the City of Elgin and the City of Weimar. The segment is currently within the monitoring networks of the TDWR, TDH and USGS.

b. Nonpoint Source Assessment.

(1) Introduction. This section presents an assessment of the impact of nonpoint source pollutants in the Colorado River Basin Segement 1402. Additional detailed information is provided in Appendix I, Inventory and Methodology - Nonpoint Source Assessment and Appendix J, Segment Layouts with Nonpoint Source Inventory.

(2) Assessment. Segment 1402 contains the City of Austin SMSA and, as such, is designated as an Intensive Planning Area. To assess the effect that the Austin SMSA has on the segment, an analysis of the urban nonpoint source loads has been done. The Austin intensive planning area was subdivided into 12 watersheds as well as an additional area above the Tom Miller Dam draining directly into Lake Austin, and an area below the dam draining directly into Town Lake (Figure 5, Appendix J). The study area boundary was defined according to land-use projections made in consultation with the Austin City Planning Department. This boundary represents the areal extent of projected urban development which the City of Austin is expected to experience over the course of the next 20 years. Land-use data for existing conditions

were compiled from the updated 1974 land-use map prepared by the Planning Department. Table 1, Appendix K, gives existing land-use data for Austin watersheds. Land-use data for future conditions were based upon projections for 5-, 10-, and 20-year intervals also prepared in consultation with the City Planning Department and are shown in Volume I of the Basin Plan. Projected land-use data for Austin watersheds are found in Tables 2 through 4, Appendix K.

In several instances, the existing developed land area does not encompass the entire watershed, thereby leaving much of the drainage area in vacant and/or agricultural land. So as to emphasize the "change" in land-use character and ultimately the change in pollutant loadings in each watershed over the 5-, 10-, and 20-year periods, that portion of the watersheds contained within the 20-year urban limit line was included in acreage totals even for existing conditions. In other words, the total area of the watershed remained constant throughout the 20-year projections while the number of acres of land in the various land-use categories increased or decreased according to the projected development.

Impervious cover was determined, as discussed in Appendix I, resulting in a percent impervious area for each watershed. Subdividing the whole Austin urban area enabled a more refined assessment of pollutant loads because individual differences in land use and topography among watersheds were more closely accounted.

At this point, the critical storm was determined for the urban area and applied across the watersheds. A two-year return period was selected as frequent enough to produce potential pollution problems. The storm was then based on a three 1/2-hour rainfall of 2.9 inches. The time of concentration of a watershed is the time required for runoff to flow from the most remote point (in flow time) of the drainage area to the outlet, once the soil is saturated and the small depressions are filled. Shoal Creek was chosen because its time of concentration was sufficient to allow the other watersheds to empty. In addition, in looking at street contaminant removal as a function of runoff, it is noted in the Planning Methodology that 0.5 inch of runoff will wash off approximately 90 percent of the surface pollutants. Applying the 2.9 inches of rainfall based on Shoal Creek with the average runoff-to rainfall ratio of 0.31 for all Austin watersheds resulted in approximately 0.9 inch of runoff. This would appear capable of washing off practically all of the street contaminants and not produce a significant amount of diluting water.

It became evident that Big Walnut and Williamson/Onion creeks have a longer time of concentration than does Shoal Creek, and therefore might not fully empty into the river using the latter time of concentration. However, large outlying portions of these watersheds are not developed but lie rather as vacant and/or agricultural land. Given that the purpose here is to assess urban stormwater loads, these areas are less critical as they are not true indicators of an urban load. The developed areas of the watersheds do have sufficient time to empty under the storm based on the time of concentration of Shoal Creek.

Loads were then generated based upon the estimation of the average concentration of pollutants in the stormwater found in Table 8, Appendix I. Tables 5 through 8, Appendix K, contain pollutant loads for existing and projected land uses within Austin watersheds. Several of the watersheds do not exhibit changes in pollutant loads over the 5-, 10-, and 20-year periods due to minimal changes in the land use throughout the basins. Others exhibit slight to moderate increases in loads due to increasing runoff volume resulting from greater urbanization.

Other nonpoint source activities in Segment 1402 would generally contribute to water quality problems essentially in the segment area downstream from the City of Austin's influence. There are numerous waste disposal sites throughout the segment. Sanitary landfills are concentrated in Fayette and Bastrop counties. Groundwater contamination is a potential problem in these areas. There are 13 animal feedlots and 22 septic tank areas scattered throughout the segment. A septic tank area is defined as an area which contains more than 100 people and has a density greater than two dwellings per acre. Runoff from feedlots poses potential surface water pollution, whereas septic tank systems are likely to affect groundwater. The Texas Department of Water Resources noted coliform violations for Segment 1402 in 1976. Possible nonpoint sources are feedlots and septic tanks.

There is much active mining in Segment 1402, particularly sand and gravel operations. Figure 3B, Appendix J, depicts 50 sand and gravel mines, five clay mines, and six limestone mines primarily concentrated in Colorado and Travis counties. These mines range in size from less than two acres to over 100 acres, with the majority falling under two acres. In sand and gravel mining, the primary method of treating wastewater is through the use of settling ponds. These are usually located adjacent to a stream, making

proper treatment of the wastewater essential. Potential water quality changes which may result from sand and gravel operations include increases in total suspended solids and turbidity. Although two-thirds of the mining sites in the segment are inactive, they present potential nonpoint source pollution due to surface runoff. There are 12 gas fields, 23 oil fields, and 22 combination oil and gas fields in the segment. Two-thirds of these fields are active, with most activity concentrated near the coast in Matagorda, Wharton, and Colorado counties. Oil field brine production poses a potential water quality problem in terms of increasing dissolved solids concentrations in streams.

Agricultural land and forestland are the dominant land uses throughout Segment 1402, giving rise to potentially significant nonpoint source pollution problems relative to other segments in the study area. The predominant agricultural activity in the lower portion of Segment 1402 gives rise to the potential problem associated with the discharge of toxic substances in rice irrigation return flows. The significance of this problem is presently undefined and will require field studies in the future. The sediment loading for Segment 1402 is relatively high. Travis and Fayette counties contribute a large amount of agricultural activity. There are nine "no discharge" sites in Travis County. These sites do not have permits to discharge directly into streams; therefore, treated effluent is released across the land often as irrigation water. Groundwater contamination is a potential problem.

Aside from the City of Austin there are ten additional smaller urban areas throughout the segment which contribute significant amounts of urban runoff. These areas average individually about 1,200 acres in size. The cities of Bastrop, La Grange, Columbus, and Wharton are particularly significant as they are located in close proximity to the main river stem.

Construction activity is prevalent in Segment 1402, particularly in Travis County. There are five active highway construction sites in the segment, four of which are in operation along Interstate 35 in Travis County. Erosion of surface soils and resulting sediment production is of primary concern. Greases, oils, and wastewater from concrete operations at construction sites also contribute to impairment of water quality.

c. Wastewater Projections. This segment is classified as a Category IV segment. Wasteloads are projected for both point and nonpoint sources.

(1) Point Sources. There are twenty-seven municipal and five industrial point source dischargers in the segment. The wasteload contribution from the existing municipal point sources amounts to approximately 7,800 lbs/day of BOD and 7,800 lbs/day of TSS. These loads are projected to nearly double by the year 2000. The industrial discharges contribute very minimal wasteloads to the segment in comparison to the municipal loadings and are not projected to increase significantly through the planning period. These existing and projected wasteloads are summarized as follows:

Planning	BOD (lbs/day)			TSS (lbs/day)		
Year	Mun.	Indus.	Total	Mun.	Indus.	Total
Existing	7,791	2	7,793	7,801	495	8,296
1983	7,992	2	7,994	8,023	495	8,518
1990	9,650	2	9,652	9,687	495	10,182
2000	12,521	3	12,524	12,571	605	13,176

A more detailed breakdown of these loads is presented in Appendix M as well as a discussion of the methodology used.

d. Wastewater Analysis. The Texas Department of Water Resources has completed computer modeling runs for this segment using critical low flow, summer temperatures, and projected point source discharges. Model results for effluent set 1 indicated compliance well within the stream dissolved oxygen (DO) standard of 5.0 mg/l. The minimum DO concentration was 6.96 mg/l near the Ionion Creek wasteload. Additional computer runs were made to determine the maximum possible discharge under critical conditions. Wasteloadings were increased until a DO concentration less than 5.0 mg/l was predicted in the river. Interpolation of these runs yielded a figure of 335 cfs as the total discharge amount from all the Austin STP's. This amount would vary with changes in the locations and relative magnitudes of flows from the three major discharges but as an approximation it should be adequate.

e. Alternative Plans for the Elgin Sewerage Planning Area.

The City of Elgin is an incorporated general law municipality located in the northern portion of Bastrop County. Land use for the city is characterized by scattered residential development and concentrated commercial and public facilities along major thoroughfares in the central areas of the city. The economic resource base is primarily agricultural with no known significant industrial contribution. A moderate increase in population is anticipated for Elgin for the next twenty years. The population estimates are as follows:

Year	Existing	1983	1990	2000
Population	4,220	4,810	4,300	6,100

The existing wastewater collection system of the city is comprised of 6- to 8-inch clay pipe with some 12-inch clay pipe in the outfall line. Several lift stations are utilized in the system due to the hilly terrain of the area. The system is basically in good condition and there are no significant areas of town where septic tanks are the primary means of sewage disposal.

The existing sewage treatment plant was constructed in 1962 with a design capacity of 0.375 mgd. It consists of a bar screen and grit chamber, two pre-aerators, a primary clarifier, a trickling filter, a two-stage digester, two sludge drying beds, and five oxidation ponds in series.

Based on projected population growth, the wastewater collection and treatment system is projected to be inadequate by 1983. Therefore, alternative plans were developed for providing the required additional capacity.

(1) Structural Alternatives

(a) Collection System. Since there are no major septic tank areas within the city, additional lines are needed only to serve the anticipated development around the outskirts of the city. However, with the additional flow contribution from the northeast section, a relief sewer will have to be provided for the main trunk line through the center of the city. The proposed collection system improvements include two lift stations and approximately 90 inch-miles of sewer line which should provide enough capacity through the planning period based on the "Water Quality Management Planning Methodology for Municipal Waste Treatment Needs Assessment."

(b) Treatment and Disposal. There are three broad options which were investigated for disposal of sewage for the City of Elgin. These options are 1) treatment and discharge, 2) treatment and reuse, and 3) land application. Since there are few industries in the area, reuse of treated water for industrial processes is of little potential, and factors such as public health, soil conditions, and economic considerations make the reuse of treated water as a potable water source or groundwater recharge infeasible. Therefore, only the treatment and discharge, and land application options were considered. Based on the State methodology, three alternatives were developed for these two options.

Alternative 1. This alternative proposes expansion of the existing trickling filtration unit to 0.6 mgd and addition of final clarifiers and chlorination facilities by 1980. This should provide the plant with adequate capacity through the year 2000 as well as an effluent meeting the permitted requirements.

Alternative 2. This alternative proposes abandonment of the existing plant and installation of a new 0.6 mgd package plant by 1980. The package plant should produce better quality effluent and have less operating problems. Additional sludge drying beds are needed to dewater the increased amount of sludge. Dry sludge will still be landfilled. It is appropriate to note that package plant construction does not necessarily mean above grade, steel tanks. In this case, it is the expressed desire of city officials to utilize concrete construction to the fullest extent in order to ease maintenance requirements and prolong the system life.

Alternative 3. This alternative proposes land application of effluent. The existing trickling filter unit will be abandoned, primary treatment capacity expanded, and chlorination facilities added. The chlorinated effluent will be used for spray irrigation. Effluent spray equipment and approximately 275 acres of land are required. Primary sludge will be aerobically digested, dewatered, and landfilled. In addition, emergency holding ponds are proposed to be constructed for temporary storage of effluent when the situation does not allow the effluent to be used for irrigation.

Another alternative discussed with city officials which may prove to be most cost effective during the facility planning phase is diversion of about 60 percent of the existing flow to a new, second plant at a different site. The existing

plant would be kept in service after any necessary modernization. Such an approach could reduce the cost of collection by shortening the distances for main interceptor lines. Preliminary engineering information must be developed to allow meaningful consideration of this alternative.

(2) Costs of Technical Alternatives

Using the State methodology referenced previously, costs were developed for the three technical alternatives considered. For each alternative, capital cost, operation and maintenance cost, and annualized total and per capita costs (with and without EPA grant) were calculated. While developing these costs, all capital costs were assumed to be incurred in the year 1980; the facility life was assumed to be 20 years; and 6-3/8 percent annual interest rate was used. All values are in March 1977 dollars. Year 1980 population was selected as the basis for calculating the annualized per capita costs. These estimated costs are presented in Table II-D-1.

(3) Impacts of Technical Alternatives

The monetary cost for these three alternatives is only one of several aspects which should be considered in selecting the most beneficial alternative. The environmental, social, and economic impacts of different alternatives, such as energy and resources use, sensitive ecosystems, air quality, local health problems, etc., should also be evaluated. These nonmonetary costs or impacts are presented in Table II-D-2.

(4) Management Alternatives

Two conceptual models should be considered when designing a management system for Elgin and other sewerage planning areas in the Lower Colorado River Basin: centralized and decentralized.

(a) Decentralized Operations. The decentralized model relies on each individual city or special district to provide sewage treatment services. The decentralized model is found in most areas of Texas, and it most closely represents the management system presently operating the Lower Colorado River planning area.

As noted in section (1) above, the City of Elgin presently owns and operates a sewage collection and treatment system. The city has a small professional staff, with a full-time

TABLE II-D-1

COST OF TECHNICAL ALTERNATIVE PLANS FOR

CITY OF ELGIN

	Alternative 1	Alternative 2	Alternative 3 (Land cost included)	Alternative 3 (Land cost excluded)
Capital Cost				
Collection System	$ 975,000	$ 975,000	$ 975,000	$ 975,000
Treatment Plant	575,000	449,000	2,402,000	2,032,000
Total	$1,550,000	$1,424,000	$3,377,000	$3,007,000
O & M Cost				
Collection System	$ 44,000/yr	$ 44,000/yr	$ 44,000/yr	$ 44,000/yr
Treatment Plant	45,000/yr	53,000/yr	63,000/yr	63,000/yr
Total	$ 89,000/yr	$ 97,000/yr	$ 107,000/yr	$ 107,000/yr
Annualized Cost				
Without Grant				
Total	$ 228,000/yr	$ 225,000/yr	$ 410,000/yr	$ 377,000/yr
Per Capita	$ 50/yr	$ 49/yr	$ 89/yr	$ 82/yr
With Grant				
Total	$ 124,000/yr	$ 129,000/yr	$ 183,000/yr	$ 175,000/yr
Per Capita	$ 27/yr	$ 28/yr	$ 40/yr	$ 38/yr

TABLE II-D-2

IMPACTS OF TECHNICAL ALTERNATIVE PLANS FOR

CITY OF ELGIN

Criterion	Alternative 1	Alternative 2	Alternative 3
Electricity Use	Approx. 253,000 KWH/yr	Approx. 500,000 KWH/yr	Approx. 301,000 KWH/yr
Chemical Use	9.3 tons Chlorine per yr.	9.3 tons Chlorine per yr.	23.2 tons Chlorine per yr.
Manport Requirements	2.3 man-yr/yr	2.3 man-yr/yr	3.3 man-yr/yr
Land Requirements	Existing Plant site	Existing plant site	Additional 270-ac required
Aesthetics	Visual impression will be matter of good architectural design and site maintenance.	Visual impression will be matter of good architectural design and site maintenance.	Land disposal site could be utilized as green belt.
Local Health	Local health improved because of better effluent quality	Local health improved because of better effluent quality	Local health improved because of no effluent discharges.
Sensitive Ecosystems	Temporary alteration of ground from sewer construction.	Temporary alteration of ground from sewer construction.	Large land required could cause destruction of trees, etc.
Air Quality	No serious odor problem anticipated if properly operated.	No serious odor problem anticipated if properly operated.	No serious odor problem anticipated if properly operated.

water works superintendent. The city government has the legal authority and has demonstrated adequate management competence to operate expanded sewage treatment facilities. The key issue is whether the city can finance the necessary improvements without state or federal financial assistance.

Table II-D-1 summarizes the costs of each technical alternative. In preparing a financial plan, several basic options are available to the city. Each is discussed briefly below.

General Obligation Bonds. General obligation or tax bonds are secured by the ad valorem taxing authority of the city. The city's only GO debt is self-supporting (for water works), and represents less than 2 percent of the city's assessed valuation (at 30 percent of actual value). Although only 25 cents of the $1.50 tax rate is given over to debt service, the city could not finance any of the alternatives without increasing tax revenues, probably through an increase in the basis of assessment. Even with an increase to 100 percent of assessed value, the city would have difficulty financing the least expensive alternative with tax bonds alone.

Revenue Bonds. Revenue bonds are secured by the income from user fees and charges. The city has $462,000 of water and sewer system bonds outstanding. In order to issue parity bonds, the city must have net revenues from one year preceding the issuance of new bonds equal to one and one-half times average annual requirements, after giving effect of the additional bonds. For the fiscal year ending June 30, 1976, the city had coverage of 1.68. Unless coverage was substantially higher in 1977, a substantial rate increase would be necessary to finance any of the alternatives, and the rate increase would have to be enforced for 12 months prior to the issuance of the new bonds. To finance the least expensive alternative would require sewer use charges of approximately $12.00 per customer per month, in addition to the rates in force in 1976.

Texas Water Quality Enhancement Fund. The Texas Water Quality Enhancement Fund, administered by the Texas Department of Water Resources, is designed to assist local communities that cannot finance water quality facilities through regular commercial channels. If the loan is approved by TDWR, the Department will purchase the city's bonds secured by a junior lien on the net revenues of the system. User fee increases likely would be required, although probably less than those required to issue parity bonds. It should be noted that rate increases necessary to

finance junior lien bonds automatically increase coverage, thus improving the capacity to issue additional parity bonds in the future if they should be necessary.

Federal Construction Grant Program. The federal construction grant program, authorized under section 201 of P.L. 92-500, would finance 75 percent of the capital costs for any of the alternatives. The city would be required to finance the 25 percent from local or state sources. Thus, the city could use any of the financing approaches outlined above to meet the matching requirements for the construction grant program. (Certain federal funds may also be used to meet matching requirements, as discussed below.) Operation and maintenance costs, however, must be paid from user charges.

Other Federal Assistance Programs. The Farmer's Home Administration (FMHA) administers a loan and grant program for wastewater systems in rural communities. If a community meets the eligibility requirements, FMHA grants and loans may be used in combination to finance sewage collection and treatment systems. Other grant and loan programs are administered by the Economic Development Administration for communities in economic development areas. Community development bloc grants, administered by the Department of Housing and Urban Development, may be used to finance collection systems, but not sewage treatment plants. Finally, federal revenue sharing funds may be used for any lawful purpose, including the matching requirements of other federal programs.

(b) Centralized Operations. The centralized model would involve an areawide special district or authority (or a series of authorities) with responsibility to plan, finance, construct, operate, and maintain sewage treatment facilities throughout all or parts of the basin. The authority would be a "wholesaler" of sewage treatment services to local governments who would "retail" services to businesses and households. Local governments who were customers of the authority would enter intergovernmental contracts providing them with guaranteed sewage treatment capacity in one (or more) sewage treatment plants operated by the authority. Each local government would retain ownership and maintenance of its own collection system and would be responsible for billing and collection operations.

The Lower Colorado River Authority (LCRA) has the statutory authority, jurisdiction, and financial and management capability to assume ownership and/or operation of a city's sewage treatment facilities and to implement the technical

alternatives. However, the LCRA would assume this responsibility only upon a finding by the consultants that no other alternatives were feasible.

By and On Behalf of Bonds. Under the general laws of the State, the LCRA may issue water quality improvement bonds "on behalf of" a local government. Ordinarily, these bonds are issued by a river authority that has contracted with a local government to operate the local sewage treatment facility. The local government enters a contract with the authority, promising to make payments adequate to meet debt service or debt service and operating and maintenance costs. To meet its obligations under the contract, the city may take revenues from any source (except sales tax receipts). The bonds are secured solely by the intergovernmental contract. The credit of the authority is not pledged.

f. Alternative Plans for the City of Weimar Sewerage Planning Area.

The City of Weimar is an incorporated general law municipality located in the western portion of Colorado County. Land use for the city is characterized by scattered residential development with commercial and public facilities concentrated along major thoroughfares in the central areas of the city. Existing population of the city is estimated to be about 2,160. A moderate increase in population is projected within the next twenty years. Population estimates for the planning years are shown as follows:

Year	Existing	1983	1990	2000
Population	2,160	3,100	3,700	4,500

The existing wastewater collection system for the city generally consists of 6-, 8-, and 10-inch lines. The system is considered adequate for present needs. However, in order to serve the projected population, expansion of the existing system would be required within the planning period.

The city's wastewater treatment plant was constructed in 1950 and consists of three oxidation ponds in series with two mechanical aerators in the first pond. Effluent Set O (30 mg/l BOD_5, 30 mg/l TSS) is required for this facility. TDWR self-reporting data indicate that in 1976 the plant encountered high TSS concentrations (averaging 109 mg/l) and marginal BOD_5 concentrations (averaging 30 mg/l) in the effluent. The high suspended solids concentrations are generally inevitable for the oxidation pond effluent due to algae problems. Therefore, unless administrative relief on suspended solids requirements is obtained from the TDWR, the existing treatment process would have to be upgraded.

Future growth projected for the City of Weimar will create needs for additional collection and treatment capacity to serve the 4,500 people within the next twenty years. Therefore, alternative plans are developed for these sewerage needs.

(1) Structural Alternatives

(a) Collection System. Since the existing collection system of Weimar is generally considered adequate for present

needs, alternative plans are developed only for future needs. The additional capacity required would serve the projected population increase of 2,340 people within the planning period.

The expansion of the collection system would most likely continue to consist of gravity lines and pump stations, if required, at appropriate locations. Construction of needed facilities would probably take place in stages as needs grow. However, for the purpose of this study single-stage construction is considered in the analysis. Based on the statewide methodology, Water Quality Management Planning Methodology for Municipal Waste Treatment Needs Assessment, an analysis for gross collection system requirements of Weimar was made. The required improvements have been estimated to include approximately two lift stations and 143 inch-miles of gravity lines.

It should be emphasized that the analysis made in this study is not intended to replace a full engineering study, but rather to serve as a basis for estimating the approximate costs of the collection system improvements.

(b) Treatment and Disposal. Three broad options for disposal of sewage are generally available. These options include (1) treatment and disposal, (2) treatment and reuse, and (3) land application of sewage effluent. For the purpose of this study, reuse of treated wastewater is not considered as a viable solution due to the potential public health problems and economic considerations. Therefore, only treatment and discharge, and land application options were examined. Based on the methodology mentioned previously, three structural alternatives were developed from these two broad options for the City of Weimar.

Alternative 1. This alternative proposes expansion of the existing pond system. The expansion would include deepening the first two existing ponds to a depth of 6 feet, installing additional mechanical aerators with a total capacity of 200 horsepower, and constructing an additional stabilization pond with a surface area of 3.6 acres. The proposed system is expected to have adequate capacity to serve 4,500 people and produce an effluent meeting the BOD_5 requirements. However, as discussed before, the oxidation pond system cannot constantly produce an effluent with total suspended solids concentration less than 30 mg/l due to algae problems. Therefore, administrative relief on TSS requirements has to be obtained before this alternative can be adopted.

Alternative 2. This alternative would require abandonment of existing oxidation pond system and construction of a new 0.45 mgd prefabricated contact stabilization package plant with sludge drying beds. The package plant would include components for preliminary treatment, aeration and reaeration, final clarification, disinfection, and aerobic sludge digestion. Effluent from the plant would be discharged into Harvey's Creek. Final sludge disposal would be by contract hauling.

Alternative 3. Land application of sewage effluent is considered in this alternative. Construction of 0.45 mgd units for primary treatment, disinfection, aerobic digestion, and sludge drying beds would be required; spray irrigation equipment and approximately 230 acres of land would also be needed. If the existing city golf course is utilized for effluent irrigation, the amount of land required can be reduced to approximately 150 acres. The treated and disinfected effluent would be sprayed over the irrigation field and would not discharge to the receiving stream. Existing ponds would be utilized as emergency holding ponds. Sludge disposal would be by contract hauling.

It should be emphasized that these three alternatives shown are from a prescribed list given in the statewide methodology, and presentation of the three alternatives is not intended to eliminate any viable alternative from use for this location, but rather to limit for planning purposes the number of possible selections to those which offer a meaningful difference in various project costs. The options presented should be understood in the context of being representative examples of reasonable planning level solutions and costs.

(2) Costs of Technical Alternatives

Based on the State methodology referenced previously, costs for collection and treatment alternatives were estimated. For each alternative, capital cost, operation and maintenance cost, and annualized total and per capita costs (with and without EPA grants) were calculated. All costs are given in terms of 1977 dollars and presented in Table II-D-3. The interest rate used in this analysis is 6-3/8 percent and the service life of all equipment and structures is assumed equal to 20 years. The capital costs are assumed to be incurred in 1980 and are spread over the projected population for the same year as the basis for calculating the annualized per capita costs.

TABLE II-D-3

COSTS OF TECHNICAL ALTERNATIVE PLANS FOR

CITY OF WEIMAR

	Alternative 1	Alternative 2	Alternative 3 (Land cost included)	Alternative 3 (Land cost excluded)
Capital Cost				
Collection System	$1,441,000	$1,441,000	$1,441,000	$1,441,000
Treatment Plant	440,000	465,000	2,250,000	1,943,000
Total	$1,881,000	$1,906,000	$3,691,000	$3,384,000
O & M Cost				
Collection System	$ 45,400/yr	$ 45,400/yr	$ 45,400/yr	$ 45,400/yr
Treatment Plant	54,300/yr	55,000/yr	48,000/yr	48,000/yr
Total	$ 99,700/yr	$ 100,400/yr	$ 93,400/yr	$ 93,400/yr
Annualized Cost				
Without Grant				
Total	$ 269,000/yr	$ 272,000/yr	$ 425,000/yr	$ 398,000/yr
Per Capita	$ 98/yr	$ 99/yr	$ 155/yr	$ 145/yr
With Grant				
Total	$ 142,000/yr	$ 143,000/yr	$ 176,000/yr	$ 169,000/yr
Per Capita	$ 52/yr	$ 52/yr	$ 64/yr	$ 62/yr

(3) Impacts of Technical Alternatives

The monetary cost for the developed alternatives is only one of several aspects which should be considered in selecting the most beneficial alternative. The environmental, social, and economic impacts of these alternatives should also be evaluated. These nonmonetary costs or impacts are presented in Table II-D-4. The summarized impacts do not indicate any adverse or unusual effects that could be expected from implementation of any of these alternatives.

(4) Management Alternatives

Two conceptual models should be considered when designing a management system for Weimar and other sewerage planning areas in the Lower Colorado River basin: centralized and decentralized.

(a) Decentralized Operations. The decentralized model relies on each individual city or special district to provide sewage treatment services. The decentralized model is found in most parts of Texas, and it most closely represents the management system found presently in the Lower Colorado River basin.

The City of Weimar owns and operates a sewage collection and treatment system. The city's population is increasing gradually, placing demands on the existing facilities, and some areas of the city need collection systems.

Table II-D-3 indicates that costs for technical alternatives range from $1.9 million to $3.7 million. The most important issue is the method of financing the needed improvements.

General Obligation Bonds. General obligation bonds are secured by the ad valorem taxing authority of the city. The City of Weimar has no general obligation debt. Its estimated assessed valuation of $18 million would be adequate to finance alternative 1 ($1.9 million), although this one issue would exhaust the city's capacity to issue tax bonds for other purposes.

Revenue Bonds. The City of Weimar has no revenue bond indebtedness. To issue revenue bonds, which are secured by the net revenues for the water and sewer systems, the city would have to establish user charges at a level adequate to pay operating and maintenance costs and 1-1/2 times debt

TABLE II-D-4

IMPACTS OF TECHNICAL ALTERNATIVE PLANS FOR

CITY OF WEIMAR

Criterion	Alternative 1	Alternative 2	Alternative 3
Electricity Use	Approx. 1,300,000 KWH/yr	Approx. 550,000 KWH/yr	Approx. 350,000 KWH/yr
Chemical Use	None	6.8 tons Chlorine per yr.	17.1 tons Chlorine per yr
Manpower Requirements	0.2 man-yr/yr	2.3 man-yr/yr	2.0 man-yr/yr
Land Requirements	4.6 acres	Existing plant site	Approx. 230 acres
Aesthetics	Visual impression will be matter of good architectural design and site maintenance.	Visual impression will be matter of good architectural design and site maintenance.	Land disposal sites could be utilized as green belt.
Local Health	Local health improved because of better effluent quality.	Local health improved because of better effluent quality.	Local health improved because of no effluent discharges.
Sensitive Ecosystems	Alteration of ground from plant construction.	Temporary aleration of ground from sewer construction.	Large land required could cause destruction of trees, etc.
Air Quality	No serious odor problem anticipated if properly operated.	No serious odor problem anticipated if properly operated.	No serious odor problem anticipated if properly operated.

service. Annual costs of alternative 1 are $269,000 per year, or approximately $269 per connection. The total rate increases necessary for financing alternative 1 would depend on net revenues available for debt service from present rates.

Texas Water Quality Enhancement Fund. The Texas Water Quality Enhancement Fund, administered by the Texas Department of Water Resources, is designed to assist local communities that cannot finance water quality facilities through regular commercial channels at reasonable interest rates. Because of the total debt and O&M costs Weimar must bear, all or a part of the financial requirements might be met by a TDWR loan.

Federal Construction Grant Program. The federal construction grant program, authorized under Section 201 of P.L. 92-500, would finance 75 percent of the capital costs for any of the alternatives. The city would be required to finance the 25 percent from local or State sources. Thus, the city could use any of the financing approaches outlined above to meet the matching requirements for the construction grant program. (Certain federal funds may also be used to meet matching requirements, as discussed below.) Operation and maintenance costs, however, must be paid from user charges.

Other Federal Assistance Programs. The Farmer's Home Administration (FmHA) administers a loan and grant program for wastewater systems in rural communities. If a community meets the eligibility requirements, FmHA grants and loans may be used in combination to finance sewage collection and treatment systems. Other grant and loan programs are administered by the Economic Development Administration for communities in economic development areas. Weimar does not appear to qualify for FmHA or EDA assistance. Community development bloc grants, administered by the Department of Housing and Urban Development, may be used to finance collection systems, but not sewage treatment plants. Finally, federal revenue sharing funds may be used for any lawful purpose, including the matching requirements of other federal programs.

(b) Centralized Operations. The centralized model would involve an areawide special district or authority (or a series of authorities) with responsibility to plan, finance, construct, operate, and maintain sewage treatment facilities throughout all or parts of the basin. The authority would be a "wholesaler" of sewage treatment services to local

governments who would "retail" services to businesses and households. Local governments who were customers of the authority would enter intergovernmental contracts providing them with guaranteed sewage treatment capacity in one (or more) sewage treatment plants operated by the authority. Each local government would retain ownership and maintenance of its own collection system and would be responsible for billing and collection operations.

The Lower Colorado River Authority (LCRA) has the statutory authority, jurisdiction, and financial and management capability to assume ownership and/or operation of Weimar's sewage treatment facilities and to implement the technical alternatives. However, the LCRA would assume this responsibility only upon request of the city and upon a finding by the consultants that no other alternatives were feasible.

By and On Behalf of Bonds. Under the general laws of the State, the LCRA may issue water quality improvement bonds "on behalf of" a local government. Ordinarily, these bonds are issued by a river authority that has contracted with a local government to operate the local sewage treatment facility. The local government enters a contract with the authority, promising to make payments adequate to meet debt service or debt service and operating and maintenance costs. To meet its obligations under the contract, the city may take revenues from any source (except sales tax receipts). The bonds are secured solely by the intergovernmental contract. The credit of the authority is not pledged.

3. SEGMENT 1403

a. Summary of Existing Agencies and Water Quality Control Problems.

(1) Introduction. This section summarizes the existing management agencies and water quality programs in the Colorado River Basin Segment 1403. Additional detailed information is provided in Appendix E, Inventory of Existing Agencies and Practices, Appendix F, Financial Management Experience, Appendix G, Intergovernmental Cooperation in the LCRA 208 Planning Area, and Appendix H, Areawide Plans and Programs. This section contains three major topics: description of boundaries, identification of major management agencies, and the definition of water quality control programs in Segment 1403.

(2) Physical Boundaries and Description. Segment 1403 lies in the central part of Travis County encompassing Lake Austin. The segment extends from Tom Miller Dam to Mansfield Dam.

(3) Existing Management Agencies. All federal and state agencies, primarily the Environmental Protection Agency and Texas Department of Water Resources, are involved in segment management functions. The segment is completely within the management jurisdiction of two regional agencies, Capital Area Planning Council and Lower Colorado River Authority. Each of these agencies has specific authority to perform planning and/or management functions. Intergovernmental devices allow for contracting for wastewater management functions between or among agencies within or outside the stream within Travis County and contains one general law city, West Lake Hills, and three water districts, Travis Co. WCID Nos. 10, 14, and 17. Six waste control orders are in existence.

(4) Water Quality Control Programs. Segment 1403 is completely within the planning boundaries of Capital Area Planning Council. The segment does not contain any Section 201 facility planning areas or any sewerage planning areas as defined by this study. Water quality in the segment is monitored through the monitoring network of the TDWR, TDH and USGS.

b. Nonpoint Source Assessment.

(1) Introduction. This section presents an assessment of the impact of nonpoint source pollutants in the Colorado River Basin Segment 1403. Additional detailed information

is provided in Appendix I, Inventory and Methodology - Nonpoint Source Assessment and Appendix J, Segment Layouts with Nonpoint Source Inventory.

(2) Assessment. Segment 1403 encompasses the lower portion of the Highland Lakes chain focusing on Lake Austin. Localized bacteriological and extensive aquatic macrophyte growths are existing water quality problems in Lake Austin. However, in all aspects except dissolved oxygen the waters of the lake are of good quality and relatively unpolluted.

Potential nonpoint source pollution problems fall primarily into two categories: septic tanks and urban runoff. As Figure 6, Appendix J, illustrates, septic tanks are concentrated in the Bee Creek area of Lake Austin largely servicing West Lake Hills. Severe soil limitations in the area complicate the proper performance of the disposal systems, thus posing potential water quality problems to both surface and groundwater supplies. Urban runoff from the City of Austin is an additional potential source of pollution for Segment 1403. Aside from pollutant loads resulting from existing development, urbanization is projected to extend northwest of the city, thereby increasing the possibility of pollution problems related to urban stormwater runoff. In addition, there are three sites in the segment where effluent discharge directly into streams is not permitted. This results in treated effluent used as irrigation water. Potential groundwater problems may result.

c. Wasteload Projections. The segment is classified as a Category IV segment. There are no point source discharges in this segment. Nonpoint source wasteload assessment is presented in Appendix D, Results of Special Studies in Intensive Planning Areas.

d. Wasteload Analysis. Lake Austin is classified as an 'Effluent Limiting' segment and has desirable water uses of recreation, propagation of fish and wildlife, and domestic raw water supply. The following standards have been defined for water quality:

Dissolved Oxygen (not less than)	5 mg/l
pH Range	7.0-9.0
Coliform (log. avg. more than)	200 FECAL/100 ml
Temperature	90°F
Chloride (not more than)	100 mg/l
Sulfate (not more than)	75 mg/l
Total Dissolved Solids (not more than)	400 mg/l

There are no point sources discharging to this segment. Nonpoint source loadings to the segment are attributed to septic tanks and urban runoff from development adjacent to the Lake.

In the past, water quality of Lake Austin has been relatively good. Water quality records for the Lake did show a violation of DO in 1975, when a DO value of 3.6 mg/l was recorded. Other DO measurements recorded during the water year ranged from 5.5 to 8.6 mg/l. The range of DO measurements in 1974 was 5 to 10 mg/l; the average being 8.2 mg/l. It is not known what caused the single DO violation recorded in 1975. It is not felt to be a result of nonpoint pollution since the violation occurred in July during a period of little or no rainfall.

No point source discharges are projected for the segment through the planning period; therefore, no water quality problems are anticipated as a result of point source discharges.

The nonpoint source pollutant loads from urban runoff are expected to increase during the planning period due to anticipated northwesterly growth of the City of Austin. The impact of this urban runoff on the quality of Segment 1403 will be studied in conjunction with Austin SMSA as an Intensive Planning Area.

e. Sewerage Planning Area Alternative Plans. There are no sewerage planning areas located in this segment; thus no alternative plans were developed.

4. SEGMENT 1404

a. Summary of Existing Agencies and Water Quality Control Programs.

(1) Introduction. This section summarizes the existing management agencies and water quality programs in the Colorado River Basin Segment 1404. Additional detailed information is provided in Appendix E, Inventory of Existing Agencies and Practices, Appendix F, Financial Management Experience, Appendix G, Intergovernmental Cooperation in the LCRA 208 Planning Area, Appendix H, Areawide Plans and Programs. This section contains three major topics: description of boundaries, identification of major management agencies, and the definition of water quality control programs in Segment 1404.

(2) Physical Boundaries and Description. Segment 1404 lies in three counties - Blanco, Burnet, and Travis. The segment encompasses Lake Travis and its drainage area.

(3) Existing Management Agencies. All federal and state agencies, primarily the Environmental Protection Agency and the Texas Department of Water Resources, are involved in segment management functions. The segment is within the management jurisdiction of two regional agencies, Capital Area Planning Council and Lower Colorado River Authority. Each has specific authority to perform management functions. Intergovernmental devices allow for contracting for wastewater management functions between or among agencies within or outside the segment boundaries. The segment is partially within three counties, Blanco, Burnet, and Travis, and contains two general law cities, two municipal districts, and three water districts. Nineteen waste control orders are in existence. Presented below is a tabulation of municipalities and special districts within the segment:

Municipalities	Special Districts
Burnet	Lakeway MUD No. 1
Lakeway	Travis County WCID - Point Venture
	Travis County MUD
	Travis County WCID #15
	Travis County WCID #17

(4) Water Quality Control Programs. Segment 1404 is completely within the planning boundaries of Capital Area Planning Council. The segment contains one sewerage

planning area, the City of Burnet. No Section 201 facility planning areas are located in this segment.

Water quality and quantity in the segment are monitored through the TDWR, TDH, and USGS monitoring networks.

b. Nonpoint Source Assessment.

(1) Introduction. This section presents an assessment of the impact of nonpoint source pollutants in the Colorado River Basin Segment 1404. Additional detailed information is provided in Appendix I, Inventory and Methodology - Nonpoint Source Assessment, and Appenidx J, Segment Layouts with Nonpoint Source Inventory.

(2) Assessment. Segment 1404 encompasses the drainage area of Lake Travis. There have been no reported existing water quality problems in the segment; however, extensive use of septic tanks in the area surrounding the lake poses potential nonpoint source pollution. Septic tank disposal systems present possible water quality contamination related to increased coliform concentrations and/or dissolved oxygen depletion. There are six "no discharge" sites treating municipal wastewater in Segment 1404. These sites do not have permits to discharge directly into streams; therefore, treated effluent is used as irrigation water. There are two sanitary landfills and two animal feedlots in the segment capable of impairing water quality with increased coliform counts. The eight mining sites in the segment can potentially contribute to increases in suspended solids or short-term dissolved oxygen reductions.

c. Wasteload Projections. This segment is classified as a Category IV segment. Wasteloads are projected for point sources. Nonpoint source impact assessment is presented in Appendix D, Results of Special Studies in Intensive Planning Areas.

(1) Point Sources. Three municipal and one industrial point sources will contribute wasteloads to this segment by the year 1983. The 1983 wasteload for municipal point sources is approximately 12 lbs/day of BOD and TSS. The municipal wasteloads are projected to increase 40 lbs/day by the year 2000. The industrial wasteload is anticipated to increase from an existing load of 90 lbs/day to approximately 180 lbs/day of TSS by the year 2000. The following is a summary of the existing and projected wasteloads:

Planning Year	BOD_5 (lbs/day) Mun.	Indus.	Total	TSS (lbs/day) Mun.	Indus.	Total
Existing	5	-	5	5	90	95
1983	12	-	12	12	90	102
1990	25	-	25	25	120	145
2000	40	-	40	40	178	218

A more detailed breakdown of these loads is presented in Appendix M as well as a discussion of the methodology used.

d. Wasteload Analysis. This segment encompasses the drainage area of Lake Travis and is classified as 'Effluent Limiting.' The waters of the Lake are considered desirable for recreation, propagation of fish and wildlife, and domestic raw water supply. The water quality standards for the Lake are as follows:

Dissolved Oxygen (not less than)	5.0 mg/l
pH Range	7.0-9.0
Coliform (log. avg. not more than)	200 FECAL/100 ml
Temperature	90°F
Chloride (not more than)	100 mg/l
Sulfate (not more than)	75 mg/l
Total Dissolved Solids (not more than)	400 mg/l

The existing total oxygen demand created by point sources is estimated to be 46 lbs/day. This demand is from one municipal point source discharging directly to the Lake. In addition, one industrial point source discharges into Delaware Creek, a tributary of Hamilton Creek, approximately 13 miles from the Lake measured along the tributaries. No oxygen demand is anticipated from this industrial discharge. Possible sources of nonpoint pollution to the segment are identified as septic tank disposal systems and runoff from animal feed lots and landfills. No water quality problems have been experienced in the waters of Lake Travis from existing wasteload conditions.

The total point source load on the segment projected to the year 2000 is estimated to be 350 lbs/day of total oxygen demand. This total is from two new point sources and the one existing point source discharging directly to the Lake. Considering the normally high DO level of Lake Travis, the projected total oxygen demand (350 lbs/day) from point sources is not anticipated to create any water quality problems. Therefore, current treatment levels can remain unchanged for the purpose of this evaluation.

e. Alternative Plans for the City of Burnet Sewerage Planning Area.

The City of Burnet is an incorporated general law municipality located in the central portion of Burnet County. Land use for the city is typical of that found in other small cities and is characterized by scattered residential development and a concentration of commercial and public facilities along major thoroughfares in the central areas of the city. The economic resource base is primarily agricultural with some industrial contribution. Existing population of the city is estimated to be about 3,400. An increase in population is projected within the next twenty years. The estimated population for the planning years are as follows:

Year	Existing	1983	1990	2000
Population	3,400	4,230	4,960	6,000

The existing wastewater collection system of Burnet is comprised of 6-, 8-, 10-, and 12-inch lines. The system is generally adequate to serve the present service area; however, septic tanks are still utilized for sewage disposal in some southern sections of town. In order to serve the projected population and those areas presently utilizing septic tanks, expansion of the collection system will be required within the planning period.

The city's existing wastewater treatment plant was constructed in 1966 with a design capacity of 0.4 mgd. The plant consists of a bar screen, a flow meter, a contact-stabilization unit, a clarifier, four oxidation ponds, a chlorination chamber and 230 acres of irrigation fields, of which 81 acres are city owned. Effluent Set 1 (20 mg/l BOD_5, 20 mg/l TSS) is required for the intermediate treatment prior to irrigation. The plant has adequate capacity to serve the present needs; but to accommodate the future needs created from the projected population increase, it will require expansion within the planning period. Therefore, alternative plans are developed for the city to expand its existing sewerage system.

(1) Structural Alternatives

(a) Collection System. The existing septic tank areas and future growth of Burnet create needs for additional collection system capacity within the next twenty years.

The expansion and extensions of the existing system would most likely continue to be gravity lines and pump stations, if required, at appropriate locations. Construction of needed facilities probably would take place in stages as needs grow. However, for planning purposes only single-stage construction is considered in this study.

Based on the State methodology, Water Quality Management Planning Methodology for Municipal Waste Treatment Needs Assessment, an analysis of gross collection system requirements was made for the City of Burnet. The analysis indicates approximately 144 inch-miles of gravity lines would be needed.

It is emphasized that the analysis made in this study is not intended to replace a full engineering study, but rather to serve as a basis for estimating the approximate costs of collection system improvements.

(b) Treatment and Disposal. Three broad options for disposal of sewage are generally available. These options include (1) treatment and disposal, (2) treatment and reuse, and (3) land application of sewage effluent. For the purpose of this study, reuse of treated wastewater is not considered as a viable solution because significant industrial users do not exist, public health problems could arise, and economic requirements are unattractive. Therefore only treatment and discharge, and land application options were examined in this analysis. Two structural alternatives were developed from these two broad options for the expansion of Burnet's wastewater treatment system.

Alternative 1. This alternative would require construction of a new 0.2 mgd prefabricated contact stabilization package plant with sludge drying beds. The package plant would include components for preliminary treatment, aeration and reaeration, final clarification, disinfection, and aerobic sludge digestion. Final sludge disposal would be handled by contract hauling. This alternative could be implemented only if the existing permit was revised to allow a discharge into Hamilton Creek about 15 miles from the Lake.

Alternative 2. Land application is considered in this alternative. Since 0.4 mgd secondary treatment capacity plus 230 acres for irrigation exists, the least cost and most practical system to provide for the additional flow of 0.2 mgd prior to spray irrigation is the addition of a

package plant as described under alternative 1, followed by emergency holding ponds, transmission line, irrigation network, and approximately 20 acres of additional land. The treated and disinfected effluent would be sprayed over the irrigation field, resulting in no discharge from the system. Additional sludge drying beds would also be required. Final sludge disposal would be by contract hauling.

It should be emphasized that these alternatives are from a prescribed list given in the statewide methodology, and presentation of them is not intended to eliminate any viable alternative from use for this location, but rather to limit for planning purposes the number of possible selections to those which offer a meaningful difference in various project costs. The options presented should be understood in the context of being representative examples of reasonable planning level solutions and costs.

(2) Cost of Technical Alternatives. Based on the State methodology referenced previously, costs for collection and treatment alternatives were estimated. For each alternative, capital cost, operation and maintenance cost, and annualized total and per capita costs (with and without EPA grants) were calculated. All costs are given in terms of 1977 dollars and presented in Table II-D-5. The interest rate used in this analysis is 6-3/8 percent and the service life of all equipment and structures is assumed to be incurred in 1980 and are spread over the projected population for the same year as the basis for calculating the annualized per capita costs.

(3) Impacts of Technical Alternatives. The monetary cost for the developed alternatives is only one of several aspects which should be considered in selecting the most beneficial alternative. The environmental, social, and economic impacts of these alternatives should also be evaluated. These nonmonetary costs or impacts are presented in Table II-D-6. The summarized impacts do not indicate any adverse or unusual effects that could be expected from implementation of any of these alternatives.

(4) Management Alternatives. Two conceptual models should be considered when designing a management system for Burnet and other sewerage planning areas in the Lower Colorado River basin: centralized and decentralized.

TABLE II-D-5

COSTS OF TECHNICAL ALTERNATIVE PLANS FOR

CITY OF BURNET

	Alternative 1	Alternative 2 (Land cost included)	Alternative 2 (Land cost excluded)
Capital Cost			
Collection System	$1,286,000	$1,286,000	$1,286,000
Treatment Plant	266,000	330,000	303,000
Total	$1,552,000	$1,616,000	$1,589,000
O & M Cost			
Collection System	$ 18,200/yr	$ 18,200/yr	$ 18,200/yr
Treatment Plant	36,100/yr	41,400/yr	41,400/yr
Total	$ 54,300/yr	$ 59,600/yr	$ 59,600/yr
Annualized Cost			
Without Grant			
Total	$ 194,000/yr	$ 205,000/yr	$ 202,000/yr
Per Capita	$ 48/yr	$ 51/yr	$ 50/yr
With Grant			
Total	$ 89,200/yr	$ 96,000/yr	$ 95,000/yr
Per Capita	$ 22/yr	$ 24/yr	$ 24/yr

TABLE II-D-6

IMPACTS OF TECHNICAL ALTERNATIVE PLANS FOR

CITY OF BURNET

Criterion	Alternative 1	Alternative 2
Electricity Use	Approx. 270,000 KWH/yr	Approx. 284,000 KWH/yr
Chemical Use	3.0 tons Chlorine per yr.	3.0 tons Chlorine per yr.
Manpower Requirements	1.7 man-yr/yr	1.8 man-yr/yr
Land Requirements	Existing plant site	Approx. 20 acres
Aesthetics	Visual impression will be matter of good architectural design and site maintenance.	Land disposal site could be utilized as green belt.
Local Health	Local health improved because of better effluent quality.	Local health improved because of no effluent discharges.
Sensitive Ecosystems	Temporary alteration of ground from sewer construction.	Some land required; could cause destruction of habitat of shift in land use.
Air Quality	No serious odor problem anticipated if properly operated.	No serious odor problem anticipated if properly operated.

(a) Decentralized Operations. The decentralized model relies on each individual city or special district to provide sewage treatment services. The decentralized model is found in most parts of Texas, and it most closely represents the management system found presently in the Lower Colorado River basin.

The City of Burnet owns and operates a sewage collection and treatment system. As noted above, the city's sewerage system must be expanded to meet the anticipated growth of the community. Table II-D-5 indicates costs for technical alternatives to be about $1.6 million. The most important issue will be methods for financing needed improvements.

General Obligation Bonds. General obligation bonds are secured by the ad valorem taxing authority of the city. The City of Burnet has no general obligation debt. Estimated assessed valuations of $5.0 million, at 30 percent of actual value, would support $500 thousand in GO bonds; assessments rates of 50-75 percent of actual value would sustain $850 thousand to $1.2 million. To finance all of alternative 2 with tax bonds would require assesments of 100 percent of actual value. In these circumstances, the city's capacity to borrow against tax income would be virtually exhausted.

Revenue Bonds. The city has approximately $1.3 million in outstanding revenue bonds. Bonds issued in 1964 have a closed lien on net revenues. Bonds issued in 1971 and 1972 have subordinate lien on net operating revenues. In order to issue bonds with security equal to the 1971-1972 issues, coverage of 1 and 1/3 times annual debt service requirements would have to be met; coverage must include all outstanding and new bonds. A rate increase, adequate to meet coverage requirements, would have to be enforced for 12 months preceding a new bond issue. To finance the requirements solely from water and sewer revenues would require substantial rate increases.

Texas Water Quality Enhancement Fund. The Texas Water Quality Enhancement Fund, administered by the Texas Department of Water Resources, is designed to assist local communities that cannot finance water quality through commercial channels at reasonable rates. All or part of the city's capital requirements might be met by a long-term loan from TDWR.

Federal Construction Grant Program. The federal construction grant program, authorized under Section 201 of P.L. 92-500, would finance 75 percent of the capital costs for any of the alternatives. The city would be required to finance the 25 percent from local or State sources. Thus, the city could use any of the financing approaches outlined above to meet the matching requirements for the construction grant program. (Certain federal funds may also be used to meet matching requirements, as discussed below.) Operation and maintenance costs, however, must be paid from user charges.

Other Federal Assistance Programs. The Farmer's Home Administration (FmHA) administers a loan and grant program for wastewater systems in rural communities. If a community meets the eligibility requirements, FmHA grants and loans may be used in combination to finance sewage collection and treatment systems. Other grant and loan programs are administered by the Economic Development Administration for communities in economic development areas. Burnet does not appear to qualify for FmHA or EDA assistance.

Community development bloc grants, administered by the U. S. Department of Housing and Urban Development, may be used to finance collection systems, but not sewage treatment plants. Finally, federal revenue sharing funds may be used for any lawful purpose, including the matching requirements of other federal programs.

(b) Centralized Operations. The centralized model would involve an areawide special district or authority (or a series of authorities) with responsibility to plan, finance, construct, operate, and maintain sewage treatment facilities throughout all or parts of the basin. The authority would be a "wholesaler" of sewage treatment services to local governments who would "retail" services to businesses and households. Local governments who were customers of the authority would enter intergovernmental contracts providing them with guaranteed sewage treatment capacity on one (or more) sewage treatment plants operated by the authority. Each local government would retain ownership and maintenance of its own collection system and would be responsible for billing and collection operations.

The Lower Colorado River Authority (LCRA) has the statutory authority, jurisdiction, and financial and management capability to assume ownership and/or operation of Burnet's sewage treatment facilities and to implement the technical

alternatives. However, the LCRA would assume this responsibility only upon request of the city and upon a finding by the consultants that no other alternative was feasible.

By and On Behalf of Bonds. Under the general laws of the State, the LCRA may issue water quality improvement bonds "on behalf of" a local government. Ordinarily, these bonds are issued by a river authority that has contracted with a local government to operate the local sewage treatment facility. The local government enters a contract with the authority, promising to make payments adequate to meet debt service or debt service and operating and maintenance costs. To meet its obligations under the contract, the city may take revenues from any source (except sales tax receipts). The bonds are secured solely by the intergovernmental contract. The credit of the authority is not pledged.

5. SEGMENT 1405

a. Summary of Existing Agencies and Water Quality Control Programs.

(1) Introduction. This section summarizes the existing management agencies and water quality programs in the Colorado River Basin Segment 1405. Additional detailed information is provided in Appendix E, Inventory of Existing Agencies and Practices, Appendix F, Financial Management Experience, Appendix G, Intergovernmental Cooperation in the LCRA 208 Planning Area and Appendix H, Areawide Plans and Programs. This section contains three major topics: description of boundaries, identification of major management agencies, and the definition of water quality control programs in Segment 1405.

(2) Physical Boundaries and Description. Segment 1405 lies primarily in Burnet County and a small portion in both Blanco and Llano counties. This segment includes Lake Marble Falls which extends from Max Starke Dam to Alvin Wirtz Dam.

(3) Existing Management Agencies. All federal and state agencies, primarily the Environmental Protection Agency and the Texas Department of Water Resources, are involved in stream segment management functions. The segment is within the management jurisdiction of two regional agencies, Capital Area Planning Council and Lower Colorado River Authority. Each of these agencies has specific authority to perform planning and/or management functions. Intergovernmental devices allow for contracting for wastewater management functions between or among agencies within or outside the stream segment boundaries. The segment is partially within three counties, Blanco, Burnet, and Llano, and contains one general law city, Marble Falls, one municipal district, Meadowlake MUD, and one water district, Marble Falls WCID #1. Three waste control orders are in existence.

(4) Water Quality Control Programs. Segment 1405 is completely within the planning boundaries of the Capital Area Planning Council. The segment does not contain any Section 201 facility planning areas, but has one sewerage planning area, the City of Marble Falls. Water quality and quantity in the segment are currently monitored through the TDWR, TDH, and USGS monitoring networks.

b. Nonpoint Source Assessment.

(1) Introduction. This section presents an assessment of the impact of nonpoint source pollutants in the Colorado River Basin Segment 1405. Additional detailed information is provided in Appendix I, Inventory and Methodology - Nonpoint Source Assessment and Appendix J, Segment Layouts with Nonpoint Source Inventory.

(2) Assessment. Segment 1405 exhibits no observable existing water quality problems. Nonpoint source activity is related to mining and disposal sites. There are five mines in the segment, three of which are active. Although two of the sites are inactive, they present potential nonpoint source pollution due to surface runoff. Burnet County has three municipal sanitary landfills and an area serviced by septic tanks with possible effects on groundwater. The City of Marble Falls in Burnet County is the major source of urban runoff in the segment with potential water quality problems. Table 10 of Appendix I indicates potential urban pollutant loads as measured by average daily dust and dirt accumulation. The segment has a moderate sediment loading resulting from agricultural activity.

c. Wasteload Projections.

This segment is classified as Category II.

(1) Point Sources. There is one municipal and no industrial point sources discharging into the segment. The existing and projected wasteloads from this source are as follows:

Planning Year	BOD (lbs/day)	TSS (lbs/day)
Existing	21	21
1983	52	52
1990	57	57
2000	67	67

A more detailed breakdown of these loads is presented in Appendix M as well as a discussion of the methodology used.

d. Wasteload Analysis.

Lake Marble Falls is classified as an 'Effluent Limiting' segment and has water uses of recreation, propagation of fish and wildlife, and domestic raw water supply. The following are some of the water quality standards which apply to the Lake's waters:

Dissolved Oxygen (not less than)	5.0 mg/l
pH Range	7.0-9.0
Coliform (log. avg. not more than)	200 FECAL/100 ml
Temperature	94°F
Chloride (not more than)	100 mg/l
Sulfate (not more than)	75 mg/l
Total Dissolved Solids (not more than)	400 mg/l

The existing total oxygen demand to the segment created by the single point source discharge is 70 lbs/day. This load is computed based on the present treatment level at which the City of Marble Falls is treating its sewage. Possible sources of nonpoint pollution to the segment have been attributed to groundwater contamination due to mineral extraction and septic tanks. Urban runoff from the City of Marble Falls is also identified as a possible nonpoint source. The existing and past water quality of the segment, as indicated by the Water Quality Assessment Chapter of Basic Data Report, is very good. The chapter indicates that there have been no violations of the standards.

The projected total oxygen demand by point sources for the year 2000 is 160 lbs/day. This demand is based on Effluent Set 2 currently required for the segment. Although the total wasteload to the segment is projected to more than double during the planning period, the year 2000 total oxygen demand is still relatively small for the total segment. Considering the present water quality of the segment, the projected wasteload is not anticipated to create any water quality problems. The presently defined effluent set for the segment, Set 2, should enable the existing water quality to be maintained through the planning period. However, it should be noted that the permit of the City of Marble Falls contains a cause which will encourage construction of facilities by 1979 to produce effluent Set 4P.

e. Alternative Plans for the Marble Falls Sewerage Planning Area.

The City of Marble Falls is an incorporated general law municipality located on Lake Marble Falls in Burnet County. Land use for the city is characterized by scattered residential development and a concentration of commercial and public facilities along major thoroughfares in the central area of the city. A substantial increase in population is anticipated for Marble Falls in the next twenty years. Population estimates for the city are as follows:

Year	Existing	1983	1990	2000
Population	2,555	3,050	3,400	4,000

The city's existing wastewater collection system consists of 6-, 8-, 10-, and 15-inch lines. Expansion of the existing collection system to serve septic tank areas has been recently completed. With the new lines, the city now provides service to a major portion of the residents and has satisfied immediate needs. However, the expected population growth, which local officials believe can be double the amount projected above, will require further expansion of the collection system sometime in the future. No additional collection system improvements are included in the plan at this time, but should be considered as part of the next plan update.

The existing wastewater treatment plant, constructed in 1961, consists of a clarigester, trickling filter, final clarifier, chlorination facilities, sludge drying beds, and a holding pond. The plant has a design capacity of 0.24 mgd and is discharging an effluent meeting the current permit requirements. However, more stringent effluent requirements will be imposed on this facility when the current permit expires in November 1979. Therefore, advanced treatment processes will be needed for the plant. In addition, to provide the service for the projected population growth, the plant capacity must be expanded to 0.4 mgd. Thus, alternative plans were developed to upgrade and expand the existing wastewater treatment plant.

(1) Structural Alternatives

(a) Collection System. Recent collection system improvements satisfy immediate needs, but provision of additional lines should be considered periodically in updated plans as population grows.

(b) Treatment and Disposal. There are three broad options which were investigated for disposal of sewage for the City of Marble Falls. These options are 1) treatment and discharge, 2) treatment and reuse, and 3) land application. Since there are few industries in the area, reuse of treated water for industrial processes is of little potential, and factors such as public health, soil conditions, and economic considerations make the reuse of treated water as potable water source or groundwater recharge infeasible. Therefore, only the treatment and discharge, and land application options were considered. Based on the State methodology, three alternatives were developed for these two options.

Alternative 1. This alternative proposes expansion of the existing plant by the addition of an additional trickling filter unit to bring the total capacity to 0.4 mgd. In addition, tertiary line treatment, sand filtration, and activated carbon treatment units are proposed to produce an effluent quality equal to set 4P (5 mg/l BOD, 5 mg/l TSS, and 1 mg/l P) as recommended for the future in the city's current permit.

Alternative 2. This alternative proposes abandonment of the existing plant and installation of a new 0.4 mgd extended aeration package treatment plant and sludge drying beds. In addition, polymer feed, tertiary lime treatment, and filtration units are proposed to produce an effluent quality equal to set 4P as discussed under alternative 1, above.

Alternative 3. Land application of effluent is considered in this alternative. The existing trickling filter unit is to be abandoned, and the primary treatment and chlorination capacity expanded to 0.4 mgd. Spray irrigation facilities and emergency holding ponds are proposed to be constructed and approximately 100 acres of land is needed for the irrigation field. The treated and chlorinated effluent is to be sprayed over the irrigation field, resulting in no discharge from the plant.

It should be emphasized that the above three alternatives are from a prescribed list given in the statewide methodology, and their presentation is not intended to eliminate any viable alternative from use from this location, but rather to limit for planning purposes the number of possible selections to those which offer a meaningful difference in various project costs. The options presented should be understood in the context of being representative examples of reasonable planning level solutions and costs.

(2) Costs of Technical Alternatives

Using the State methodology, costs were developed for the three technical alternatives considered. For each alternative, capital cost, operation and maintenance cost, and annualized total and per capita costs (with and without EPA grant) were estimated. While developing these costs, all capital costs were assumed to be incurred in the year 1980; the facililty life was assumed to be 20 years; and 6-3/8 percent annual interest rate was used. All cost values are in March 1977 dollars. Year 1980 population was selected as the basis for calculating the annualized per capita costs. These estimated costs are presented in Table II-D-7.

(3) Impact of Technical Alternatives

The monetary cost for these three alternatives is only one of several aspects which should be considered in selecting the most beneficial alternatives. The environmental, social, and economic impacts of different alternatives, such as energy and resources use, sensitive ecosystems, air quality, local health problems, etc., should also be evaluated. These nonmonetary costs or impacts are presented in Table II-D-8.

(4) Management Alternatives

Two conceptual models should be considered when designing a management system for Marble Falls and other sewerage planning areas in the Lower Colorado River planning area: centralized and decentralized.

(a) Decentralized Operations. The decentralized model relies on each individual city or special district to provide sewage treatment services. The decentralized model is found in most areas of Texas, and it most closely represents the management system found presently operating in the Lower Colorado River planning area.

The City of Marble Falls owns and operates its sewage collection and treatment system. A full-time staff operates the waterworks and sewerage systems. In 1977, the city acquired the systems from Marble Falls WCID No. 1. In doing so, the city restructured its debt, issued $500,000 in revenue bonds to finance improvements, and imposed a substantial user fee increase. City officials appear to be in general agreement that the system needs improvements. The key issue is the means of financing the improvements.

TABLE II-D-7

COSTS OF TECHNICAL ALTERNATIVE PLANS FOR

CITY OF MARBLE FALLS

	Alternative 1	Alternative 2	Alternative 3 (Land cost included)	Alternative 3 (Land cost excluded)
Capital Cost				
Collection System	-	-	-	-
Treatment Plant	$1,245,000	$754,000	$1,194,000	$1,060,000
Total				
O & M Cost				
Collection System	-	-	-	-
Treatment Plant	$ 116,000/yr	$ 51,000/yr	$ 35,000/yr	$ 35,000/yr
Total				
Annualized Cost				
Without Grant				
Total	$ 228,000/yr	$119,000/yr	$ 142,000/yr	$ 130,000/yr
Per Capita	$ 80/yr	$ 42/yr	$ 50/yr	$ 45/yr
With Grant				
Total	$ 144,000/yr	$ 67,942/yr	$ 62,000/yr	$ 59,000/yr
Per Capita	$ 50/yr	$ 24/yr	$ 22/yr	$ 21/yr

TABLE II-D-8

IMPACTS OF TECHNICAL ALTERNATIVE PLANS FOR

CITY OF MARBLE FALLS

Criterion	Alternative 1	Alternative 2	Alternative 3
Electricity Use	Approx. 153,000 KWH/yr	Approx. 358,000 KWH/yr	Approx. 177,000 KWH/yr
Chemical Use	2.4 tons Chlorine per yr. 97 tons Lime per yr.	2.4 tons Chlorine per yr. 97 tons Lime per yr.	6.1 tons Chlorine per yr.
Manpower Requirements	5.4 man-yr/yr	2.2 man-yr/yr	1.9 man-yr/yr
Land Requirements	Existing plant site	Existing plant site	Additional 100-ac required
Aesthetics	Visual impression will be matter of good architectural design and site maintenance.	Visual impression will be matter of good architectural design and site maintenance.	Land disposal site could be utilized as green belt.
Local Health	Local health improved because of better effluent quality.	Local health improved because of better effluent quality.	Local health improved because of no effluent discharges.
Sensitive Ecosystems	Temporary alteration of existing site from construction.	Temporary alteration of existing site from construction.	Additional land required could cause destruction of habitat or shift in land use.
Air Quality	No serious odor problem anticipated if properly operated.	No serious odor problem anticipated if properly operated.	No serious odor problem anticipated if properly operated.

General Obligation Bonds. General obligation bonds are secured by the ad valorem taxing authority of the city. The city has $1.2 million in outstanding debt, of which $0.2 million is self-supporting. Based on an assessed valuation of $18 million, the city has a total GO bond capacity of about $1.8 million, for all purposes. Subtracting from this capacity the amount represented by existing tax debt leaves approximately $0.8 million available for additional tax debt. It would be possible for the city to finance the capital costs of the least expensive alternative (alternative 2, $754,000) with tax bonds, although a tax increase would be required. The city does not have the economic base necessary to finance alternatives 1 or 3 from GO bonds alone.

Revenue Bonds. $500,000 of first lien revenue bonds were issued in 1977. Coverage of 1.5 times annual debt service requirements, after giving effect of the additional bonds, is required for the fiscal year preceding issuance of additional bonds. If parity bonds were used to finance the least expensive alternative, substantial increase in user fees would have to be imposed for one fiscal year before the new bonds were issued. Because of substantial recent rate increase, this alternative may not be politically feasible.

Junior lien revenue bonds, secured by a subordinate lien on the net operating revenues of the system, might be purchased by the Texas Department of Water Resources or the Farmer's Home Administration (see the discussions below). Presently, a second lien on net revenues is pledged to combination tax and revenue bonds assumed from WCID No. 1. In 1976-77, only 26 percent of that debt was self-supporting.

Texas Water Quality Enhancement Fund. The Texas Water Quality Enhancement Fund, administered by the Texas Department of Water Resources, is designed to assist local communities that cannot finance water quality facilities through regular commerical channels. If the loan is approved by TDWR, the Department will purchase the city's bonds secured by a junior lien on the net revenues of the system. User fee increases likely would be required, although probably less than those required to issue parity bonds. It should be noted that rate increases necessary to finance junior lien bonds automatically increase coverage, thus improving the capacity to issue additional parity bonds in the future if they should be necessary.

Federal Construction Grant Program. The federal construction grant program, authorized under section 201 of

P.L. 92-500, would finance 75 percent of the capital costs for any of the alternatives. The city would be required to finance the 25 percent from local or State sources. Thus, the city could use any of the financing approaches outlined above to meet the matching requirements for the construction grant program. (Certain federal funds may also be used to meet matching requirements, as discussed below.) Operation and maintenance costs, however, must be paid from user charges.

Other Federal Assistance Programs. The Farmer's Home Administration (FmHA) administers a loan and grant program for wastewater systems in rural communities. If a community meets the eligibility requirements, FmHA grants and loans may be used in combination to finance sewage collection and treatment systems. Other grant and loan programs are administered by the Economic Development Administration for communities in economic development areas. Community development bloc grants, administered by the Department of Housing and Urban Development, may be used to finance collection systems, but not sewage treatment plants. Finally, federal revenue sharing funds may be used for any lawful purpose, including the matching requirements of other federal programs.

(b) Centralized Operations. The centralized model would involve an areawide special district or authority (or a series of authorities) with responsibility to plan, finance, construct, operate, and maintain sewage treatment facilities throughout all or parts of the basin. The authority would be a "wholesaler" of sewage treatment services to local governments who would "retail" services to businesses and households. Local governments who were customers of the authority would enter into intergovernmental contracts providing them with guaranteed sewage treatment capacity in one (or more) sewage treatment plants operated by the authority. Each local government would retain ownership and maintenance of its own collection system and would be responsible for billing and collection operations.

The Lower Colorado River Authority (LCRA) has the statutory authority, jurisdiction, and financial and management capability to assume ownership and/or operation of a city's sewage treatment facilities and to implement the technical alternatives. However, the LCRA would assume this responsibility only upon request of the city and upon a finding by the consultants that no other alternatives were feasible.

By and On Behalf of Bonds. Under the general laws of the State, the LCRA may issue water quality improvement bonds "on behalf of" a local government. Ordinarily, these bonds are issued by a river authority that has contracted with a local government to operate the local sewage treatment facility. The local government enters into a contract with the authority, promising to make payments adequate to meet debt service or debt service and operating and maintenance costs. To meet its obligations under the contract, the city may take revenues from any source (except sales tax receipts). The bonds are secured solely by the intergovernmental contract. The credit of the authority is not pledged.

6. SEGMENT 1406

a. Summary of Existing Agencies and Water Quality Control Programs.

(1) Introduction. This section summarizes the existing management agencies and water quality programs in the Colorado River Basin Segment 1406. Additional detailed information is provided in Appendix E, Inventory of Existing Agencies and Practices, Appendix F, Financial Management Experience, Appendix G, Intergovernmental Cooperation in the LCRA 208 Planning Area, and Appendix H, Areawide Plans and Programs. This section contains three major topics: description of boundaries, identification of major management agencies, and the definition of water quality control programs in Segment 1406.

(2) Physical Boundaries and Description. Segment 1406, lying between the Alvin Wirtz Dam and the Roy Inks Dam, represents the Lake Lyndon B. Johnson area. It lies in parts of Blanco, Burnet, Gillespie, and Llano counties.

(3) Existing Management Agencies. All federal and state agencies, primarily the Environmental Protection Agency and the Texas Department of Water Resources, are involved in stream segment management functions. The segment is within the management jurisdiction of two regional agencies, Capital Area Planning Council and Lower Colorado River Authority. Each has specific authority to perform planning and/or management functions. Intergovernmental devices allow for contracting for wastewater management functions between or among agencies within or outside the stream segment boundaries. The segment is partially within four counties: Blanco, Burnet, Gillespie, and Llano; contains one general law city, Granite Shoals; four municipal districts, Lake LBJ MUD No. 1, Lake LBJ MUD No. 2, and Sunrise Beach MUD #1; and one water district, Llano Co, FWSD #1. Nine waste control orders are in existence.

(4) Water Quality Control Programs. Segment 1406 is completely within the planning boundaries of the Capital Area Planning Council. The segment does not contain any Section 201 facility planning areas or any sewerage planning areas. Water quality in the segment is currently monitored through the TDWR and TDH monitoring networks. The segment is not presently within the monitoring networks of the USGS.

b. Nonpoint Source Assessment.

(1) Introduction. This section presents an assessment of the impact of nonpoint source pollutants in the Colorado River Basin Segment 1406. Additional detailed information is provided in Appendix I, Inventory and Methodology - Nonpoint Source Assessment, and Appendix J, Segment Layouts with Nonpoint Source Inventory.

(2) Assessment. Segment 1406 exhibits no observable existing water quality problems. Nonpoint source activity is varied throughout the segment. Lake LBJ has a considerable number of sites serviced by septic tanks posing potential impacts related to groundwater supplies. Also, according to Public Advisory Committee comments, there are recurring septic tank problems in the Knob Hill area near Kingsland MUD #1. Several municipal landfills and animal feedlots contribute to possible increases in coliforms and depressed dissolved oxygen. There are four "no discharge" sites in Burnet and Llano counties where wastewater cannot be released directly into streams. As a result, treated effluent is used as irrigation water or disposed of in evaporation ponds. Mining activity is varied with limestone, granite, marble, sand, and gravel mines. Pollutants in surface runoff as well as seepage of pollutants into groundwater supplies pose potential problems. The sediment loading from agricultural/silvicultural activity in Segment 1406 is at a moderate level in comparison to other segments in the study area. Construction-related nonpoint source pollution poses little problem with two on-going operations in the segment; any effects would be localized.

c. Wasteload Projections.

This segment is classified as a Category II segment.

(1) Point Sources. There are no municipal point source discharges in this segment at the present time, but three municipal and one industrial dischargers are projected to contribute a wasteload of approximately 60 lbs/day of BOD and 140 lbs/day of TSS by 1983. These loads are projected to nearly double by the year 2000, as shown in the following table.

Planning Year	BOD (lbs/day) Mun.	Indus.	Total	TSS (lbs/day) Mun.	Indus.	Total
Existing	0	-	0	0	80	80
1983	58	-	58	58	80	138
1990	81	-	81	81	95	176
2000	114	-	114	114	124	238

A more detailed breakdown of these loads is presented in Appendix M as well as a discussion of the methodology used.

d. Wasteload Analysis.

This segment, Lake Lyndon B. Johnson (LBJ), is classified as an 'Effluent Limiting' segment. The Lake's waters are deemed desirable for recreation, propagation of fish and wildlife, and domestic raw water supply. The water quality standards for the segment are as follows:

Dissolved Oxygen (not less than)	5.0 mg/l
pH range	7.0-9.0
Coliform (log. avg. not more than)	200 FECAL/100 ml
Temperature	94°F
Chloride (not more than)	100 mg/l
Sulfate (not more than)	75 mg/l
Total Dissolved Solids (not more than)	400 mg/l

There are presently no point sources discharging to the segment. However, three are projected by 1983, of which two will discharge into the Lake and one into a tributary, Sandy Creek, about 3 miles from its confluence with the Lake. Each of these projected dischargers has an effluent permit corresponding to Effluent Set 4 (5 mg/l BOD, 5 mg/l TSS). Possible sources of nonpoint pollution have been identified as septic tanks adjacent to the Lake, and runoff from feedlots and landfills. Available water quality monitoring data as presented in Chapter F of the Basic Data Report indicates no violation of the stream standards as a result of the existing point and nonpoint wasteloads.

The estimated total carbonacious and nitrogenous oxygen demand to the segment from point sources is projected to be about 1,000 lbs/day by the year 2000. The magnitude of this projected load could possibly produce some water quality problems in the future; however, such problems cannot be predicted based on this preliminary analysis.

Therefore, it is recommended that no changes be made at this time in the required treatment level and that water quality of the segment be closely monitored for changing conditions.

e. Sewerage Planning Area Alternative Plans.

No sewerage planning areas have been identified in this segment; thus, no alternative plans have been developed for Segment 1406.

7. SEGMENT 1407

a. Summary of Existing Agencies and Water Quality Control Programs.

(1) Introduction. This section summarizes the existing management agencies and water quality programs in the Colorado River Basin Segment 1407. Additional detailed information is provided in Appendix E, Inventory of Existing Agencies and Practices, Appendix F, Financial Management Experience, Appendix G, Intergovernmental Cooperation in the LCRA 208 Planning Area, and Appendix H, Areawide Plans and Programs. This section contains three major topics: description of boundaries, identification of major management agencies, and the definition of water quality control programs in Segment 1407.

(2) Physical Boundaries and Description. Segment 1407, lying between Roy Inks Dam and Buchanan Dam, encompasses Inks Lake. The segment is within both Burnet and Llano counties.

(3) Existing Management Agencies. All federal and state agencies, primarily the Environmental Protection Agency and the Texas Department of Water Resources, are involved in stream segment management functions. The segment is within the management jurisdiction of two regional agencies, Capital Area Planning Council and Lower Colorado River Authority. Each of these agencies has specific authority to perform planning and/or management functions. Intergovernmental devices allow for contracting for wastewater management functions between or among agencies within or outside the stream segment boundaries. The segment is partially within two counties: Burnet and Llano. It contains no general law cities and has no special districts. Two waste control orders are in existence.

(4) Water Quality Control Programs. Segment 1407 is within the planning boundaries of Capital Area Planning Council. The segment does not contain any Section 201 facility planning areas or any sewerage planning areas. Water quality and quantity in the segment are currently monitored through the TDWR, TDH, and USGS monitoring networks.

b. Nonpoint Source Assessment

(1) Introduction. This section presents an assessment of the impact of nonpoint source pollutants in the Colorado River Basin Segment 1407. Additional detailed information

is provided in Appendix I, Inventory and Methodology - Nonpoint Source Assessment and Appendix J, Segment Layouts with Nonpoint Source Inventory.

(2) Assessment. Segment 1407 encompasses the drainage area of Inks Lake. Numerous septic tank sites along the lake are potential contributors; in addition, an active graphite mine in Burnet County might contribute to changes in dissolved solids concentration. Exposed natural salt deposits in proximity to mining operations would give rise to increases in chloride and sulfate. There is one "no discharge" site in the segment where treated effluent is used as irrigation water.

c. Wasteload Projections

This segment is classified as a Category I segment. There are two dischargers, one municipal and one industrial, located in the segment. No significant water quality problems exist nor are anticipated in this segment. The classification of the segment as Category I is not proposed to be changed, and as such, no projections of wasteloads were made.

d. Wasteload Analysis

This segment encompasses the drainage area of Inks Lake and is classified as 'Effluent Limiting.' The water uses of the lake are deemed desirable for recreation, fish and wildlife propagation, and domestic raw water supply. The following are the water quality standards established for the segment:

Dissolved Oxygen (not less than)	5.0 mg/l
pH Range	7.0-9.0
Coliform (log. avg. not more than)	200 FECAL/100 ml
Temperature	90°F
Chlorides (not more than)	100 mg/l
Sulfate (not more than)	75 mg/l
Total Dissolved Solids (not more than)	400 mg/l

The two point sources discharging into the segment contribute very minimal wasteloads to the Lake. Possible nonpoint source pollutants are attributed to septic tanks and an active graphite mine. No water quality problems have been identified within this segment, although the total dissolved solids (TDS) concentration runs close to that defined by the stream segment standard. No violations of standards have been recorded. No water quality problems are anticipated

for this segment through the planning period, based on presently available information, and therefore no changes in present treatment levels are recommended.

e. Sewerage Planning Area Alternative Plans

No sewerage planning areas have been identified for Segment 1407; thus, no alternative plans have been developed.

8. SEGMENT 1408

a. Summary of Existing Agencies and Water Quality Control Programs.

(1) Introduction. This section summarizes the existing management agencies and water quality programs in the Colorado River Basin, Segment 1408. Additional detailed information is provided in Appendix E, Inventory of Existing Agencies and Practices, Appendix G, Intergovernmental Cooperation in the LCRA 208 Planning Area, and Appendix H, Areawide Plans and Programs. This section contains three major topics: description of boundaries, identification of major management agencies, and the definition of water quality control programs in Segment 1408.

(2) Physical Boundaries and Description. Segment 1408 extends from Buchanan Dam to the Lake Buchanan headwaters including Lake Buchanan as well as the adjacent areas draining directly to the Lake.

(3) Existing Management Agencies. All federal and state agencies, primarily the Environmental Protection Agency and the Texas Department of Water Resources, are involved in stream segment management functions. Segment 1408 is within the management jurisdiction of three regional agencies: Capital Area Planning Council, Central Texas Council of Governments, and the Lower Colorado River Authority. Each of these agencies has specific authority to perform planning and/or management functions. Intergovernmental devices allow for contracting for wastewater management functions between or among agencies within or outside the stream segment boundaries.

This segment is partially within three counties: Burnet, Llano, and San Saba. It contains no general law cities or special districts. Four waste control orders are in existence in Segment 1408.

(4) Water Quality Control Programs. Segment 1408 is within the planning boundaries of the Capital Area Planning Council and the Central Texas Council of Governments. The segment contains no Section 201 facility planning areas or any sewerage planning areas. Water quality and quantity in the segment is currently monitored through the TDWR, TDH, and the USGS monitoring networks.

b. Nonpoint Source Assessment

(1) Introduction. This section presents an assessment of the impact of nonpoint source pollutants in the Colorado River Basin Segment 1408. Additional detailed information is provided in Appendix I, Inventory and Methodology - Nonpoint Source Assessment and Appendix J, Segment Layouts with Nonpoint Source Inventory.

(2) Assessment. Mining and septic tank areas are the principal contributors to potential nonpoint source pollution. Septic tanks are concentrated along Lake Buchanan. The mining sites are inactive; however, surface runoff at these mines can pick up pollutants detrimental to nearby watercourses. The segment has a moderate sediment loading from agricultural/silvicultural activity, posing no serious water quality problems.

c. Wasteload Projections

This segment is classified as a Category II segment.

(1) Point Sources. There is one municipal discharger and no industrial dischargers contributing wasteloads to the segment. The wasteload contributed by the existing municipal discharger is very minimal and is projected to remain constant through the planning period, as summarized by the following table.

Planning Year	BOD (lbs/day)	TSS (lbs/day)
Existing	1	1
1983	1	1
1990	1	1
2000	1	1

A more detailed breakdown of loads is presented in Appendix M as well as a discussion of the methodology used.

d. Wasteload Analysis. Lake Buchanan is classified as an 'Effluent Limiting' segment and has water uses for recreation, propagation of fish and wildlife, and domestic raw water supply. The water quality standards for the Lake are established as follows:

Dissolved Oxygen (not less than)	5.0 mg/l
pH Range	7.0-9.0
Coliform (log. avg. not more than)	200 FECAL/100 ml
Temperature	90°F

Chloride (not more than)	100 mg/l
Sulfate (not more than)	75 mg/l
Total Dissolved Solids (not more than)	400 mg/l

One point source discharges into the Lake with a total oxygen demand of about 13 lbs/day. The possible sources of nonpoint pollutants are mining operations and septic tank development adjacent to the Lake. There have been no water quality problems identified for this segment.

The future point and nonpoint source wasteloads are not projected to increase significantly through the year 2000, and therefore no water quality problems are anticipated for Lake Buchanan.

e. Sewerage Planning Area Alternative Plans

No sewerage planning areas have been identified in Segment 1408; thus, no alternative plans have been developed.

3. SEGMENT 1409

a. Summary of Existing Agencies and Water Quality Control Programs.

(1) Introduction. This section summarizes the existing management agencies and water quality programs in the Colorado River Basin Segment 1409. Additional detailed information is provided in Appendix E, Inventory of Existing Agencies and Practices, Appendix F, Financial Management Experience, Appendix G, Intergovernmental Cooperation in the LCRA 208 Planning Area, and Appendix H, Areawide Plans and Programs. This section contains three major topics: description of boundaries, identification of major management agencies, and the definition of water quality control programs in Segment 1409.

(2) Physical Boundaries and Description. Segment 1409 is comprised of that portion of the Colorado River between the Lake Buchanan headwaters and the San Saba River confluence. The segment lies partially in Burnet, Lampasas, Mills, and San Saba counties.

(3) Existing Management Agencies. All federal and state agencies, primarily the Environmental Protection Agency and the Texas Department of Water Resources, are involved in stream segment management functions. The segment is within the management jurisdiction of two regional agencies, Central Texas Council of Governments and Lower Colorado River Authority. Each of these agencies has specific authority to perform planning and/or management functions. Intergovernmental devices allow for contracting of wastewater management functions between or among agencies within or outside the stream segment boundaries. The segment is partially within four counties: Burnet, Lampasas, Mills, and San Saba. It contains no general law cities or special districts. No waste control orders are in existence.

(4) Water Quality Control Programs. Segment 1409 is completely within the planning boundaries of the Central Texas Council of Governments. The segment does not contain any Section 201 facility planning areas or any sewerage planning areas. Water quality and quantity in the segment are currently monitored through the TDWR, TDH, and USGS monitoring networks.

b. Nonpoint Source Assessment.

(1) Introduction. This section presents an assessment of the impact of nonpoint source pollutants in the Colorado River Basin Segment 1409. Additional detailed information is provided in Appendix I, Inventory and Methodology - Nonpoint Source Assessment, and Appendix J, Segment Layouts with Nonpoint Source Inventory.

(2) Assessment. Segment 1409 does not exhibit extensive nonpoint source activity. Several small towns are serviced by septic tanks; however, no significant problem exists. There are two municipal sanitary landfills with no serious water quality impacts. Construction activity is minimal with one operation at present. Sediment loading from agricultural/silvicultural activities is relatively low in comparison to other segments in the study area.

c. Wasteload Projections.

(1) Point Sources. This segment is classified as a Category II segment. There are no existing municipal or industrial dischargers. No wasteload projections were made.

d. Wasteload Analysis.

This segment is the reach of the Colorado River between the headwaters of Lake Buchanan and the confluence of the San Saba River. This segment is classified as 'Effluent Limiting.' Its waters are deemed desirable for recreation, propagation of fish and wildlife and domestic raw water supply. The following water quality standards have been established for this segment:

Dissolved Oxygen (not less than)	5.0 mg/l
pH Range	6.5-8.5
Coliform (log. avg. not more than)	200 FECAL/100 ml
Temperature	91°F
Chloride (not more than)	200 mg/l
Sulfate (not more than)	200 mg/l
Total Dissolved Solids (not more than)	500 mg/l

There are no point source wasteloads discharging into the segment. No currently identified nonpoint source wasteloads are sufficiently large to result in water quality problems. A review of Water Quality Assessment Chapter F in Volume I of this report indicates that the segment is free of any

violations of established standards. No serious water quality problems are anticipated in the future within the segment.

e. Sewerage Planning Area Alternative Plans.

No sewerage planning areas have been identified in Segment 1409; thus, no alternative plans have been developed.

10. SEGMENT 1410

a. Summary of Existing Agencies and Water Quality Control Programs.

(1) Introduction. This section summarizes the existing management agencies and water quality programs in the Colorado River Basin, Segment 1410. Additional detailed information is provided in Appendix E, Inventory of Existing Agencies and Practices, Appendix F, Financial Management Experience, Appendix G, Intergovernmental Cooperation in the LCRA 208 Planning Area, and Appendix H, Areawide Plans and Programs. This section contains three major topics: description of boundaries, identification of major management agencies, and the definition of water quality control programs in Segment 1410.

(2) Physical Boundaries and Description. Segment 1410 is that portion of the Colorado River between the San Saba River confluence and E. V. Spence Reservoir (Robert Lee Dam). Only the portion of this segment which is below the proposed Stacy Reservoir Dam site (at approximately river mile 615) is within this study area. The segment includes portions of Brown, Coleman, Concho, McCulloch, Mills, and San Saba counties.

(3) Existing Management Agencies. All federal and state agencies, primarily the Environmental Protection Agency and the Texas Department of Water Resources, are involved in stream segment management functions. The segment is within the management jurisdiction of four regional agencies: Central Texas Council of Governments, Concho Valley Council of Governments, West Central Texas Council of Governments, and Lower Colorado River Authority. Each of these agencies has specific authority to perform planning and/or management functions. Intergovernmental devices allow for contracting for wastewater management functions between or among agencies within or outside the stream segment boundaries. The segment is partially within six counties, Brown, Coleman, Concho, McCulloch, Mills, and San Saba and contains three general law cities, Bangs, Goldthwaite, and Santa Anna. Six waste control orders presently exist in Segment 1410.

(4) Water Quality Control Programs. Segment 1410 is partially within the planning boundaries of Central Texas Council of Governments, Concho Valley Council of Governments, and West Central Texas Council of Governments. The segment contains one Section 201 facility planning area, #987, but no sewerage planning areas. Water quality

and quantity in the segment are currently monitored through the TDWR, TDH, and USGS monitoring networks.

b. Nonpoint Source Assessment.

(1) Introduction. This section presents an assessment of the impact of nonpoint source pollutants in the Colorado River Basin, Segment 1410. Additional detailed information is provided in Appendix I, Inventory and Methodology - Nonpoint Source Assessment and Appendix J, Segment Layouts with Nonpoint Source Inventory.

(2) Assessment. Mining activity is quite extensive throughout Segment 1410. Twenty-five oil and gas fields are fairly concentrated in the upper portion of the segment. Oil field brine poses potential water quality problems in terms of increasing dissolved solids concentration in streams. Saline water could also migrate into freshwater aquifers through improperly sealed oil and gas wells. There are eight mines in the segment, six of which are inactive bituminous coal mines. Nonpoint source pollution could result from surface runoff at these sites.

Segment 1410 has a moderate sediment loading from agricultural/silvicultural activity relative to other segments in the study area. Farming activity is prevalent throughout all counties in the segment. Several farming areas in Brown and Mills counties use treated effluent for irrigation. Construction-related nonpoint source pollution poses little problem at present as there is only one current ongoing operation in the segment, and the effects of the activity would be quite localized.

c. Wasteload Projections.

This segment is classified as Category II.

(1) Point Sources. Three incorporated cities contribute municipal wasteload and there are no industrial wasteload contributions to the segment. The wasteloads are projected to increase from a present load of approximately 90 lbs/day of BOD and TSS to about 110 lbs/day of BOD and TSS by the year 2000. The following is a summary of the wasteload projections:

Planning Year	BOD (lbs/day)	TSS (lbs/day)
Existing	93	93
1983	96	96
1990	101	101
2000	108	108

A more detailed breakdown of loads is presented in Appendix M, as well as a discussion of the methodology used.

d. Wasteload Analysis.

This segment is the reach of the Colorado River between the San Saba River confluence and E. V. Spence Reservoir. The segment is classified as 'Effluent Limiting' and the desirable uses are recreation, propagation of fish and wildlife, and domestic water supply. The water quality standards established for this segment are as follows:

Dissolved Oxygen (not less than)	5.5 mg/l
pH Range	6.5-8.5
Coliform (log. avg. not more than)	200 FECAL/100 ml
Temperature	91°F
Chloride (not more than)	550 mg/l
Sulfate (not more than)	600 mg/l
Total Dissolved Solids (not more than)	2,000 mg/l

Three point source discharges contribute a total oxygen demand to the segment of 290 lbs/day. Each of the three point sources discharges into tributaries of the main segment. The City of Goldthwaite discharges into Bull Creek about 8 miles upstream of its confluence with the Colorado River. The City of Bangs discharges into Clear Creek about 29 miles from the Creek's confluence. The City of Santa Anna discharges into Home Creek about 23 miles from its confluence. Possible nonpoint source wasteloads in this segment of the Colorado are attributed to surface runoff from coal mines and pollution from oil field brine.

Past water quality monitoring of the segment has not indicated any serious problems. Water Quality Assessment, Chapter F, Volume I of the Basic Data Report indicates a violation of pH standard in 1974, which was apparently due to excessive growth of plankton. At the time of the pH violation, the DO was recorded to be 18.8 mg/l. No other violation, of water quality standards has been observed.

The projected total oxygen demand contributed by the three point sources is expected to be about 345 lbs/day by the year 2000. To evaluate the future water quality, the projected wasteloads from point source discharges were reduced to residual loads at the confluence points to be incorporated into the EPA simplified model for a 7-day, 2-year-frequency stream low-flow analysis. The dissolved oxygen computed for the main stem of the Colorado River for the projected year 2000 load is presented in Table 3, Appendix M. The minimum DO value predicted for the stream is 5.5 mg/l. This is greater than the required DO standard, and therefore no future water quality problems are anticipated for the segment and no change in the treatment level is recommended.

e. Sewerage Planning Area Alternative Plans.

No sewerage planning areas have been identified for Segment 1410; thus, no alternative plans have been developed.

11. SEGMENT 1414

a. Summary of Existing Agencies and Water Quality Control Programs.

(1) Introduction. This section summarizes the existing management agencies and water quality programs in the Colorado River Basin, Segment 1414. Additional detailed information is provided in Appendix E, Inventory of Existing Agencies and Practices, Appendix F, Financial Management Experience, Appendix G, Intergovernmental Cooperation in the LCRA 208 Planning Area, and Appendix H, Areawide Plans and Programs. This section contains three major topics: description of boundaries, identification of major management agencies, and the definition of water quality control programs in Segment 1414.

(2) Physical Boundaries and Description. Segment 1414 includes the main stem of the Pedernales River. The drainage area of the segment includes a large portion of Blanco and Gillespie counties and very small portions of Hays, Kendall, Kerr, Kimble, and Travis counties.

(3) Existing Management Agencies. All federal and state agencies, primarily the Environmental Protection Agency and the Texas Department of Water Resources, are involved in stream segment management functions. The segment is within the management jurisdiction of three regional agencies: Capital Area Planning Council, Alamo Area Council of Governments, and Lower Colorado River Authority. Each has specific authority to perform management functions. Intergovernmental devices allow for contracting for wastewater management functions between or among agencies within or outside the stream segment boundaries. The segment is partially within seven counties, Blanco, Gillespie, Hays, Kendall, Kerr, Kimble, and Travis and contains two general law cities, Fredericksburg and Johnson City. Ten waste control orders presently exist in Segment 1414.

(4) Water Quality Control Programs. Segment 1414 is partially within the planning boundaries of Alamo Area Council of Governments and Capital Area Planning Council. The segment contains one Section 201 facility planning area, #1052, but no sewerage planning areas. Water quality and quantity in the segment are currently monitored through the TDWR, TDH, and USGS monitoring networks.

b. Nonpoint Source Assessment.

(1) Introduction. This section presents an assessment of the impact of nonpoint source pollutants in the Colorado River Basin Segment 1414. Additional detailed information is provided in Appendix I, Inventory and Methodology - Nonpoint Source Assessment, and Appendix J, Segment Layouts with Nonpoint Source Inventory.

(2) Assessment. Potential for nonpoint source pollution in Segment 1414 is varied. The three sanitary landfills and six animal feedlots in the central portion of the segment have potential to increase coliform counts. There are several septic tank areas in the segment and two "no discharge" treatment plants in Gillespie County using treated effluent as irrigation water.

Mining activity is predominantly sand and gravel operations. These operations frequently use settling ponds to treat wastewater, and when located adjacent to a watercourse, they pose potential pollution problems. Segment 1414 registers a moderate to high sediment loading due to agricultural/silvicultural activity which is concentrated in Gillespie and Blanco counties. Fredericksburg in Gillespie County is the major source of urban runoff in the segment with potential pollution problems as measured by average daily dust and dirt accumulation.

c. Wasteload Projections.

This segment is classified as a Category II segment.

(1) Point Sources. The segment consists of three municipal facilities discharging wasteloads to the segment, two of which are incorporated cities having major contributions. There are no industrial wasteload contributions. The existing total wasteload to the segment is approximately 320 lbs/day of BOD and TSS, which is projected to increase to approximately 560 lbs/day of BOD and TSS by the year 2000. A brief summary of the wasteload projections for the segment is given below.

Planning Year	BOD (lbs/day)	TSS (lbs/day)
Existing	319	319
1983	446	446
1990	492	492
2000	559	559

A more detailed breakdown of loads is presented in Appendix M as well as a discussion of the methodology used.

d. Wasteload Analysis.

The Pedernales River is an 'Effluent Limiting' segment. Its water is deemed desirable for recreation, propagation of fish and wildlife, and for domestic raw water supply. The following are the water quality standards established for the segment:

Dissolved Oxygen (not less than)	5.0 mg/l
pH Range	6.5-9.0
Coliform (log. avg. not more than)	200 FECAL/100 ml
Temperature	91°F
Chloride (not more than)	80 mg/l
Sulfate (not more than)	50 mg/l
Total Dissolved Solids (not more than)	500 mg/l

Three point sources discharge a total oxygen demand of 950 lbs/day to the segment. Two point sources discharge directly into the Pedernales River and one into Baron's Creek about 2 miles upstream from its confluence with the Pedernales River. The nonpoint sources of pollution which may be significant have been identified as runoff from sanitary landfills, animal feedlots, and septic tanks. However, the potential septic tanks' pollution is more likely to affect groundwater than surface water.

According to the Water Quality Assessment, Chapter F, Volume I, no existing water quality problems are identified within this segment. No violations of the standards have been found with the segment waters.

The future total oxygen demand from point sources is projected to be about 1,620 lbs/day. The effect of this projected oxygen demand was analyzed considering multiple point sources as outlined in the EPA simplified model. Table 4, Appendix M, presents the details of this analysis. The maximum DO deficit calculation for the segment in the year 2000 is 2 mg/l. Thus, the minimum DO predicted (5.4 mg/l) is greater than the minimum stream standard. Based on this analysis, the future water quality of the segment is expected to remain satisfactory. No change is necessary in the present treatment requirements.

e. Sewerage Planning Area Alternative Plans.

No sewerage planning areas have been identified in Segment 1414, and therefore no alternative plans were developed.

12. SEGMENT 1415

a. Summary of Existing Agencies and Water Quality Control Programs.

(1) Introduction. This section summarizes the existing management agencies and water quality programs in the Colorado River Basin Segment 1415. Additional detailed information is provided in Appendix E, Inventory of Existing Agencies and Practices, Appendix F, Financial Management Experience, Appendix G, Intergovernmental Cooperation in the LCRA 208 Planning Area, and Appendix H, Areawide Plans and Programs. This section contains three major topics: description of boundaries, identification of major management agencies, and the definition of water quality control programs in Segment 1415.

(2) Physical Boundaries and Description. Segment 1415 is defined as the Llano River from its confluence with the Colorado River to its headwaters. The segment drainage area includes a major portion, if not all, of Llano, Mason and Junction counties and small portions of Edwards, Gillespie, Kerr, Menard, and Sutton counties.

(3) Existing Management Agencies. All federal and state agencies, primarily the Environmental Protection Agency and the Texas Department of Water Resources, are involved in stream segment management functions. The segment is within the management jurisdiction of five regional agencies: Alamo Area Council of Governments, Capital Area Planning Council, Concho Valley Council of Governments, Middle Rio Grande Development Council, and Lower Colorado River Authority. Each of these agencies has specific authority to perform planning and/or management functions. Intergovernmental devices allow for contracting for wastewater management functions between or among agencies within or outside the stream segment boundaries. The segment is partially within eight counties, Edwards, Gillispie, Kerr, Kimble, Llano, Mason, Menard, and Sutton, and contains three general law cities, Junction, Llano and Mason. Eleven waste control orders are in existence.

(4) Water Quality Control Programs. Segment 1415 is partially within the planning boundaries of Alamo Area Council of Governments, Capital Area Planning Council, Concho Valley Council of Governments, and Middle Rio Grande Development Council. The segment does not contain any Section 201 facility planning areas, but has two sewerage planning areas, the cities of Mason and Junction. Water quality and quantity in the segment are currently monitored through the TDWR, TDH, and USGS monitoring networks.

b. Nonpoint Source Assessment

(1) Introduction. This section presents an assessment of the impact of nonpoint source pollutants in the Colorado River Basin Segment 1415. Additional detailed information is provided in Appendix I, Inventory and Methodology - Nonpoint Source Assessment and Appendix J, Segment Layouts with Nonpoint Source Inventory.

(2) Assessment. Segment 1415 does not exhibit any significant existing water quality problems; however, waste disposal sites and mining activities present the greatest potential for nonpoint source pollution problems. As Figure 13, Appendix J illustrates, there are 21 animal feedlots in the segment concentrated in Llano and Mason counties; in addition, there are six municipal sanitary landfills dispersed throughout the segment. If operated improperly, these sites pose potential pollution problems to surface and/or groundwater supplies. Septic tank areas are relatively sparse in the segment, thereby posing no observed significant pollution problems to date.

Mining activities are prevalent throughout Segment 1415. Figure 13 also indicates 15 mines, particularly sand and gravel operations and limestone mines. In sand and gravel mining, the primary method of treating wastewater is through the use of settling ponds. These are usually located adjacent to a stream, making proper treatment of the wastewater essential. Although nine of the mining sites in the segment are inactive, they present potential nonpoint source pollution due to surface runoff. There are eight oil and gas fields in the segment, four of which are active. Brine brought to or near the surface as a byproduct of oil production can reach streams over the surface or through the ground.

Agricultural/silvicultural activities do not pose a significant pollution problem in the area, indicated by the sediment loading factor of 1.05 in Table 3 of Appendix I, which ranks Segment 1415 last relative to the other segments in the study area. This is mainly attriubuted to the fact that agriculture/silviculture land uses are far overshadowed by a predominance of rangeland throughout the drainage area.

c. Wasteload Projections

This is a Category II segment.

(1) Point Sources. The wasteload discharged to the segment is from three municipal facilities; there is no industrial wasteload contribution. All three municipal facilities are incorporated cities and the total wasteload from these plants is projected to increase slightly from a present load of 240 lbs/day of BOD and TSS to 270 lbs/day of BOD and TSS by the year 2000. These projections are as follows:

Planning Year	BOD (lbs/day)	TSS (lbs/day)
Existing	240	240
1983	254	254
1990	261	261
2000	270	270

A more detailed breakdown of loads is presented in Appendix M as well as a discussion of the methodology used.

d. Wasteload Analysis

This segment encompasses the drainage area of the Llano River and is classified as 'Effluent Limiting.' The desirable uses of segment waters are recreation, propagation of fish and wildlife, and domestic raw water supply. The following are the water quality standards established for the segment:

Dissolved Oxygen (not less than)	5.0 mg/l
pH Range	6.5-9.0
Coliform (log. avg. not more than)	200 FECAL/100 ml
Temperature	91°F
Chloride (not more than)	50 mg/l
Sulfate (not more than)	50 mg/l
Total Dissolved Solids (not more than)	300 mg/l

Three point sources discharge about 650 lbs/day of total oxygen demand to the segment. Two point sources discharge to the Llano River. The other point source discharges to Comanche Creek at a point about 9 miles upstream from its confluence with the Llano River. Possible nonpoint source loads are attributed to runoff from feedlots, municipal disposal sites, septic tank developments, and mineral extraction.

A review of Water Quality Assessment, Chapter F, Volume I, indicates that the water quality of Llano River has exhibited no violations of standards. The monitoring data indicates an annual average DO concentration greater than 9.0 mg/l for the segment.

The projected total oxygen demand from point sources in the year 2000 is estimated to be about 740 lbs/day. The minimum DO produced by the future loads was calculated to be 6.3 mg/l using the EPA simplified model for multiple point sources. The results of this analysis are shown on Table 5, Appendix M. Therefore, no water quality problems are anticipated for the segment, since the DO established is 5.0 mg/l. No changes in the present treatment requirements are proposed.

e. Alternative Plans for the Mason Sewerage Planning Area.

The City of Mason is an incorporated general law municipality located in the center of Mason County. The city's land use pattern is characterized by scattered residential development with commercial and public facilities concentrated in the central areas of the city and along major thoroughfares. The economic resource base is primarily agricultural with no significant industrial contribution. Population projections for the city indicate a slight decrease in population in the next twenty years. The population estimates are as follows:

Year	Existing	1983	1990	2000
Population	1,800	1,800	1,800	1,700

The existing wastewater collection system consists of 6-, 8-, and 10-inch lines. The system is generally adequate for present needs. However, city officials indicate certain line segments experience high flows which may require some relief. Also, there may be need for minor extensions in the future to serve presently undeveloped areas. There are no septic tank areas identified within the city. The need for collection system work should be reviewed as part of the next plan update study.

The existing wastewater treatment plant was built in 1949 with a design capacity of 0.135 mgd. The plant consists of an Imhoff tank, oxidation ponds, and sludge drying beds. Special flow measurements at the plant indicate the rate varies between 50,000 gpd and 190,000 gpd on a normal dry-weather day. The approximate daily volume is 100,000 gallons. Past self-reporting data should not be used in establishing flow quantities because the means available for measuring the sewage rate has been inaccurate.

In order to satisfy the design criteria for serving 1,800 people, the plant capacity needs to be expanded to 0.18 mgd. The need for modernization, as well as providing some expansion in capacity, was deemed sufficient to identify the city as a sewerage planning area and to develop the following alternative plans.

(1) Structural Alternatives

(a) Collection System. Since the existing system is considered adequate through the planning period, no alternative plans were developed.

(b) Treatment and Disposal. There are three broad options which were investigated for disposal of sewage for the City of Mason. These options are 1) treatment and discharge, 2) treatment reuse, and 3) land application. Since there are few industries in the area, reuse of treated water for industrial processes shows little potential. Further, factors such as public health, soil conditions, and economic considerations make the reuse of treated water for potable water supply or groundwater recharge infeasible. Therefore, only treatment and discharge, and land application options were considered. Based on the State methodology, two alternatives were developed for these options.

Alternative 1. This alternative proposes an expansion of the existing oxidation ponds, the addition of primary treatment and chlorination facilities, the conversion of the Imhoff tank to an aerobic digester, and the installation of sludge drying beds. The total treatment capacity of the modified plant will be 0.18 mgd. For this alternative, the raw wastewater is first settled in the primary clarifier, then treated by the oxidation ponds, and finally chlorinated prior to discharge. The settled primary sludge is to be aerobically digested, dewatered on sludge drying beds, and land spread. However, it should be noted that oxidation pond systems cannot constantly produce an effluent with a total suspended solids concentration equal to 30 mg/l due to algae problems. Therefore, administrative relief on TSS requirements has to be obtained before this alternative can be adopted. It should also be noted that, if administration relief is obtained, the final engineering design may not require a special disinfection step. Chlorination can be omitted and costs saved, if there is sufficient detention time in the ponds.

Alternative 2. This alternative proposes the conversion of the existing Imhoff tank to an aerobic sludge digester, the addition of primary treatment, chlorination and spray irrigation facilities, and the expansion of sludge drying beds. The total treatment capacity of the modified plant will be 0.18 mgd. The raw wastewater to the plant is first settled in the primary clarifier, then chlorinated and finally sprayed on irrigation fields. The primary sludge is to be aerobically digested, dewatered on drying beds, and land spread. To implement this alternative, the city would need about 50 acres of land for irrigation, which could include use of certain areas at the county airport. It should be noted that according to section 35.940.3a of EPA regulations and EPA PRM 75-25, the cost of land which is an integral part of the treatment process in a system for land treatment is eligible for grant

assistance. The existing oxidation ponds will be utilized as emergency holding ponds when the treated effluent cannot be used for irrigation.

It should be emphasized that the two alternatives shown are from a prescribed list given in the statewide methodology, and their presentation is not intended to eliminate any viable alternative from use for this location, but rather to limit for planning purposes the number of possible selections to those which offer a meaningful difference in various project costs. The options presented should be understood in the context of being representative examples of reasonable planning level solutions and costs.

(2) Costs of Technical Alternatives

Using the State methodology, costs were developed for the two technical alternatives considered. For each alternative, capital cost, operation and maintenance cost, and annualized total and per capita costs (with and without EPA grant) were estimated. While developing these costs, all capital costs were assumed to be incurred in 1980; the facility life was assumed to be 20 years; and 6-3/8 percent annual interest rate was used. All values are in March 1977 dollars. Year 1980 population was selected as the basis for calculating the annualized per capita costs. These estimated costs are presented in Table II-D-9.

(3) Impacts of Technical Alternatives

The monetary cost of these two alternatives is only one of several aspects which should be considered in selecting the most beneficial alternatives. The environmental, social, and economic impacts of different alternatives, such as energy and resources use, sensitive ecosystems, air quality, local health problems, etc., should also be evaluated. These nonmonetary costs or impacts are presented in Table II-D-10.

(4) Management Alternatives

Two conceptual models should be considered when designing a management system for Mason and other sewerage planning areas in the Lower Colorado Basin: centralized and decentralized.

TABLE II-D-9

COST OF TECHNICAL ALTERNATIVE PLANS FOR

CITY OF MASON

	Alternative 1	Alternative 2 (Land cost included)	Alternative 2 (Land cost excluded)
Capital Cost			
Collection System	-	-	-
Treatment Plant	$314,000	$896,000	$715,000
Total			
O & M Cost			
Collection System	-	-	-
Treatment Plant	$ 24,600/yr	$ 32,000/yr	$ 32,000/yr
Total			
Annualized Cost			
Without Grant			
Total	$ 53,000/yr	$113,000/yr	$ 96,000/yr
Per Capita	$ 29/yr	$ 63/yr	$ 53/yr
With Grant			
Total	$ 32,000/yr	$ 52,000/yr	$ 48,000/yr
Per Capita	$ 18/yr	$ 29/yr	$ 27/yr

TABLE II-D-10

IMPACTS OF TECHNICAL ALTERNATIVE PLANS FOR

CITY OF MASON

Criterion	Alternative 1	Alternative 2
Electricity Use	Approx. 92,000 KWH/yr	Approx. 142,000 KWH/yr
Chemical Use	2.6 tons Chlorine per yr.	6.5 tons Chlorine per yr.
Manpower Requirements	1.4 man-yr/yr	1.8 man-yr/yr
Land Requirements	Additional 2-ac required	Additional 54-ac required
Aesthetics	Visual impression will be matter of good architectural design and site maintenance.	Land disposal site could be utilized as green belt.
Local Health	Local health improved because of better effluent quality.	Local health improved because of no effluent discharges
Sensitive Ecosystems	Temporary disruption of plant site for construction.	Amount of land required could cause destruction of habitat and cause land use shift.
Air Quality	No serious odor problem anticipated if properly operated.	No serious ordor problem anticipated if properly operated.

(a) Decentralized Operations. The decentralized model relies on each individual city or special district to provide sewage treatment services. The decentralized model is found in most parts of Texas, and it most closely represents the management system found presently in the Lower Colorado Basin.

The City of Mason owns and operates a sewage collection and treatment system. The city has a stable population, and its need for expanded facilities is not well documented. Nevertheless, the city is interested in expanding or updating its facility to assure it meets 1983, 1985, and subsequent federal and state requirements.

As indicated in Table II-D-9, costs for technical alternatives range from $314,000 for treatment facilities to $896,000 for treatment facilities and land application. Because proper land application would constitute no pollution discharge, city officials evidenced considerable interest in this alternative.

City officials also indicated an interest in the availability of federal grant funds to offset land and other treatment facility costs. To the extent that federal funds were available, the city's financing requirements would be reduced.

General Obligation Bonds. General obligation bonds are secured by the ad valorem taxing authority of the city. The City of Mason has no general obligation debt. Its assessed valuation would appear to be adequate to finance either alternative, although substantial tax increases would be required.

Revenue Bonds. The city retired its utility system revenue bonds in 1977, and has no outstanding obligations. Annual capital costs for alternative 2 are estimated to be $81,000. From available data, the utility system revenues would appear to be adequate to meet operating and debt service requirements of this magnitude.

Texas Water Quality Enhancement Fund. The Texas Water Quality Enhancement Fund, administered by the Texas Department of Water Resources, is designed to assist local communities that cannot finance water quality facilities through regular commercial channels.

Federal Construction Grant Program. The federal construction grant program, authorized under section 201 of P.L. 92-500, would finance 75 percent of the capital costs for any of the alternatives. The city would be required to finance the 25 percent from local or state sources. Thus, the city could use any of the financing approaches outlined above to meet the matching requirements for the construction grant program. (Certain federal funds may be used to meet matching requirements, as discussed below). Operation and maintenance costs, however, must be paid from user charges.

Other Federal Assistance Programs. The Farmer's Home Administration (FmHA) administers a loan and grant program for wastewater systems in rural communities. If a community meets the eligibility requirements, FmHA grants and loans may be used in combination to finance sewage collection and treatment systems. Other grant and loan programs are administered by the Economic Development Administration for communities in economic development areas. (Mason, however, is not in an economic development area.) Community development bloc grants, administered by the Department of Housing and Urban Development, may be used to finance collection systems, but not sewage treatment plants. Finally, federal revenue sharing funds may be used for any lawful purpose, including the matching requirements of other federal programs.

(b) Centralized Operations. The centralized model would involve an areawide special district or authority (or a series of authorities) with responsibility to plan, finance, construct, operate, and maintain sewage treatment facilities throughout all or parts of the basin. The authority would be a "wholesaler" of sewage treatment services to local governments who would "retail" services to businesses and households. Local governments who were customers of the authority would enter into intergovernmental contracts providing them with guaranteed sewage treatment capacity in one (or more) sewage treatment plants operated by the authority. Each local government would retain ownership and maintenance of its own collection system and would be responsible for billing and collection operations.

The Lower Colorado River Authority (LCRA) has the statutory authority, jurisdiction, and financial and management capability to assume ownership and/or operation of Mason's sewage treatment facilities and to implement the technical alternatives. However, the LCRA would assume this responsibility only upon request of the city and upon a finding by the consultants that no other alternatives were feasible.

By and On Behalf of Bonds. Under the general laws of the State, the LCRA may issue water quality improvements bonds "on behalf of" a local government. Ordinarily, these bonds are issued by a river authority that has contracted with a local government to operate the local sewage treatment facility. The local government enters a contract with the authority, promising to make payments adequate to meet debt service or debt service and operating and maintenance costs. To meet its obligations under the contract, the city may take revenues from any source (except sales tax receipts). The bonds are secured solely by the intergovernmental contract. The credit of the authority is not pledged.

f. Alternative Plans for the Junction Sewerage Planning Areas.

The City of Junction is an incorporated general law municipality located in the central portion of Kimble County. The city's land use is characterized by scattered residential development and a concentration of commercial and public facilities along major thoroughfares in the central areas of the city. The economic resource base is primarily agricultural with no significant industrial contribution. Significant population growth is not anticipated for the city in the next twenty years. However, city officials have indicated that an increase in tourism will add an additional 10 to 20 percent to the effective population in the near future and that significant growth in the permanent population appears possible over the planning period. By city estimates the effective population could range between 3,100 and 5,000 people by the year 2000.

The population estimates for the city are as follows:

Year	Existing	1983	1990	2000
Population	2,727	2,800	2,800	2,800

The city's existing wastewater collection system, consisting of 6-, 8-, 10-, and 12-inch lines, serves most parts of the city, except for an area west of the Llano River and an area around the intersection of IH 10 and Highway 83. In both areas private septic tanks are utilized for sewage disposal. Expansion of the present collection system is proposed to serve these areas.

The existing wastewater treatment plant for Junction was constructed in 1950 with a design capacity of 0.21 mgd. Originally, the plant consisted of a bar screen, an Imhoff tank and three oxidation ponds. However, the plant is located on the banks of the Llano River and two oxidation ponds have been lost to the river with only one remaining in service at the present time. Due to this erosion problem, the city has initiated preliminary planning aimed at relocating the existing plant out of the flood plain. Interest in two potential sites was expressed by the city. One site is located on the west side of the Llano River about one-half mile north of the intersection of IH 10 and FM 2169; the other site is located approximately half a mile west of the existing plant site. Considering the relatively high cost of crossing the Llano River with the

sanitary sewer trunk line, relocation of the plant to the west of the existing site would be more economical and is addressed in this analysis.

Based on 100 gallons per capita per day waste contribution, the existing treatment capacity must be expanded to 0.28 mgd in order to meet the effluent requirements throughout the planning period. Therefore, alternative plans were developed for constructing a new 0.28 mgd treatment plant and for expanding the exisitng collection system to serve the unsewered areas. However, due to the potential for change in the predicted population to be served, the actual size should be based on the most current information at the time of engineering design.

(1) Structural Alternatives

(a) Collection System. Since no substantial population growth is expected for Junction, only minor expansion and extensions of the collection system are needed for the existing sewered area in the next twenty years. To provide service to the two septic tank areas described above, approximately 7,000 feet of gravity line, 5,500 feet of pressure line, two lift stations, and two river crossings are needed.

(b) Treatment and Disposal. There are three broad options which were investigated for disposal of sewage for the City of Junction. These options are 1) treatment and discharge, 2) treatment and reuse, and 3) land application. Since there are few industries in the area, reuse of treated water for industrial processes is of little potential, and factors such as public health, soil conditions, and economic considerations make the reuse of treated water as potable water source or groundwater recharge infeasible. Therefore, only the treatment and discharge, and land application options were considered. Based on the State methodology, two alternatives were developed for these two options.

Alternative 1. This alternative proposes the installation of a 0.28 mgd package treatment plant. The package plant will produce an effluent meeting the TDWR Effluent Set 1 requirements. In addition, approximately 5,600 square feet of sludge drying beds are required for dewatering aerobically digested sludge. Dry sludge is proposed to be land spread.

Alternative 2. This alternative proposes land disposal of treated effluent. Primary treatment, chlorination, spray irrigation, aerobic digestion, and sludge drying equipment capable of handling an average waste flow of 0.28 mgd are proposed to be constructed. About 80 acres of land are estimated to be required for spray irrigation of the effluent. Raw wastewater to the treatment plant is first treated in the primary clarifier, then chlorinated and finally sprayed over the irrigation field. The settled sludge from the primary clarifier is digested in the proposed aerobic digester and dewatered on the sludge drying beds. Dry sludge is to be land spread.

(2) Costs of Technical Alternatives

Using the State methodology, costs were developed for the two technical alternatives considered. For each alternative, capital cost, operation and maintenance cost, and annualized total and per capita costs (with and without an EPA grant) were estimated. While developing these costs, all capital costs were assumed to be incurred in the year 1980; the facility life was assumed to be 20 years; and 6-3/8 percent annual interest rate was used. All cost values are in March 1977 dollars. Year 1980 population was selected as the basis for calculating the annualized per capita costs. These estimated costs are presented in Table II-D-11.

(3) Impacts of Technical Alternatives

The monetary cost for these two alternatives is only one of several aspects which should be considered in selecting the most beneficial alternatives. The environmental, social, and economic impacts of different alternatives, such as energy and resources use, sensitive ecosystems, air quality, local health problems, etc., should also be evaluated. These nonmonetary costs or impacts are presented in Table II-D-12.

(4) Management Alternatives

Two conceptual models should be considered when designing a management system for Junction and other sewerage planning areas in the Lower Colorado River planning area: centralized and decentralized.

(a) Decentralized Operations. The decentralized model relies on each individual city or special district to provide sewage treatment services. The decentralized

TABLE II-D-11

COSTS OF TECHNICAL ALTERNATIVE PLANS FOR

CITY OF JUNCTION

	Alternative 1	Alternative 2 (Land cost included)	Alternative 2 (Land cost excluded)
Capital Cost			
Collection System	$291,000	$ 291,000	$ 291,000
Treatment Plant	310,000	1,113,000	1,001,000
Total	$601,000	$1,404,000	$1,292,000
O & M Cost			
Collection System	$ 5,000/yr	$ 5,000/yr	$ 5,000/yr
Treatment Plant	41,000/yr	40,000/yr	44,000/yr
Total	$ 46,000/yr	$ 49,000/yr	$ 49,000/yr
Annualized Cost			
Without Grant			
Total	$100,000/yr	$ 175,000/yr	$ 165,000/yr
Per Capita	$ 36/yr	$ 63/yr	$ 59/yr
With Grant			
Total	$ 59,500/yr	$ 80,700/yr	$ 78,000/yr
Per Capita	$ 21/yr	$ 29/yr	$ 28/yr

TABLE II-D-12

IMPACTS FOR TECHNICAL ALTERNATIVE PLANS FOR

CITY OF JUNCTION

Criterion	Alternative 1	Alternative 2
Electricity Use	Approx. 360,000 KWH/yr	Approx. 228,000 KWH/yr
Chemical Use	4.3 tons Chlorine per yr.	10.6 yons Chlorine per yr.
Manpower Requirements	1.9 man-yr/yr	2.5 man-yr/yr
Land Requirements	New plant site (less than 1 acre)	Additional 83-ac required
Aesthetics	Visual impression will be matter of good architectural design and site maintenance.	Land disposal site could be utilized as green belt.
Local Health	Local health improved because of better effluent quality.	Local health improved because of no effluent discharges.
Sensitive Ecosystems	Temporary alteration of site from sewer construction, small loss of habitat.	Amount of land required could cause destruction of habitat or a shift in land use.
Air Quality	No serious odor problem anticipated if properly operated.	No serious odor problem anticipated if properly operated.

model is found in most parts of Texas, and it most closely represents the management system found presently operating in the Lower Colorado Basin.

The City of Junction owns and operates a sewage collection and treatment system, staffed by full-time personnel. The treatment facilities are inadequate, partly due to erosion by the river in the vicinity of the plant site. A new plant must be built at a different location, and collection systems are needed for a portion of the city. The area to be served is a predominately Mexican-American neighborhood with a high percentage of low income families. City officials are agreed on the immediate need to improve the sewage treatment system. The key issue is the means of financing the improvements.

General Obligation Bonds. General obligation or tax bonds are secured by the ad valorem taxing authority of the city. The city presently has $109,000 in outstanding GO debt against assessed valuation of $4.6 million (at 33.3 percent of actual value). By increasng the basis of assessment from 33.3 to 50 percent, the city would generate adequate ad valorem tax capacity to finance the capital costs of the less expensive alternative (alternative 1, $601,000). It is doubtful that the city could finance alternative 2, $1.4 million, solely from ad valorem taxes even with a 100 percent assessment rate.

If grant funds could be used to finance the collection system, $310,000 would be required for the treatment plant, thus reducing substantially the GO bond requirements necessary for the less expensive alternative. (See the discussion of federal grant and loan programs below.) The city appears to have adequate ad valorem tax capacity to finance the plant without increasing the basis of assessment.

Revenue Bonds. The city has $335,000 in outstanding water and sewer system revenue bonds. To issue parity bonds to finance alternative 1 would require substantial user charge increases in order to meet coverage requirements. Coverage of 1.5 times average annual debt service requirements, after giving effect of the additional bonds, must be projected for operation of the system. (Historical coverage is not required by the indenture.)

The availability of grant funds for financing the collection system would also reduce the revenue bond requirements.

Texas Water Quality Enhancement Fund. The Texas Water Quality Enhancement Fund, administered by the Texas Department of Water Resources, is designed to assist local communities that cannot finance water quality facilities through regular commercial channels. If the loan is approved by TDWR, the department will purchase the city's bonds secured by a junior lien on the net revenues of the system. User fee increases likely would be required, although probably less than those required to issue parity bonds. It should be noted that rate increases necessary to finance junior lien bonds automatically increase coverage, thus improving the capacity to issue additional parity bonds in the future if they should be necessary.

Federal Construction Grant Program. The federal construction grant program, authorized under section 201 of P.L. 92-500, would finance 75 percent of the capital costs for any of the alternatives. The city would be required to finance the 25 percent from the local or State sources. Thus, the city could use any of the financing approaches outlined above to meet the matching requirements for the construction grant program. (Certain federal funds may also be used to meet matching requirements, as discussed below.) Operation and maintenance costs, however, must be paid from user charges.

Other Federal Assistance Programs. The Farmer's Home Administration (FmHA) administers a loan and grant program for wastewater systems in rural communities. If a community meets the eligibility requirements, FmHA grants and loans may be used in combination to finance sewage collection and treatment systems. Other grant and loan programs are administered by the Economic Development Administration for communities in economic development areas (Junction is not eligible for EDA grants). Community development bloc grants, administered by the Department of Housing and Urban Development may be used to finance collection systems, but not sewage treatment plants. Finally, federal revenue sharing funds may be used for any lawful purpose, including the matching requirements of other federal programs.

(b) Centralized Operations. The centralized model would involve an areawide special district or authority (or a series of authorities) with responsibility to plan, finance, construct, operate, and maintain sewage treatment facilities throughout all or parts of the basin. The authority would be a "wholesaler" of sewage treatment services to local governments who would "retail" services

to businesses and households. Local governments who were customers of the authority would enter into intergovernmental contracts providing them with guaranteed sewage treatment capacity in one (or more) sewage treatment plants operated by the authority. Each local government would retain ownership and maintenance of its own collection system and would be responsible for billing and collection operations.

The Lower Colorado River Authority (LCRA) has the statutory authority, jurisdiction, and financial and management capability to assume ownership and/or operation of a city's sewage treatment facilities and to implement the technical alternatives. However, the LCRA would assume this reponsibility only upon request of the city and upon a finding by the consultants that no other alternatives were feasible.

By and On Behalf of Bonds. Under the general laws of the State, the LCRA may issue water quality improvement bonds "on behalf of" a local government. Ordinarily, these bonds are issued by a river authority that has contracted with a local government to operate the local sewage treatment facility. The local government enters into a contract with the authority, promising to make payments adequate to meet debt service or debt service and operating and maintenance costs. To meet its obligations under the contract, the city may take revenues from any source (except sales tax receipts). The bonds are secured solely by the intergovernmental contract. The credit of the authority is not pledged.

13. SEGMENT 1416

a. Summary of Existing Agencies and Water Quality Control Programs.

(1) Introduction. This section summarizes the existing management agencies and water quality programs in the Colorado River Basin Segment 1416. Additional detailed information is provided in Appendix E, Inventory of Existing Agencies and Practices, Appendix F, Financial Management Experience, Appendix G, Intergovernmental Cooperation in the LCRA 208 Planning Area, and Appendix H, Areawide Plans and Programs. This section contains three major topics: description of boundaries, identification of major management agencies, and the definition of water quality control programs in Segment 1416.

(2) Physical Boundaries and Description. Segment 1416 is defined as the San Saba River from its confluence with the Colorado River to its headwaters. The drainage area of the segment includes significant portions of Menard, McCulloch, San Saba and Schleicher counties and smaller portions of Concho and Mason counties.

(3) Existing Management Agencies. All federal and state agencies, primarily the Environmental Protection Agency and the Texas Department of Water Resources, are involved in stream segment management functions. The segment is within the management jurisdiction of three regional agencies: Central Texas Council of Governments, Concho Valley Council of Governments, and Lower Colorado River Authority. Intergovernmental devices allow for contracting for wastewater management functions between or among agencies within or outside the stream segment boundaries. The segment is partially within six counties, Concho, Mason, McCulloch, Menard, San Saba, and Schleicher, and contains six general law cities, Brady, Eden, Melvin, Menard, Richland Springs, and San Saba. Eleven waste control orders presently exist in Segment 1416.

(4) Water Quality Control Programs. Segment 1416 is partially within the planning boundaries of Central Texas Council of Governments and Concho Valley Council of Governments. The segment does not contain any Section 201 facility planning areas, but has one sewerage planning area, the City of San Saba. Water quality and quantity in the segment are currently monitored through the TDWR, TDH, and USGS monitoring networks.

b. Nonpoint Source Assessment

(1) Introduction. This section presents an assessment of the impact of nonpoint source pollutants in the Colorado River Basin Segment 1416. Additional detailed information is provided in Appendix I, Inventory and Methodology - Nonpoint Source Assessment and Appendix J, Segment Layouts with Nonpoint Source Inventory.

(2) Assessment. There are no significant water quality problems in Segment 1416; however, potential nonpoint source pollution problems can be associated with the oil and gas operations in the area. There are 16 fields in the western portion of the segment, nine of which are active. Oil field brine production poses a potential water quality problem in terms of increasing dissolved solids concentration in streams. Saline water could also migrate into freshwater aquifers through improperly sealed oil and gas wells. Municipal waste disposal contributes to dissolved solids concentration, and as Figure 14, Appendix J displays, there are nine sites in Segment 1416.

Construction-related nonpoint source pollution poses little problem at present, as there is only one current on-going operation in the segment and the effects of the activity would be quite localized. Agricultural/silvicultural activities are few throughout the segment, thus resulting in a relatively low sediment loading attributable to such land uses for the drainage area. Table 10 in Appendix I indicates that Segment 1416 has four urban areas which contribute a moderate amount of urban runoff. The pollutants resulting from urban land uses pose potential water quality problems related to suspended and dissolved solids. There are four "no discharge" sites in Segment 1416. These sites do not have permits to discharge directly into streams; therefore, treated effluent is used as irrigation water.

c. Wasteload Projections

This segment is classified as a Category II segment.

(1) Point Sources. The wasteload contribution to the segment consists of municipal discharge from three incorporated cities and industrial discharge from one facility. The projection of municipal wasteloads shows a decreasing trend, primarily due to a projected decrease in population served by one of the facilities. The total existing wasteload from municipal and industrial discharges to the segment is about 145 lbs/day of BOD and

180 lbs/day of TSS which, for the year 2000, is projected to be approximately 160 lbs/day of BOD and 205 lbs/day of TSS. The following gives a summary of wasteloads for the planning period:

	BOD (lbs/day)			TSS (lbs/day)		
Planning Year	Mun.	Indus.	Total	Mun.	Indus.	Total
Existing	145	-	145	145	33	178
1983	167	-	167	167	33	200
1990	166	-	166	166	35	201
2000	163	-	163	163	42	205

A more detailed breakdown of loads is presented in Appendix M as well as a discussion of the methodology used.

d. Wasteload Analysis

This segment encompasses the drainage area of the San Saba River and is classified as an 'Effluent Limiting' segment. The desirable uses of river waters are recreation, propagation of fish and wildlife, and domestic raw water supply. The following standards have been established for the river waters:

Dissolved Oxygen (not less than)	5.0 mg/l
pH Range	6.5-8.5
Coliform (log. avg. not more than)	200 FECAL/100 ml
Temperature	90°F
Chloride (not more than)	80 mg/l
Sulfate (not more than)	50 mg/l
Total Dissolved Solids (not more than)	500 mg/l

Three point sources discharge about 400 lbs/day of total oxygen demand to the segment. About 70 percent of this existing load is discharged to Brady Creek, a tributary of San Saba River, by two point sources located from 30 to 80 miles upstream from the confluence. The remainder of the loading is discharged directly to the San Saba River. Nonpoint sources identified as possibly significant are oil fields (brine) and municipal waste disposal sites. No significant water quality problems have been experienced in the river to date.

The total oxygen demand for the segment through the year 2000 is projected to be approximately 530 lbs/day. Utilizing the EPA simplified model, the main segment as well as Brady Creek was analyzed to estimate the DO sag due to this projected oxygen demand. The analysis of Brady Creek indicated a DO in the stream of 2.2 mg/l. Based on a stream standard of 2.0 mg/l for unclassified tributaries,

no violation of the DO standard is projected on Brady Creek through the year 2000. Calculations of the total sag curve also indicate that the point sources on Brady Creek will not impact the main stem of the San Saba River.

The analysis performed for the San Saba River to estimate the DO sag created by the point source discharging directly to the river yielded a minimum DO value of 7.2 mg/l under the seven-day, two-year low flow condition. Based on the present 5.0 mg/l DO standard, no water quality problem is anticipated in the segment for the projected point source wasteloads. Since no known instances of violations have occurred relating to nonpoint sources, the future quality of the segment is generally expected to be unchanged. No changes in the present treatment requirements are recommended.

e. Alternative Plans for the San Saba Sewerage Planning Area.

The City of San Saba is an incorporated general law municipality located in the south-central portion of San Saba County. Land use for the city is characterized by scattered residential development and a concentration of commercial and public facilities along major thoroughfares in the central area of the city. The economic resource base is primarily agricultural with some light industrial contributions. Population projections for the city indicate an insignificant increase over the next twenty years. The estimated populations are as follows:

Year	Existing	1983	1990	2000
Population	2,628	2,700	2,700	2,700

The existing wastewater collection system consists of 6-, 8-, 10- and 12-inch lines. The system is generally adequate and serves the major portion of the city except for an area on the west where septic tanks are still the primary means of sewage disposal. The system's 12-inch outfall sewer is not in sound condition and the city is considering replacement.

The existing wastewater treatment plant, constructed in 1962 with a design capacity of 0.126 mgd, consists of an Imhoff tank, an oxidation pond, and two sludge drying beds. The plant is located in the San Saba River flood plain. Due to its location, it is proposed herein that the facility be relocated out of the 100-year flood plain. The proposed new location is about a thousand feet south of the existing site. Based on 100 gallons per day per capita waste contribution, the treatment capacity required is 0.27 mgd in order to meet the effluent requirements through the planning period. Therefore, alternative plans were developed for improvements to both the existing collection and treatment facilities.

(1) Structural Alternatives

a. Collection System. Two areas of improvements are required for the city's collection system. To serve the septic tank area on the west portion of the city, approximately 500 feet of pressure line, 6,000 feet of gravity line, and one lift station are needed. In addition, installation of a new outfall trunk line is proposed, thus eliminating problems with the existing 12-inch trunk line as well as convey the wastes to the proposed new treatment plant.

b. Treatment and Disposal. There are three broad options which were investigated for the disposal of sewage for the City of San Saba. These options are 1) treatment and discharge, 2) treatment and reuse, and 3) land application. Since there are few industries in the area, reuse of treated water for industrial processes is of little potential, and factors such as public health, soil conditions, and economic considerations make the reuse of treated water as potable water source or groundwater recharge infeasible. Therefore, only the treatment and discharge and land application options were considered. Based on the State methodology, two alternatives were developed for these options.

Alternative 1. This alternative proposes abandonment of the existing plant and installation of a new 0.27 mgd package plant beyond the limits of the 100-year flood plain on an adjacent 80-acre site. The package plant will consist of bar screens, contact stabilization tanks, a final clarifier, a chlorine contact chamber, and an aerobic sludge digester. Approximately 5,400 square feet of sludge drying beds are also proposed to dewater the digested sludge. Dry sludge is to be land spread. It should be noted that several forms of this biological process can be interchanged, such as use of a race track system rather than a package plant. The selection should be based on which option is the most cost effective. At this stage of planning, the package plant appears to be the least-cost option. However, such a conclusion could change when engineering design is performed for this project.

Alternative 2. This alternative, as with the first, proposes abandonment of the existing plant and relocation out of the flood plain, construction of a primary treatment facility, and land disposal of the treated effluent. The primary treatment facility is to include a primary clarifier followed by chlorine contact basins. To accommodate land disposal, spray irrigation equipment with a 0.27 mgd average flow capacity is proposed to be constructed, and approximately 100 acres of land is needed for the irrigation field. The treated and chlorinated effluent is to be sprayed over the irrigation field and no discharge from the plant is proposed. In addition, emergency holding ponds are proposed to be constructed for temporary storage of effluent when the situation does not allow the effluent to be used for irrigation.

It should be emphasized that the two alternatives shown are from a prescribed list given in the stateside methodology, and their presentation is not intended to eliminate any viable alternative from use for this location, but rather

TABLE II-D-13

COSTS OF TECHNICAL ALTERNATIVE PLANS FOR

CITY OF SAN SABA

	Alternative 1	Alternative 2
Capital Cost		
Collection System	$435,000	$ 435,000
Treatment Plant	327,000	1,101,000
Total	$762,000	$1,536,000
O & M Cost		
Collection System	$ 22,000/yr	$ 22,000/yr
Treatment Plant	42,000/yr	44,000/yr
Total	$ 64,000/yr	$ 66,000/yr
Annualized Cost		
Without Grant		
Total	$133,000/yr	$ 204,000/yr
Per Capita	$ 49/yr	$ 76/yr
With Grant		
Total	$ 81,000/yr	$ 101,000/yr
Per Capita	$ 30/yr	$ 37/yr

TABLE II-D-14

IMPACTS OF TECHNICAL ALTERNATIVE PLANS FOR

CITY OF SAN SABA

Criterion	Alternative 1	Alternative 2
Electricity Use	Approx. 370,000 KWH/yr	Approx. 218,000 KWH/yr
Chemical Use	4.1 tons Chlorine per yr.	10.3 tons Chlorine per yr.
Manpower Requirements	2.1 man-yr/yr	2.0 man-yr/yr
Land Requirements	Relocate to nearby 80-acre tract	Additional 100-ac required
Aesthetics	Visual impression will be matter of good architectural design and site maintenance.	Land disposal site could be utilized as green belt.
Local Health	Local health improved because of better effluent quality.	Local health improved because of no effluent discharges.
Sensitive Ecosystems	Temporary disruption of new site from construction and small loss of habitat.	Amount of land required could cause destruction of some habitat or a shift of land use.
Air Quality	No serious odor problem anticipated if properly operated.	No serious odor problem anticipated if properly operated.

to limit for planning purposes the number of possible selections to those which offer a meaningful difference in various project costs. The options presented should be understood in the context of being representative examples of reasonable planning level solutions and costs.

(2) Costs of Technical Alternatives

Using the State methodology, costs were developed for the two technical alternatives considered. For each alternative, capital cost, operation and maintenance cost, and annualized total and per capita costs (with and without EPA grant) were estimated. While developing these costs, all capital costs were assumed to be incurred in the year 1980; the facility life was assumed to be 20 years; and 6-3/8 percent annual interest rate was used. All cost values are in March 1977 dollars. Year 1980 population was selected as the basis for calculating the annualized per capita costs. These estimated costs are presented in Table II-D-13.

(3) Impacts of Technical Alternatives

The monetary cost of these two alternatives is only one of several aspects which should be considered in selecting the most beneficial alternatives. The environmental, social, and economic impacts of different alternatives, such as energy and resources use, sensitive ecosystems, air quality, local health problems, etc., should also be evaluated. These nonmonetary costs or impacts are presented in Table II-D-14.

(4) Management Alternatives

Two conceptual models should be considered when designing a management system for San Saba and other sewerage planning areas in the Lower Colorado Basin: centralized and decentralized.

(a) Decentralized Operations. The decentralized model relies on each individual city or special district to provide sewage treatment services. The decentralized model is found in most parts of Texas, and it most closely represents the management system found presently operating in the Lower Colorado Basin.

The City of San Saba owns and operates a sewage collection and treatment system. Its primary problems stem from the location of the tank and polishing pond in a flood-prone

area and needed improvements in the collection system. As noted in Table II-D-13, alternative technical approaches would cost $762,000 and $1.5 million.

According to city officials, $250,000 has been set aside from community development bloc grant funds to finance a part of the necessary collection system improvements. Additional funds are being sought from the Economic Development Administration, as San Saba qualifies for EDA assistance. Grants totaling $250,000 to $500,000 would substantially reduce the city's borrowing requirements.

General Obligation Bonds. General obligation bonds are secured by the ad valorem taxing authority of the city. San Saba has no GO debt, and it has an assessed valuation of $4.1 million at 25 percent of actual value. By increasing the assessment rate from 25 to 50 percent of actual value, San Saba would generate adequate ad valorem tax capacity to finance alternative 1. Financing alternative 2 from tax bond proceeds would exhaust the city's GO debt capacity, at 100 percent of assessed value. Indeed, financing either alternative with tax bonds may be difficult, given the declining population of the City and a probable continuing, long-term decline in assessed valuation.

Revenue Bonds. The city has $117,000 in outstanding water and sewer revenue bonds with coverage of 1.49X for FY 1976, the most recent year for which data are available. The coverage requirements of the indenture make issuance of parity bonds difficult. Net operating revenues must equal 1.75 times maximum annual debt service requirements, after giving effect of the new bonds, for the two fiscal years preceding adoption of a new bond ordinance.

A combination of grant funds and second lien revenue bonds, which might be purchased by the Texas Water Quality Enhancement Fund or the Farmer's Home Administration, would minimize the need to increase user charges.

Texas Water Quality Enhancement Fund. The Texas Water Quality Enhancement Fund, administered by the Texas Department of Water Resources, is designed to assist local communities that cannot finance water quality facilities through regular commercial channels. If the loan is approved by TDWR, the department will purchase the City's bonds secured by a junior lien on the net revenues of the system. User fee increases likely would be required, although probably less than those required to issue parity

bonds. It should be noted that rate increases necessary to finance junior lien bonds automatically increase coverage, thus improving the capacity to issue additional parity bonds in the future if they should be necessary.

Federal Construction Grant Program. The federal construction grant program, authorized under section 201 of P.L. 92-500, would finance 75 percent of the capital costs for any of the alternatives. The city would be required to finance the 25 percent from local or state sources. Thus, the city could use any of the financing approaches outlined above to meet the matching requirements for the construction grant program. (Certain federal funds may also be used to meet matching requirements as discussed below.) Operation and maintenance costs, however, must be paid from user charges.

Other Federal Assistance Programs. The Farmer's Home Administration (FmHA) administers a loan and grant program for wastewater systems in rural communities. If a community meets the eligibility requirements, FmHA grants and loans may be used in combination to finance sewage collection and treatment systems. Other grant and loan programs are administered by the Economic Development Administration for communities in economic development areas. Community development bloc grants, administered by the Department of Housing and Urban Development, may be used to finance collection systems, but not sewage treatment plants. Finally, federal revenue sharing funds may be used for any lawful purpose, including the matching requirements of other federal programs.

(b) Centralized Operations. The centralized model would involve an areawide special district or authority (or a series of authorities) with responsibility to plan, finance, construct, operate, and maintain sewage treatment facilities throughout all or parts of the basin. The authority would be a "wholesaler" of sewage treatment services to local governments who would "retail" services to businesses and households. Local governments who were customers of the authority would enter into intergovernmental contracts providing them with guaranteed sewage treatment capacity in one (or more) sewage treatment plants operated by the authority. Each local government would retain ownership and maintenance of its own collection system and would be responsible for billing and collection operations.

The Lower Colorado River Authority (LCRA) has the statutory authority, jurisdiction, and financial and management capability to assume ownership and/or operation of a city's sewage treatment facilities and to implement the technical alternatives. However, the LCRA would assume this responsibility only upon request of the city and upon a finding by the consultants that no other alternatives were feasible.

By and On Behalf of Bonds. Under the general laws of the State, the LCRA may issue water quality improvements bonds "on behalf of" a local government. Ordinarily, these bonds are issued by a river authority that has contracted with the local government to operate the local sewage treatment facility. The local government enters into a contract with the authority, promising to make payments adequate to meet debt service or debt service and operating and maintenance costs. To meet its obligations under the contract, the city may take revenues from any source (except sales tax receipts). The bonds are secured solely by the intergovernmental contract. The credit of the authority is not pledged.

14. SEGMENT 1417

a. Summary of Existing Agencies and Water Quality Control Problems.

(1) Introduction. This section summarizes the existing management agencies and water quality programs in the Colorado River Basin Segment 1417. Additional detailed information is provided in Appendix E, Inventory of Existing Agencies and Practices, Appendix F, Financial Management Experience, Appendix G, Intergovernmental Cooperation in the LCRA 208 Planning Area, and Appendix H, Areawide Plans and Programs. This section contains three major topics: description of boundaries, identification of major management agencies, and the definition of water quality control programs in Segment 1417.

(2) Physical Boundaries and Description. Segment 1417 represents the Pecan Bayou region from Lake Brownwood Dam to the Bayou's confluence with the Colorado River. The segment lies largely in Brown and Mills counties and a small part of Comanche County.

(3) Existing Management Agencies. All federal and state agencies, primarily the Environmental Protection Agency and the Texas Department of Water Resources, are involved in stream segment management functions. The segment is within the management jurisdiction of two regional agencies: Central Texas Council of Governments and West Central Texas Council of Governments. Each of these agencies has specific authority to perform planning and/or management functions. Intergovernmental devices allow for contracting for wastewater management functions between or among agencies within or outside the stream segment boundaries. The segment is partially within three counties, Brown, Comanche, and Mills, and contains one home rule city, Brownwood, and two general law cities, Blanket and Mullen. Eight waste control orders are in existence.

(4) Water Quality Control Programs. Segment 1418 is partially within the planning boundaries of Central Texas Council of Governments and West Central Texas Council of Governments. The segment contains part of Pecan Bayou Special Study Area and one Section 201 facility planning area, #1143, but no sewerage planning areas. Water quality and quantity in the segment are currently monitored through the TDWR, TDH, and USGS monitoring networks.

b. Nonpoint Source Assessment.

(1) Introduction. This section presents an assessment of the impact of nonpoint source pollutants in the Colorado River Basin Segment 1417. Additional detailed information is provided in Appendix I, Inventory and Methodology - Nonpoint Source Assessment and Appendix J, Segment Layouts with Nonpoint Source Inventory.

(2) Assessment. Segment 1417 has been identified as an Intensive Planning Area due to historical water quality problems in Pecan Bayou near and downstream from the City of Brownwood. To facilitate an examination of the effects of urbanization on the Bayou's water quality, an analysis of the urban nonpoint source loadings has been conducted.

The City of Brownwood within the Intensive Planning Area was subdivided into two major watersheds and a third area along the eastern city limits of Brownwood draining directly into Pecan Bayou (Figure 10, Appendix J). The study area boundary generally coincides with Brownwood city limits, but deviates in those areas where development has occurred beyond the city limits. Land-use data for existing conditions were compiled from an update of the land uses shown in the Wastewater Management Plan for the Colorado River (1973). Table 1, Appendix L, gives existing land-use data for Brownwood watersheds. Land-use data for future conditions were based upon modest population growth expressed by the TWDR population data and the existing growth trends. Also utilized was information drawn from preliminary work on a 201 Facility Plan for the city. Projected land-use data for Brownwood watersheds are found in Table 2, Appendix L.

Following the rationale for Austin watersheds (Segment 1402), the total areas for watersheds in Brownwood remained constant throughout the 20 years, with development manifested by changes in land use. The critical storm was chosen based on the time of concentration of Adams Branch resulting in a storm of 2.8 inches of rainfall over 2.7 hours. This 2.8 inches of rainfall, when applied with the average runoff-to-rainfall ratio of 0.28 for Brownwood watersheds, resulted in 0.8 inch of runoff. Theoretically, the runoff volume would be capable of washing off greater than 90 percent of the surface pollutants. Again, a two-year return period was selected as frequent enough to be indicative of potential pollution problems. Using the procedure previously outlined, loads were

generated for watersheds in the Brownwood urban area. The existing and projected loads are found in Tables 3 and 4, Appendix L.

Other nonpoint source activities in Segment 1417 are varied. There are five municipal sanitary landfills in Brown County. Animal feedlots are concentrated in southern Mills County, with others dispersed throughout Brown County. Runoff from feedlots poses potential surface water pollution in the form of increased coliform concentrations. Several septic tank areas in the segment, particularly around Lake Brownwood, contribute to similar problems. There are no active construction operations of any significant magnitude in Segment 1417. Mining activity is sparse--one clay mine and one limestone mine at Brownwood, and two active oil and gas fields. Nonirrigated farmland and rangeland cover most of the segment. The sediment loading is relatively high in comparison to other segments in the study area, indicating that a high potential for water quality problems associated with agricultural activities does exist.

Pecan Bayou has had extensive dissolved oxygen problems with 15 such violations between 1972 and 1975. This has been attributed to the normally low flow in the segment and the impact of the discharge of treated sewage from Brownwood's main treatment plant. However, agricultural activity, mining, and disposal areas all potentially contribute to depressed dissolved oxygen conditions whether short term or long term.

c. Wasteload Projections

This segment is classified as a Category IV segment. Wasteloads are projected for both point and nonpoint sources.

(1) Point Sources. Only one municipal facility, owned by an incorporated city, discharges into the segment. There is no industrial wasteload contribution. The projected increase of the wasteload is from an existing load of approximately 380 lbs/day of BOD and TSS to 515 lbs/day of BOD and TSS by the year 2000. A summary of the projections for the planning years is as follows:

Planning Year	BOD (lbs/day)	TSS (lbs/day)
Existing	382	382
1983	469	469
1990	482	482
2000	515	515

d. Wasteload Analysis

The results from TDWR computer modeling runs for Pecan Bayou indicate that due to the low assimilative capacity best available treatment with supplemental aeration will be necessary for compliance with the 5.0 mg/l DO standard. The results of various treatment levels are shown below:

Treatment Level	Brownwood STP BOD_5 (mg/l)	SS (mg/l)	NH_3 (mg/l)	DO (mg/l)	Minimum Dissolved Oxygen in Pecan Bayou
1	20	20	17	4	0.00
2N	10	15	5	4	1.84
4N	5	5	3	4	4.65
4NA	5	5	3	6	5.10

e. Sewerage Planning Area Alternative Plans

No sewerage planning areas have been identified for Segment 1417; thus, no alternative plans have been developed.

15. SEGMENT 1418

a. Summary of Existing Agencies and Water Quality Control Programs.

(1) Introduction. This section summarizes the existing management agencies and water quality programs in the Colorado River Basin Segment 1418. Additional detailed information is provided in Appendix E, Inventory of Existing Agencies and Practices, Appendix F, Financial Management Experience, Appendix G, Intergovernmental Cooperation in the LCRA 208 Planning Area, and Appendix H, Areawide Plans and Programs. This section contains three major topics: description of boundaries, identification of major management agencies, and the definition of water quality control programs in Segment 1418.

(2) Physical Boundaries and Description. Segment 1418 is defined as Lake Brownwood. The segment drainage area includes a major portion of Coleman County comprising Hord's Creek, which is fed by Hord's Creek Reservoir, and Jim Ned Creek below Lake Coleman. The confluence of Hord's Creek and Jim Ned Creek flow into northern Brown County and ultimately into Lake Brownwood, which is located in Brown County.

(3) Existing Management Agencies. All federal and state agencies, primarily the Environmental Protection Agency and the Texas Department of Water Resources, are involved in stream segment management functions. The segment is within the management jurisdiction of two regional agencies: Central Colorado River Authority and West Central Texas Council of Governments. Each of these agencies has specific authority to perform planning and/or management functions. Intergovernmental devices allow for contracting for wastewater management functions between or among agencies within or outside the stream segment boundaries. The segment is partially within two counties, Brown and Coleman; and contains one home rule city, Coleman. Five waste control orders are in existence.

(4) Water Quality Control Programs. Segment 1418 is completely within the planning boundaries of West Central Texas Council of Governments. The segment does not contain any Section 201 facility planning areas or any sewerage planning areas. Water quality and quantity in the segment are currently monitored through the TDWR and USGS monitoring networks. The segment is not presently within the monitoring networks of the TDH.

b. Nonpoint Source Assessment

(1) Introduction. This section presents an assessment of the impact of nonpoint source pollutants in the Colorado River Basin Segment 1418. Additional detailed information is provided in Appendix I, Inventory and Methodology - Nonpoint Source Assessment and Appendix J, Segment Layouts with Nonpoint Source Inventory.

(2) Assessment. Segment 1418 exhibits extensive oil and gas activity. Brine production resulting from these operations could be a potential contributor to nonpoint source pollution in the area. There are nine active fields in the segment and eight additional inactive areas. Mines and sanitary landfills in the area possibly contribute to these water quality problems.

Segment 1418 registers a high sediment loading from agricultural/silvicultural activity relative to other segments in the study area. The City of Coleman is the major source of urban runoff in the segment with potential pollution problems. Construction-related nonpoint source pollution poses little problem at present as there is only one current on-going operation in the segment and the effects of the activity would be quite localized. There is one "no discharge" site in Brown County. The treatment plant does not have a permit to discharge directly into streams; therefore, the treated effluent is used as irrigation water or disposed of in evaporation ponds.

c. Wasteload Projections

This segment is a Category II segment.

(1) Point Sources. The municipal contribution of wasteloads is from three facilities which presently contribute about 80 lbs/day of BOD and TSS. There are no industrial wasteloads discharged into the segment. Due to a projected decrease of population served by one of the facilities, the wasteloads for the year 2000 are projected to decrease slightly. The following gives a summary of the wasteload projections:

Planning Year	BOD (lbs/day)	TSS (lbs/day)
Existing	78	78
1983	89	89
1990	82	82
2000	76	76

d. Wasteload Analysis

Lake Brownwood is classified as an 'Effluent Limiting' segment and has waters desirable for recreation, propagation of fish and wildlife, and domestic raw water supply. The water quality of the lake is required to meet the following standards:

Dissolved Oxygen (not less than)	5.0 mg/l
pH Range	7.0-9.0
Coliform (log. avg. not more than)	200 FECAL/100 ml
Temperature	90°F
Chloride (not more than)	150 mg/l
Sulfate (not more than)	100 mg/l
Total Dissolved Solids (not more than)	500 mg/l

The existing total oxygen demand being contributed to the segment by the three point sources is estimated to be 260 lbs/day. One point source is located on Hord's Creek, approximately 12 miles upstream from the Lake, measured along the tributary, and the other two discharge directly into the Lake. Nonpoint source wasteloads to Lake Brownwood are principally contributed by oil and gas activity, mines, and sanitary landfills. Urban runoff from the City of Coleman is also a possible source of nonpoint source pollution. A review of the water quality assessment presented in Chapter F of the Basic Data Report indicates that no water quality problems have been encountered with the Lake's waters.

The total oxygen demand created by point sources is not projected to increase by the year 2000. Since no water quality violations have been recorded for the existing loads and no increase is projected, no future problems are predicted. No changes in existing treatment levels are recommended to maintain the existing stream standards.

e. Sewerage Planning Area Alternative Plans

No sewerage planning areas have been identified for Segment 1418; thus, no alternative plans have been developed.

16. SEGMENT 1419

a. Summary of Existing Agencies and Water Quality Control Programs.

(1) Introduction. This section summarizes the existing management agencies and water quality programs in the Colorado River Basin Segment 1419. Additional detailed information is provided in Appendix E, Inventory of Existing Agencies and Practices, Appendix F, Financial Management Experience, Appendix G, Intergovernmental Cooperation in the LCRA 208 Planning Area, and Appendix H, Areawide Plans and Programs. This section contains three major topics: description of boundaries, identification of major management agencies, and the definition of water quality control programs in Segment 1419.

(2) Physical Boundaries and Description. Segment 1419 is defined as Lake Coleman. The drainage area of the segment is Jim Ned Creek and other small streams that drain into Lake Coleman. The segment includes large areas of Taylor and Coleman counties and small areas of Runnels and Callahan counties.

(3) Existing Management Agencies. All federal and state agencies, primarily the Environmental Protection Agency and the Texas Department of Water Resources, are involved in stream segment management functions. The segment is within the management jurisdiction of the West Central Texas Council of Governments. The agency has the authority to perform planning functions. Intergovernmental devices allow for contracting for wastewater management functions between or among agencies within or outside the stream segment boundaries. The segment is partially within four counties, Callahan, Coleman, Runnels, and Taylor, and contains two general law cities, Goldsboro and Lawn. Three waste control orders are in existence.

(4) Water Quality Control Programs. Segment 1419 is completely within the planning boundaries of West Central Texas Council of Governments. The segment does not contain any Section 201 facility planning areas or any sewerage planning areas. Water quality in the segment is currently monitored through the TDWR monitoring networks. The segment is not presently within the monitoring networks of the TDH or USGS.

b. Nonpoint Source Assessment

(1) Introduction. This section presents an assessment of the impact of nonpoint source pollutants in the Colorado

River Basin Segment 1419. Additional detailed information is provided in Appendix I, Inventory and Methodology - Nonpoint Source Assessment and Appendix J, Segment Layouts with Nonpoint Source Inventory.

(2) Assessment. Segment 1419 is located in the upper portion of the study area where extensive oil and gas fields are found. Brine production resulting from these operations could be a potential contributor to nonpoint source pollution in the area. There are 13 active fields in the segment and four additional inactive areas. Five secondary recovery projects can be found in the segment; the saltwater injection wells used in these operations pose potential groundwater problems.

Municipal waste disposal sites and septic tank areas are sparse in Segment 1419 with no apparent problems. A fair amount of agricultural activity in the segment yields a relatively high sediment loading. Irrigated cropland is concentrated in Taylor County, while most of the nonirrigated farmland in the segment is found in Coleman County. There is an area in the southwestern portion of Taylor County where treated effluent is used for irrigation.

c. Wasteload Projections

This segment is classified as a Category I segment. There are no point source discharges in this segment. As such no projections of wasteloads were made.

d. Wasteload Analysis

Lake Coleman is classified as 'Effluent Limiting' and has waters deemed desirable for recreation, propagation of fish and wildlife and domestic raw water supply. The standards applicable to the waters of the lake are as follows:

Dissolved Oxygen (not less than)	5.0 mg/l
pH Range	7.0-9.0
Coliform (log. avg. not more than)	200 FECAl/100 ml
Temperature	93°F
Chloride (not more than)	100 mg/l
Sulfate (not more than)	100 mg/l
Total Dissolved Solids (not more than)	500 mg/l

There are no existing point source loads in the segment. Nonpoint source pollution is attributed to brine from oil and gas fields and saltwater intrusion. No existing water quality problems have been identified for this segment by the available water quality monitoring data. No future water quality problems are anticipated.

e. Sewerage Planning Area Alternative Plans

No sewerage planning areas have been identified for Segment 1419; thus, no alternative plans have been developed.

17. SEGMENT 1420

a. Summary of Existing Agencies and Water Quality Control Programs.

(1) Introduction. This section summarizes the existing management agencies and water quality programs in the Colorado River Basin Segment 1420. Additional detailed information is provided in Appendix E, Inventory of Existing Agencies and Practices, Appendix F, Financial Management Experience, Appendix G, Intergovernmental Cooperation in the LCRA 208 Planning Area, and Appendix H, Areawide Plans and Programs. This section contains three major topics: description of boundaries, identification of major management agencies, and the definition of water quality control programs in Segment 1420.

(2) Physical Boundaries and Description. Segment 1420 is described as Pecan Bayou above Lake Brownwood. The segment is fed by the Pecan Bayou drainage area, including Lake Clyde. The major parts of the segment include sections of Callahan and Brown counties primarily, and also small areas in Taylor, Coleman, and Eastland counties.

(3) Existing Management Agencies. All federal and state agencies, primarily the Environmental Protection Agency and the Texas Department of Water Resources, are involved in stream segment management functions. The segment is within the management jurisdiction of the regional agency, West Central Texas Council of Governments. The agency has the authority to perform planning functions. Intergovernmental devices allow for contracting for wastewater management functions between or among agencies within or outside the stream segment boundaries. The segment is partially within five counties, Brown, Callahan, Coleman, Eastland and Taylor, and contains two general law cities, Cross Plains and Clyde. Three waste control orders are in existence.

(4) Water Quality Control Programs. Segment 1420 is completely within the planning boundaries of West Central Texas Council of Governments. The segment does not contain any Section 201 facility planning areas or any sewerage planning areas. Water quality and quantity in the segment are currently monitored through the TDWR and USGS monitoring networks. The segment is not presently within the TDH monitoring networks.

b. Nonpoint Source Assessment

(1) Introduction. This section presents an assessment of the impact of nonpoint source pollutants in the Colorado

River Basin Segment 1420. Additional detailed information is provided in Appendix I, Inventory and Methodology - Nonpoint Source Assessment and Appendix J, Segment Layouts with Nonpoint Source Inventory.

(2) Assessment. Segment 1420 exhibits no existing water quality problems; however, the segment is comprised of a large number of oil and gas fields. There are 27 fields in the area, half of which are active. Oil field brine increases the concentration of dissolved solids in streams. There are five secondary recovery projects in the segment. Injection of saltwater into the subsurface contributes to the possibility of groundwater contamination in terms of increasing dissolved solids. Five municipal sanitary landfills are dispersed throughout the segment, posing potential problems to groundwater supplies. Segment 1420 has a moderate sediment loading related to agricultural/silvicultural activity. Most of the cropland is found in Callahan and Brown counties. In Callahan County there is a "no discharge" site where treated effluent is used as irrigation water.

c. Wasteload Projections. Segment 1420 is classified as a Category II segment.

(1) Point Sources. One municipal facility, owned by an incorporated city, contributes a wasteload to the segment which is projected to increase slightly from approximately 40 lbs/day of BOD and TSS to about 75 lbs/day of BOD and TSS. There is no industrial wasteload contribution. A summary of these projections is as follows:

Planning Year	BOD (lbs/day)	TSS (lbs/day)
Existing	44	44
1983	54	54
1990	63	63
2000	73	73

d. Wasteload Analysis

Pecan Bayou, above Lake Brownwood, is classified as an 'Effluent Limiting' segment. Its water is deemed desirable for recreation and propagation of fish and wildlife. The following standards are set for water quality:

Dissolved Oxygen (not less than)	5.0 mg/l
pH Range	6.5-8.5
Coliform (log. avg. not more than)	200 FECAL/100 ml

Temperature	90°F
Chloride (not more than)	500 mg/l
Sulfate (not more than)	500 mg/l
Total Dissolved Solids (not more than)	1,500 mg/l

The existing total oxygen demand from point source wasteloads is estimated to be approximately 120 lbs/day. The single existing point source discharger is located on Kaiser Creek, a tributary of Pecan Bayou, about 7 miles upstream from its confluence with the Bayou and approximately 30 miles from Lake Brownwood. Nonpoint sources identified as possibly significant are oil and gas fields and municipal disposal sites.

Available monitoring information, as presented in Chapter F of the Basic Data Report, indicates there have not been any water quality problems to date, except for a high average annual fecal coliform concentration during 1974. However, samples collected during subsequent years showed a substantial decrease in the coliform concentration, well within the established standards.

The projected total oxygen demand created by the point source wasteload is estimated to be 200 lbs/day by the year 2000. This projected load, although 65 percent higher than the existing load, is not expected to create any water quality problems for the segment. The relatively small load, coupled with the distance of the discharge from the main segment, contributes to this conclusion. No recommendation is made to change present treatment levels.

e. Sewerage Planning Area Alternative Plans

No sewerage planning areas have been identified for Segment 1420; thus, no alternative plans have been developed.

18. SEGMENT 1501

a. Summary of Existing Agencies and Water Quality Control Programs.

(1) Introduction. This section summarizes the existing management agencies and water quality programs in the Colorado River Basin Segment 1501. Additional detailed information is provided in Appendix E, Inventory of Existing Agencies and Practices, Appendix F, Financial Management Experience, Appendix G, Intergovernmental Cooperation in the LCRA 208 Planning Area, and Appendix H, Areawide Plans and Programs. This section contains three major topics: description of boundaries, identification of major management agencies, and the definition of water quality control programs in Segment 1501.

(2) Physical Boundaries and Description. Segment 1501 is within the Colorado-Lavaca Coastal Basin and is defined as the Tres Palacios Creek tidal region. The segment is within Matagorda County.

(3) Existing Management Agencies. All federal and state agencies, primarily the Environmental Protection Agency and the Texas Department of Water Resources, are involved in stream segment management functions. The segment is within the management jurisdiction of two regional agencies: Houston-Galveston Area Council and Lower Colorado River Authority. Each of these agencies has the specific authority to perform planning and/or management functions. Intergovernmental devices allow for contracting for wastewater management functions between or among agencies within or outside the stream segment boundaries. The segment is within Matagorda County and contains no city, no municipal districts, and no water districts. No waste control orders are in existence.

(4) Water Quality Control Programs. Segment 1501 is completely within the planning boundaries of Houston-Galveston Area Council. The segment does not contain any Section 201 facility planning areas or any sewerage planning areas. Water quality in the segment is currently monitored through the TDWR and USGS monitoring networks. The segment is not presently within the monitoring networks of the TDH.

b. Nonpoint Source Assessment.

(1) Introduction. This section presents an assessment of the impact of nonpoint source pollutants in the Colorado

River Basin Segment 1501. Additional detailed information is provided in Appendix I, Inventory and Methodology - Nonpoint Source Assessment, and Appendix J, Segment Layouts with Nonpoint Source Inventory.

(2) Assessment. Segment 1501, the tidal portion of Tres Palacios Creek, has exhibited no water quality problems other than depressed dissolved oxygen under high flow conditions. There are seven oil and gas fields throughout the segment. Problems associated with oil field brine would be the most immediate concern. During periods of low flow, saltwater intrusion occurs from the Gulf at flood tide. The predominant agricultural activity in the lower portion of Segment 1501 gives use to the potential problem associated with the discharge of toxic substances in rice irrigation return flows. The significance of this problem is presently undefined and will require field studies in the future.

c. Wasteload Projections. Segment 1501 is classified as a Category I segment and there are no point source discharges in this segment. As such, no projections of wasteloads were made.

d. Wasteload Analysis. This segment, the tidal portion of Tres Palacios Creek, is classified as an 'Effluent Limiting' segment. The water uses of this segment are identified as recreation and propagation of fish and wildlife. The water quality of the segment is required to meet the following standards:

Dissolved Oxygen (not less than)	5.0 mg/l
pH Range	7.0-9.0
Coliform (log. avg. not more than)	200 FECAL/100 ml
Temperature	95° F

There are no point source dischargers in the segment. Nonpoint sources identified as possibly significant are oil and gas fields which exist throughout the segment. Available information from Chapter F of the Basic Data Report indicates two DO violations which occurred in 1973 and 1974, the former occurring under high flow conditions. Since there are no point source dischargers, these violations can be attributed to nonpoint sources, although no specific source can be identified with the presently available data. Two vacuum trunk disposal sites were suggested as contributing to the problem by the Matagorda County Health Department and should be

investigated as part of the plan update program. The sites are located about 3 to 5 miles northeast of Palacios between FM Road 2853 and the Tres Palacios River. In addition, water quality monitoring data point to Segment 1502 as another likely cause for DO violations in this segment. The quantative analysis of Segment 1502 for high flow conditions also indicated the possibility of DO violations in Segment 1501 due to nonpoint pollution from 1502. It is recommended that special studies be conducted which would encompass Segment 1501.

e. Sewerage Planning Area Alternative Plans.

No sewerage planning areas have been identified for Segment 1501; thus, no alternative plans have been developed.

19. SEGMENT 1502

a. Summary of Existing Agencies and Water Quality Control Programs.

(1) Introduction. This section summarizes the existing management agencies and water quality programs in the Colorado River Basin Segment 1502. Additional detailed information is provided in Appendix E, Inventory of Existing Agencies and Practices, Appendix F, Financial Management Experience, Appendix G, Intergovernmental Cooperation in the LCRA 208 Planning Area, and Appendix H, Areawide Plans and Programs. This section contains three major topics: description of boundaries, identification of major management agencies, and the definition of water quality control programs in Segment 1502.

(2) Physical Boundaries and Description. Segment 1502 is the portion of Tres Palacios Creek above tidal influence. The segment drainage area starts near El Campo and includes the areas of both Wharton and Matagorda counties drained by the creek.

(3) Existing Management Agencies. All federal and state agencies, primarily the Environmental Protection Agency and the Texas Department of Water Resources, are involved in stream segment management functions. The segment is within the management jurisdiction of two regional agencies: Houston-Galveston Area Council and Lower Colorado River Authority. Each of these agencies has specific authority to perform planning and/or management functions. Intergovernmental devices allow for contracting for wastewater management functions between or among agencies within or outside the stream segment boundaries. The segment is within Matagorda and Wharton counties and contains one general law city, El Campo, one municipal district, and one water district. Four waste control orders are in existence.

(4) Water Quality Control Programs. Segment 1502 is completely within the planning boundaries of Houston-Galveston Area Council. The segment does not contain any Section 201 facility planning areas or any sewerage planning areas. Water quality in the segment is currently monitored through the TDWR monitoring networks. The segment is not presently within the monitoring networks of the TDH or USGS.

b. Nonpoint Source Assessment.

(1) Introduction. This segment presents an assessment of the impact of nonpoint source pollutants in the Colorado River Basin Segment 1502. Additional detailed information is provided in Appendix I, Inventory and Methodology - Nonpoint Source Assessment and Appendix J, Segment Layouts with Nonpoint Source Inventory.

(2) Assessment. Segment 1502, just above tidal influence, has exhibited no water quality problems other than depressed dissolved oxygen under high flow conditions. There are four oil and gas fields throughout the segments. Problems associated with oil field brine would be the most immediate concern. Another possible cause of depressed DO was suggested by the Matagorda County Health Department as being septic tank areas which result in chronic complaints about pollution. One particular location of septic tanks now in use which warrants further study as part of the plan update is the City of Midfield. Another type of problem is saltwater intrusion from Tres Palacios Bay during periods of flood tide and low stream flow in the river.

The predominant agricultural activity in the lower portion of Segment 1502 gives rise to the potential problem associated with the discharge of toxic substances in rice irrigation return flows. The significance of this problem is presently undefined and will require field studies in the future.

c. Wasteload Projections.

Segment 1502 is classified as a Category IV segment. Wasteloads are projected for both point and nonpoint sources.

(1) Point Sources. There are three dischargers generating municipal wasteload and one discharger contributing industrial wasteload to the segment. The total existing load from these point sources is about 210 lbs/day of BOD and 560 lbs/day of TSS. By the year 2000, the BOD wasteload is projected to increase to about 340 lbs/day. During the same period, the TSS value is projected to decrease to about 380 lbs/day, primarily due to increased treatment requirements which become effective in 1983. The following is a summary of these projections:

Planning Year	BOD (lbs/day) Mun.	Indus.	Total	TSS (lbs/day) Mun.	Indus.	Total
Existing	208	-	208	208	346	554
1983	278	-	278	278	23	301
1990	305	-	305	305	25	330
2000	345	-	345	345	33	378

(2) Nonpoint Sources. The predominance of agricultural land in the segment drainage area permits the potential for nonpoint source pollution to be assessed in terms of sediment contributed to the main river segment. The drainage area of Segment 1502 was subdivided into two subcatchment areas on the basis of similarities in topography, land use, and soils. The modified universal soil loss equation was applied to each subcatchment area to arrive at sediment loads generated during the critical season of the year. (The procedures for selecting the cricical season and determining the sediment loads is discussed in Appendix I.) The main river segment, Tres Palacios Creek above tidal, was marked off at specific points of impact where the loads ultimately reach the numbered segment. At these points, average streamflows were also determined for the critical season. The points of impact for the sediment in Palacios Creek is shown in Table II-D-15.

d. Wasteload Analysis.

Tres Palacios Creek above tidal is classified as 'Effluent Limiting' and has waters desirable for recreation and propagation of fish and wildlife. The following standards have been established for the segment:

Dissolved Oxygen (not less than)	5.0 mg/l
pH Range	6.5-8.5
Coliform (log. avg. not more than)	200 FECAL/100 ml
Temperature	90°F
Chloride (not more than)	250 mg/l
Sulfate (not more than)	100 mg/l
Total Dissolved Solids (not more than)	600 mg/l

The existing total oxygen demand created by point sources in the segment is estimated to be 690 lbs/day. This load is contributed by two point sources which discharge directly to the creek and one additional source which dicharges to Wilson Creek about 12 miles upstream from its confluence with Palacios Creek. Significant sources of nonpoint pollution have been identified as brine from existing oil fields.

TABLE II-D-15

SEDIMENT LOADS AT POINTS OF IMPACT
SEGMENT 1502

Point of Impact	River Miles	Average Streamflow (cfs)	Area Drainage (square miles)	Sediment Load (tons /day)
Y[1]	10	230	158	1900
Z[2]	0	420	153	3160

[1] Y - confluence of Juanita Creek and Tres Palacios Creek

[2] Z - confluence of Wilson Creek and Tres Palacios Creek

Existing water quality data for the segment indicate two DO violations during 1973, one of them during an extremely high flow. No other existing water quality problems are identified in this segment.

The total oxygen demand from point sources by the year 2000 is estimated to be approximately 1,000 lbs/day. To evaluate the impact of this projected load, the EPA simplified mathematical model was exercised utilizing the seven-day, two-year low flow. The results of the low flow analysis, shown on Table 4, Appendix M for Segment 1502, indicate no violation of DO in the creek. The calculated minimum DO as a result of the projected loads was 5.7 mg/l. This compares favorably with the established standard of 5.0 mg/l. The tributary in which one point source discharges, Wilson Creek, was also analyzed to determine the impact of the year 2000 load on the tributary. The assimilative capacity of the tributary was sufficient to accept the projected year 2000 wasteload without violation of the standards for tributaries. Therefore, based on this analysis of point sources, no changes in present treatment levels are recommended.

To evaluate the impact of the projected nonpoint source loads, a multiple source analysis utilizing the EPA simplified model for high stream flow conditions was performed. The projected nonpoint source wasteload in terms of total oxygen demand is estimated to be approximately 9,380 lbs/day impacting the segment at Midfield and 17,250 lbs/day impacting at the confluence of Wilson Creek, located approximately one mile upstream from the segment beginning. These loads were analyzed with stream flows of 230 and 420 cubic feet per second (cfs), respectively. Both point and nonpoint loads, as projected for the year 2000, were included in the analysis and the DO deficit was computed. No DO violation is predicted by the model within Segment 1502 based on the total load from Wilson Creek being applied at its confluence with the main stem of the segment. It does, however, indicate the possibility of a DO problem downstream in Segment 1501. It is quite likely that if the extremely large nonpoint load from Wilson Creek was distributed along the length of Wilson Creek, a DO problem might also be predicted in the lower portion of Wilson Creek as well as the last mile of Segment 1502 below the confluence of Wilson Creek. It is therefore recommended that more detailed studies be conducted on the Wilson Creek watershed to better determine the sources and impact of nonpoint source pollution on Wilson Creek and the lower portion of Segment 1502.

e. Sewerage Planning Area Alternative Plans.

No sewerage planning areas have been identified for Segment 1502; thus, no alternative plans have been developed.

20. SEGMENT 2452

a. Summary of Existing Agencies and Water Quality Control Programs.

(1) Introduction. This section summarizes the existing management agencies and water quality programs in the Colorado River Basin Segment 2452. Additional detailed information is provided in Appendix E, Inventory of Existing Agencies and Practices, Appendix F, Financial Management Experience, Appendix G, Intergovernmental Cooperation in the LCRA 208 Planning Area, and Appendix H, Areawide Plans and Programs. This section contains three major topics: description of boundaries, identification of major management agencies, and the definition of water quality control programs in Segment 2452.

(2) Physical Boundaries and Description. Segment 2452 represents Tres Palacios Bay, including Turtle Bay. The segment lies in Matagorda County.

(3) Existing Management Agencies. All federal and state agencies, primarily the Environmental Protection Agency and the Texas Department of Water Resources, are involved in stream segment management functions. The segment is within the management jurisdiction of two regional agencies: Houston-Galveston Area Council and Lower Colorado River Authority. Each of these agencies has specific authority to perform planning and/or management functions. Intergovernmental devices allow for contracting for wastewater management functions between or among agencies within or outside the stream segment boundaries. The segment is completely within Matagorda County and contains one general law city, Palacios. Three waste control orders are in existence.

(4) Water Quality Control Programs. Segment 2452 is completely within the planning boundaries of Houston-Galveston Area Council. This segment does not contain any Section 201 facility planning areas or any sewerage planning areas. Water quality and quantity in the segment are currently monitored through the TDWR and USGS monitoring networks. The segment is not presently within the TDH monitoring networks.

b. Nonpoint Source Assessment.

(1) Introduction. This section presents an assessment of the impact of nonpoint source pollutants in the Colorado River Basin Segment 2452. Additional detailed information

is provided in Appendix I, Inventory and Methodology - Nonpoint Source Assessment and Appendix J, Segment Layouts with Nonpoint Source Inventory.

(2) Assessment. Segment 2452 encompasses Tres Palacios Bay, including Turtle Bay. There are five oil and gas fields in the segment. Waste associated with these operations could give rise to surface water pollution. During low flow conditions salt water intrusion occurs in tributaries from the Gulf at flood tide. The predominant agricultural activity in the lower portion of Segment 2452 gives use to the potential problem associated with the discharge of toxic substances in rice irrigation return flows. The significance of this problem is presently undefined and will require field studies in the future.

c. Wasteload Projections.

This segment is classified as a Category II segment.

(1) Point Sources. Two municipal dischargers contribute waste loads to the segment, but the one industrial WCO is not being utilized at this time. The existing loads are approximately 50 lbs/day of BOD and TSS which are projected to increase to about 90 lbs/day of BOD and TSS. A summary of the projected loads is as follows:

Planning Year	BOD (lbs/day)	TSS (lbs/day)
Existing	48	48
1983	79	79
1990	84	84
2000	92	92

d. Wasteload Analysis.

Tres Palacios Bay is classified as 'Effluent Limiting' and has waters desirable for recreation and propagation of fish and wildlife. Water quality standards for the Bay are established as follows:

Dissolved Oxygen (not less than)	5.0 mg/l
pH Range	7.0-9.0
Coliform (median not more than)	70 Total/100 ml
Temperature	95° F

Two point source dischargers contribute an estimated total oxygen demand to the segment of approximately 160 lbs/day. One is located on a tributary, Cash Creek, 10 miles from the Bay, and the other discharges directly into the Bay. Sources of nonpoint pollution have been identified as wastes from oil fields during high flow. The Bay waters have generally exhibited good water quality in the recent past. The total oxygen demand from point sources is projected to increase to approximately 300 lbs/day by the year 2000. Although increasing somewhat through the planning period, the magnitude of the total load is still small and is not anticipated to create any water quality problems for the segment. No change is proposed for present effluent requirements.

e. Sewerage Planning Area Alternative Plans.

No sewerage planning areas have been identified for Segment 2452; thus, no alternative plans have been developed.