Water and Wastewater Utility Service Providers/MUD Feasibility Analysis

City of Missouri City, Texas

Prepared by:

GT GreenbergTraurig

NewGen Strategies & Solutions

EHT30 1989-2019 Enprotec / Hibbs & Todd

September 4, 2019

Bill Atkinson
Assistant City Manager
City of Missouri City
1522 Texas Parkway
Missouri City, TX 77489

Subject: Water and Wastewater Utility Service Providers/MUD Feasibility Analysis

Dear Mr. Atkinson:

Greenberg Traurig, NewGen Strategies and Solutions, and Enprotec/Hibbs & Todd are pleased to provide the enclosed report on the feasibility of consolidating water and wastewater service providers in the City of Missouri City and its Extra-Territorial Jurisdiction. This report cites previous analyses by the City of Missouri City on this topic and discusses the methodology, analysis, and conclusions of this study.

Please contact us should you have any questions regarding this report or the analysis discussed within.

Sincerely,

Greenberg Traurig

Phillip Gildan Digitally signed by Phillip Gildan Date: 2019.09.04 12:42:22 -05'00'

Phil Gildan
Shareholder

NewGen Strategies and Solutions

David S. Yanke
President – Environmental Practice

Enprotec/Hibbs & Todd

Jordan S. Hibbs, P.E.
Vice President

Table of Contents

Definition of Terms

Executive Summary

Section 1 Introduction 1-1
Authorization 1-1
Study Area Description 1-1
Previous Studies 1-3
Previous Win/Win Projects 1-3
Scope of Study 1-3

Section 2 Engineering 2-1

Section 3 Financial 3-1
Methodology and Key Assumptions 3-2
Net Present Value Analysis 3-4
Key Findings 3-5
City's Debt Capacity 3-8
Bond Rating 3-8
Ad Valorem Bonds vs Revenue Bonds 3-8
Impact of Financial Adviser Conclusions on Feasibility of Consolidation Structure Alternatives 3-10

Section 4 Legal 4-1
Sienna Plantation MUDs 4-2
Fort Bend County #149 4-2
Fort Bend County #129 4-3
Overlapping Non-Utility MUDs Infrastructure Facilities 4-3

Section 5 Implementation Options 5-1
Present to 10 Year Plan Horizon 5-1
Option 1: Maintain the Status Quo 5-1
Option 2: Implement Systematic Dissolution/Annexation Program 5-1
Option 3: Implement a Voluntary Dissolution/Annexation Program 5-4
Option 4: Negotiate a Voluntary Asset Transfer 5-5
Option 5: Create Wholesale Treatment Utility/Utility Service Providers 5-5
Option 6: Public Private Partnership to Facilitate Consolidation 5-6
10 Year to 30 Year Plan Horizon 5-7

Section 6 Next Steps 6-1

List of Appendices

A Map of MUDs in the City of Missouri City and its Extra-Territorial Jurisdiction
B 2011 Regional Water and Wastewater Planning Study by eHT
C Annexation Analysis of Sienna Plantation #2 and #3
D Annexation Analysis of Sienna Plantation #10 and #12
E Annexation Analysis of Fort Bend County #23 and #24
F 2018 Regional Water & Wastewater Planning Study by eHT
G NewGen Report on Scenario 1: MUDs with Annexation Agreements
H NewGen Report on Scenario 2: Harris County MUDs
I NewGen Report on Scenario 3: Inside City MUDs
J Financial Adviser Written Analysis
K List of Persons Providing Written Comments

List of Tables

Table 1-1: Study MUD Service Providers 1-1
Table 3-1: Relevant Components for Each Option 3-4
Table 3-2: Scenario 1 – MUDs with Annexation Agreements 3-5
Table 3-3: Scenario 2 – Harris County MUDs 3-5
Table 3-4: Scenario 3 – Inside City MUDs 3-5
Table 5-1: Current Obligations – Scenario 1 (MUDs with Annexation Agreements) 5-2
Table 5-2: Current Obligations – Scenario 2 (Harris County MUDs) 5-3
Table 5-3: Current Obligations – Scenario 3 (Inside City MUDs) 5-3

DEFINITION OF TERMS

CIP	Capital Improvement Plan
City	City of Missouri City, Texas
DBFO	Design/Build/Finance/Operate (type of procurement)
eHT	Enprotec/Hibbs & Todd
ESPC	Energy Saving Performance Contract
ETJ	Extra-Territorial Jurisdiction
FA	Financial Adviser
GRP	City Joint Groundwater Reduction Plan
GT	Greenberg Traurig, P.A
MGD	Million Gallons Per Day
MUD	Municipal Utility District
NPV	Net Present Value
NewGen	NewGen Strategies & Solutions
O&M	Operations and Maintenance
P3	Public Private Partnership
SP	Sienna Plantation
SPJDA	Sienna Plantation Joint Development Agreement
SPA	Strategic Partnership Agreement
Study	This MUD Feasibility Analysis
TCEQ	Texas Commission on Environmental Quality
WCID	Water Control and Irrigation District
2011 eHT Study	2011 Regional Water and Wastewater Planning Study by eHT
2018 eHT Plan	2018 Regional Water & Wastewater Planning Study by eHT

EXECUTIVE SUMMARY

The Study confirmed that the existing Study area's decentralized utility service structure with multiple water and wastewater utility service providers currently works efficiently and cost-effectively, which validates the City Council's initial plan for growing the City's infrastructure through development supporting its own financial weight without burdening existing residents and businesses with the cost of providing new residents/businesses infrastructure services. The Study also confirmed that much of the existing utility infrastructure has or will be reaching the end of its useful life in the near future, and that significant capital expenditures to renew, replace or expand existing utility infrastructure should be expected in the near and mid-term future, which could lead to potential synergies with respect to potential utility regionalization options. Finally, the City Council's initial plan to eventually consolidate utility services after the costs of infrastructure growth had been fully absorbed, by the new residents and businesses causing that growth, would benefit all the City's residents and businesses.

Together with City staff, the Study team developed and examined various options for the City Council to help determine whether the current Study area status quo could be improved upon for the residents and businesses of the City and the City's ETJ (e.g., financially, operationally, cost of service, level of service, etc.). We list those options below without any order of preference or recommendation, as each option has positive attributes but different implementation timing and costs.

Options

- ***Status Quo.*** Maintaining the status quo would mean eschewing the potential opportunities that consolidation could bring in the form of economies of scale and uniformity of utility rates and charges throughout the City and ETJ for residents and businesses. On the positive side, maintaining the status quo would also allow the MUDs to complete their build-out of utility infrastructure and eventual retirement of debt associated with the development and build-out of the areas served by the MUDs, making an eventual consolidation program in later years more financially feasible.
- ***Implement a systematic MUDs dissolution/annexation program.*** As MUDs' jurisdictional areas build-out, utility infrastructure is completed through such build-out, and utility infrastructure debt is retired, the City could dissolve (for in-City districts) or annex (for ETJ districts) the MUDs into the City and assume ownership and operation of the MUDs water and wastewater infrastructure. Under this option, the City would also implement their existing ETJ annexation agreements with the individual MUDs as their contractual annexation "trigger conditions" occur over time. This option would also require the City to assume responsibility for not only water and wastewater infrastructure and service, but also all other MUD obligations, including any MUD's non-water and non-wastewater infrastructure (e.g., drainage, levees, parks, fire protection, garbage, etc.).
- ***Implement a voluntary dissolution/annexation program.*** The MUDs would continue to provide water and wastewater utility service leaving the determination of timing for dissolution/annexation and transfer of water and wastewater utility service to the MUD Boards. Under this option, the City would continue to engage with the MUDs in regional water and wastewater infrastructure development/operations programs when the opportunities arise. The City would facilitate cooperation and consolidation of utility infrastructure by and among existing MUDs in the natural progression of their MUD life cycles. The City would implement ETJ annexation agreements as their annexation trigger conditions occur over time.

- ***Implement a voluntary utility infrastructure asset transfer program.*** Instead of dissolving or annexing MUDs, the City could initiate a voluntary utility infrastructure asset transfer program, where a MUD could transfer title to its water and wastewater utility infrastructure to the City (either built-out systems or mid build-out systems where the MUD continues implementing utility system infrastructure installation and financing for new development). The MUDs would continue in operation under this program. Under this option, the City would continue having the existing MUD utility operators (e.g., Quail Valley Utility District, Si Environmental, Municipal District Services, Inframark) operate the transferred utility infrastructure during a transition period (e.g., 5 to 10 years). This option does not require the dissolution or annexation of any utility districts, or the termination of existing operations as a condition of transfer of utility assets to the City.
- ***Implement a City-wide "wholesale" treatment/supply facilities utility.*** This option would contemplate each MUD retaining its retail utility customer facilities while transferring water supply and water and wastewater treatment facilities to the City. The MUDs "wholesale" facilities would be added to the existing City "wholesale" facilities (e.g., Steep Bank/Flat Bank, Surface Water Treatment Plant, Mustang Bayou) with the City providing wholesale utility service to each MUD's retained retail utility service. Under this "wholesale" program, the City could consider transferring its existing City "retail" utility systems to an appropriate abutting MUD utility service provider, leaving the City with only the "wholesale" utility service obligation. Under this option, the City would continue having the existing MUD utility operators (e.g., Quail Valley Utility District, Si Environmental, Municipal District Services, Inframark) operate the transferred "wholesale" facilities during a transition period (e.g., 5 to 10 years). This option does not require the dissolution or annexation of any utility districts.
- ***Implement a Public Private Partnership.*** This option would contemplate the City granting a long-term concession to a private operator to operate and finance consolidated utility facilities obtained by the City through any of the consolidation options. This option does not require the dissolution or annexation of any utility district, but does require the City obtain title to the MUDs' utility facilities from the districts for inclusion in the public private partnership concession offering.

Next Steps

1. **Prioritization of Scenarios, MUDs, etc. to be Considered for Consolidation Purposes.** Based on the Study, the City staff and City Council (with input from the Study team as needed) should evaluate and prioritize those opportunities where a consolidation of MUD(s) with the City water and wastewater utility system may potentially make operational, engineering and financial sense. These decisions should be made in a manner that are consistent with the goals of the City concerning long-term planning for residential and commercial buildout within the City and its ETJ.

2. **Preliminary Discussions with MUDs Identified in Step 1.** Based on any Scenarios and/or MUDs identified in Step 1 above, the City should schedule a series of meetings with any MUDs identified as potential candidates for consolidation to discuss whether there is an interest on the part of the MUDs to consider a consolidation, or under what set of conditions such a consolidation might make sense for both parties to consider such an endeavor.

3. **Develop a Detailed Financial Plan for any Opportunities Identified in Steps 1 and 2.** The analysis completed as part of this Study was conducted at a high-level and relied, in many cases, upon financial data that was available via public information, and the Study team may not have had access to the most detailed, accurate, or recent data that is relevant to the current status of each of the 30 MUDs evaluated as part of this Study. Therefore, if based on Steps 1 and 2 there are

certain MUD consolidation options that appear to create a "win-win" for both entities (City and the MUD), the Study team would strongly encourage that a more in-depth financial analysis be conducted to evaluate the following key assumptions to ensure that all information is as accurate and current as practical:

- Revenues Assumptions (all revenue streams)
- Operating Expenses (including any savings)
- Capital Expenditures (both by MUD and City)
- Capital Financing
- Growth and Buildout Assumptions
- Timing
- Other, as appropriate

It is a necessity that there would be a detailed timeline of key project deliverables, as well as numerous financial, operational and capital related meetings and planning sessions, to ensure that such a consolidation opportunity is successful for all parties.

4. **Develop a Long-Term Plan for Continued Monitoring of Consolidation Opportunities.** Regardless of whether any opportunities are identified in Steps 1 through 3 that would identify any potential MUD consolidation options, the Study team would strongly encourage a long-term plan be put in place to continue to monitor consolidation opportunities on an annual or biennial basis. This plan would put in place a methodology and check-list that would allow the City to identify when certain criteria have been achieved that may make a MUD consolidation scenario feasible (e.g. MUD debt is paid off, or de minimis; certain buildout percentages are achieved; etc.).

Section 1
INTRODUCTION

Authorization

On December 2, 2017, the City of Missouri City ("City") City Council authorized Greenberg Traurig, NewGen Strategies and Solutions, and Enprotec/Hibbs & Todd ("Study team", "we" or "us") to undertake a Feasibility Analysis regarding the consolidation of water and wastewater utility service providers for the City of Missouri City ("City") and the City's Extra-Territorial Jurisdiction ("ETJ") areas (the "Study").

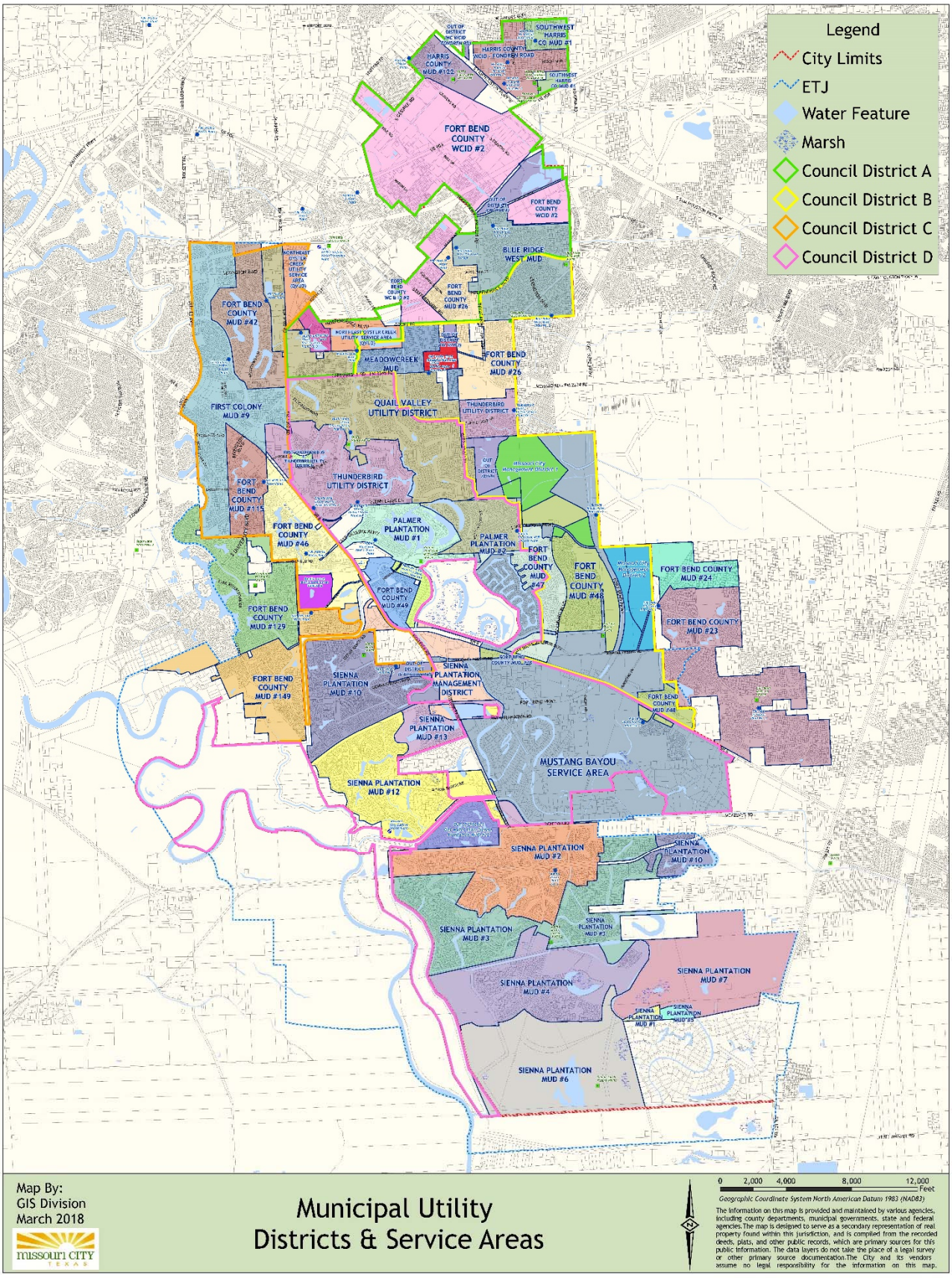
Study Area Description

The Study area encompasses thirty-one (31) water and wastewater utility service providers within the municipal boundaries of the City and the City's ETJ, including the City's water and wastewater utility. A list of the Municipal Utility District ("MUD") water and wastewater utility service providers in the Study area is shown in Table 1-1. Three water and wastewater utility service providers in or abutting the Study area were not considered in the Study. Two service providers, Fort Bend County #23 and Fort Bend County #24, are not included in the Study as they both lie within the City of Houston's ETJ, which is outside the jurisdictional control of the City. A third service provider, Fort Bend County Water Control and Improvement District #2, is not included in the Study because its utility service area encompasses multiple governmental jurisdictions precluding consolidation feasibility. Of the MUD service providers within the Study area, thirteen (13) provide utility service within the City's ETJ and seventeen (17) provide utility service within the City's municipal boundaries.

Table 1-1: Study MUD Service Providers

Blue Ridge West	Palmer Plantation #2
First Colony #9	Quail Valley Utility District
Fort Bend County #26	Sienna Plantation #1
Fort Bend County #42	Sienna Plantation #2
Fort Bend County #46	Sienna Plantation #3
Fort Bend County #47	Sienna Plantation #4
Fort Bend County #48	Sienna Plantation #5
Fort Bend County #49	Sienna Plantation #6
Fort Bend County #115	Sienna Plantation #7
Fort Bend County #129	Sienna Plantation #10
Fort Bend County #149	Sienna Plantation #12
Harris County #122	Sienna Plantation #13
Harris County Fondren Road	Sienna Plantation Management District
Meadowcreek	Southwest Harris County #1
Palmer Plantation #1	Thunderbird Utility District

The location of each MUD service provider can be found on the map below. A larger version of this map is included in Appendix A.


Legend
City Limits
ETJ
Water Feature
Marsh
Council District A
Council District B
Council District C
Council District D
FORT BEND COUNTY WCID #2
BLUE RIDGE WEST MUD
FORT BEND COUNTY MUD #42
MEADOWCREEK MUD
FORT BEND COUNTY MUD #26
FIRST COLONY MUD #9
QUAIL VALLEY UTILITY DISTRICT
THUNDERBIRD UTILITY DISTRICT
FORT BEND COUNTY MUD #115
FORT BEND COUNTY MUD #46
PALMER PLANTATION MUD #1
PALMER PLANTATION MUD #2
FORT BEND COUNTY MUD #47
FORT BEND COUNTY MUD #48
FORT BEND COUNTY MUD #24
FORT BEND COUNTY MUD #23
FORT BEND COUNTY MUD #129
FORT BEND COUNTY MUD #49
SIENNA PLANTATION MUD #10
SIENNA PLANTATION MANAGEMENT DISTRICT
SIENNA PLANTATION MUD #13
SIENNA PLANTATION MUD #12
MUSTANG BAYOU SERVICE AREA
SIENNA PLANTATION MUD #2
SIENNA PLANTATION MUD #3
SIENNA PLANTATION MUD #4
SIENNA PLANTATION MUD #7
SIENNA PLANTATION MUD #1
SIENNA PLANTATION MUD #6
Map By:
GIS Division
March 2018
missouri CITY TEXAS
Municipal Utility Districts & Service Areas
0 2,000 4,000 8,000 12,000 Feet
Geographic Coordinate System North American Datum 1983 (NAD83)
The information on this map is provided and maintained by various agencies, including county departments, municipal governments, state and federal agencies. The map is designed to serve as a secondary representation of real property found within this jurisdiction, and is compiled from the recorded deeds, plats, and other public records, which are primary sources for this public information. The data layers do not take the place of a legal survey or other primary source documentation. The City and its vendors assume no legal responsibility for the information on this map.

Previous Studies

The City has undertaken a number of prior studies on consolidating and regionalizing water and wastewater utility infrastructure. These include:

- The 2011 Regional Water & Wastewater Planning Study ("2011 eHT Study") by Enprotec/Hibbs & Todd ("eHT"), which is attached as Appendix B;
- The March 10, 2015, Feasibility Analysis, Annexation of Sienna Plantation Municipal Utility Districts 2 and 3, which is attached as Appendix C;
- The March 31, 2015 Feasibility Analysis Annexation of Sienna Plantation Municipal Utility Districts 10 and 12, which is attached as Appendix D; and
- The April 20, 2015 Feasibility Analysis of Fort Bend County Municipal Utility Districts 23 and 24, which is attached as Appendix E.

Previous Win/Win Projects

The City has had considerable success in recent years working with MUDs to create joint regional utility infrastructure projects at the treatment plant/wholesale utility service level. These include:

- Surface Water Treatment Plant and Ground Water Reduction Plan
  - 35 public well owners
  - Full compliance with Fort Bend Subsidence District requirements
  - Initially 10 MGD, expanding to 20 MGD
  - Lowest pumpage fee in the region ($1.72/1,000 gallons)
- Steepbank/Flatbank Wastewater Treatment Plant
  - Currently 7 participants
  - 3 MGD facility, expanding to approx. 4.5 MGD
- Mustang Bayou Utility Service Area
  - Currently 3 participants, expanding to 5 (adding MMD #1 and MMD #2)
  - .95 MGD facilities, expanding to 1.5 MGD

These successful collaborative projects demonstrate one potentially effective option that will be discussed in the Study.

Scope of Study

The scope of the Study was to determine whether the current Study area structure of multiple municipal utility districts providing water and wastewater utility service within their segmented jurisdictional boundaries could be improved upon for the residents and businesses of the City and the City's ETJ (e.g., financially, operationally, cost of service, level of service, etc.). The Study team was tasked with identifying options and structures for potential enhancement of water and wastewater utility service delivery City/ETJ wide to improve efficiency. Finally, the Study team was tasked with identifying optimal timing for implementation of the various feasibility options (e.g., short term – zero (0) to ten (10) years; long term – ten (10) years and longer).

As part of the Study, eHT issued a 2018 Regional Water and Wastewater Planning Study ("2018 eHT Plan"), updating the 2011 eHT Study. The 2018 eHT Plan report is included in Appendix F. eHT identified regionalized water and wastewater infrastructure consolidation options, identifying technical feasibility, capital improvement cost estimates, and life-cycle operating and capital costs for each option. NewGen Strategies and Solutions ("NewGen") then undertook a financial review of each MUD's outstanding financial obligations and annual operating statements, applied the regionalization/consolidation and technical/financial projections in the eHT Study, and provided financial scenarios for the various consolidation feasibility options identified by the Study team.

The City coordinated a number of meetings with the Study area utility service providers. The City also created a Utility Operators' Committee (Operators' Committee) and held meetings with the Operators' Committee to exchange information, solicit proposed Study structure options, and receive technical feedback on infrastructure and operational issues. The City also formed a Study Area Utility Service Providers Attorneys' Committee (Attorneys' Committee) and held a meeting with the Attorneys' Committee to exchange information, solicit proposed Study structure options, and receive feedback on the legal feasibility of proposed options. City staff and the Study team held numerous work sessions and strategic planning meetings to review historical practices, current operations, and projected future water and wastewater utility needs for the Study area. Finally, City staff and the Study team provided a draft of the Study to the MUDs, held a work session with the MUDs to review the draft and obtain feedback. In addition to verbal comments at the work session, the City was pleased to receive written comments from the individuals listed in Appendix K. The Study team appreciated these comments and reviewed them carefully. Comments were addressed in the Study, as needed, and are reflected in the final report, as appropriate.

Section 2
ENGINEERING

At the request of the City and its joint Groundwater Reduction Plan ("GRP") participants, eHT prepared two regionalization study reports for the City – the 2011 eHT Study and the 2018 eHT Plan. The objectives of these reports were to address the following:

- Establish existing conditions for water and wastewater facilities of the approximately 30 entities in the Study area;
- Identify specific water and wastewater consolidation projects and their associated costs and implementation schedule;
- Prepare an environmental assessment of the recommended consolidation projects; and
- Analyze regional opportunities and the potential funding mechanisms.

In coordination with the City and MUDs, eHT received and evaluated statistics related to the City's population, water and wastewater connections and demands, and existing water and wastewater infrastructure to help develop recommendations to address the items summarized above. The 2011 eHT Study established the core background for the regionalization opportunities across the City, as well as the environmental impact, cost implications, and funding options associated with the regionalization efforts. The purpose of the 2018 eHT Plan was to consider changes in the underlying statistics that occurred between 2011 and 2018. Correspondingly, the 2018 eHT Plan utilized many of the data analysis methods developed in the 2011 eHT Study to highlight changes to the water and wastewater landscape since 2011. Based on the analysis, wastewater regionalization opportunities became the emphasis of the 2018 eHT Plan, including an updated cost analysis and conceptual implementation strategy.

Section 3
FINANCIAL

MUD Financials

NewGen developed the financial feasibility analyses related to the Study, which included evaluating several regionalization scenarios as developed in consultation with City staff regarding the potential consolidation of several MUDs located in and/or near the City with the City's existing water/wastewater utility systems. In establishing the scenarios for NewGen to analyze, City staff identified geographically, technically, and developmentally related MUDs to be considered as natural groupings for consolidation. The three main scenarios, and sub-scenarios, are as follows:

Scenario 1: MUDs with Annexation Agreements

- **Scenario 1.1: Riverstone MUDs**
  - Fort Bend County #129
  - Fort Bend County #149
- **Scenario 1.2: Sienna Plantation #1 MUDs**[1]
  - Sienna Plantation #1
  - Sienna Plantation #2
  - Sienna Plantation #3
  - Sienna Plantation #10
  - Sienna Plantation #12
  - Sienna Plantation #13
  - Sienna Plantation Management District
- **Scenario 1.3: Sienna Plantation #5 MUDs**[2]
  - Sienna Plantation #4
  - Sienna Plantation #5
  - Sienna Plantation #6
  - Sienna Plantation #7

Scenario 2: Harris County MUDs

- Harris County #122
- Harris County WC&ID - Fondren Road
- Southwest Harris County #1

Scenario 3: Inside City MUDs

- **Scenario 3.1: Inside City MUDs with No Property Tax Revenue**
  - Quail Valley Utility District
  - Thunderbird Utility District

[1] Sienna Planation #1 controls the MUDs in Scenario 1.2
[2] Sienna Plantation #5 controls the MUDs in Scenario 1.3

- **Scenario 3.2: Other Inside City MUDs[3]**
  - Palmer Plantation #1
  - Palmer Plantation #2
  - Blue Ridge West
  - First Colony #9
  - Fort Bend County #26
  - Fort Bend County #42
  - Fort Bend County #46
  - Fort Bend County #47
  - Fort Bend County #48
  - Fort Bend County #49
  - Fort Bend County #115
  - Meadowcreek

A comprehensive report for each of the three scenarios is attached as Appendices G, H, and I.

Methodology and Key Assumptions

As part of the Study, NewGen evaluated the forecasted customer growth, revenue, capital costs, debt service, and operations and maintenance ("O&M") costs over a 30-year period (FY 2020 – FY 2049) to evaluate the financial impact that a consolidation may have on the City. The customer growth was forecasted from the 2018 eHT Plan, which was validated by City staff. Further, upon acquisition, the City would assume the continuing future obligation to maintain, upgrade, expand and replace the water/wastewater utility system infrastructure acquired, as conveyed in a Capital Improvement Plan ("CIP"). It is assumed that the depreciation (a non-cash item) included within the cash flow forecast would sufficiently fund any necessary capital renewals and replacements.

The relevant water CIP projects were taken from Table 4-20 of the 2011 eHT Study. Since the CIP project costs in the 2011 eHT Study were not in current dollars, NewGen increased the costs taken from the 2011 eHT Study by either approximately 3.6%[4] per year for interconnection projects or approximately 1.3%[5] per year for elevated storage tank projects. While the 2011 eHT Study lists 15 different water interconnection and storage projects, for this analysis NewGen focused on the projects directly related to the MUDs in the analysis. In this case, NewGen identified several relevant water projects and allocated the costs to the relevant participants based on build out connection counts and then inflated the costs to 2019 dollars.

For wastewater CIP projects, per input from eHT and City staff, the most cost-effective means of providing wastewater service to the area would be to consolidate down to two master regional wastewater treatment plants as seen in Option 5 in Table 5-1 in the 2018 eHT Plan. Since the costs for this project cannot be pinpointed to each individual MUD, the costs were allocated based on the total build out size of each participant, as found in the 2018 eHT Study.

[3] Although Missouri City Management District #1 and Missouri City Management District #2 were originally identified to be included in Scenario 3, these two MUDs were excluded from the Study because they have no current customers and did not have any forecasted customers. Further, they have negligible operating expenses (primarily legal, accounting, or other contractual services) that are primarily offset by advances or loans. Thus, their inclusion was not meaningful to the Study.

[4] Based on the annualized change in the Handy Whitman Index cost for water mains (NARUC 331) within the South Central region of the country between January 2011 and January 2018

[5] Based on the annualized change in the Handy Whitman Index cost for elevated steel tanks (NARUC 330) within the South Central region of the country between January 2011 and January 2018

As directed by City staff, NewGen developed its scenario analysis based on two potential consolidation implementation structures – 1) annexation or dissolution of each MUD, title acquisition by the City of each MUD's assets (including both water/wastewater assets and all other assets of the MUD), and assumption by the City of all of the MUD's liabilities and obligations (including MUD debt and all operating expense obligations); and 2) voluntary negotiated transfer by each MUD of its water/wastewater utility assets to the City (with each MUD continuing in existence), and no assumption by the City of MUD liabilities and obligations (except continuing utility intergovernmental agreements).

MUD Annexation or Dissolution Option

In the MUD annexation or dissolution option, the MUD would cease to exist as a governmental entity. By law, upon annexation or dissolution of the MUDs, the City would obtain title to all of the MUDs' assets and assume all the MUDs' expenses, debts and other obligations. The City would not assume the MUDs' ability to levy a MUD property tax to fund the expenses, debts and other assumed obligations, and would have to identify other funding sources within the City to pay such assumed obligations. Since most MUDs are using property tax revenue to pay water/wastewater utility debt, and to supplement utility rate revenues to pay operating expenses, the loss of MUD property tax revenue support has a very negative effect on the financial feasibility of this option. Under this option, the former MUD water/wastewater customers would face a lower overall tax burden as the MUD property tax expired, but the City would have to either substantially raise the former MUD customers' water/wastewater utility rates, or allocate general City tax revenues to subsidize the cost of water/wastewater utility service to the former MUD customers (and if general revenues were not sufficient, the City would have to raise additional general tax revenues City-wide to support such assumed cost burden). In addition, the existing debt of each MUD would have to be paid off by the City via a new debt issuance by the City, with the City funding the debt service either through increased water/wastewater utility rates or City general fund revenues. The City could not assume the MUDs' existing debt as the debt is secured by MUD property taxes, which the City would have no recourse to. Finally, under this option, the City would have to assume the provision of all other governmental services being provided by the MUDs in addition to water/wastewater services, again without recourse to the MUDs property tax levees currently funding operation of those services.

Asset Acquisition Option

In the asset acquisition option, the MUDs would voluntarily divest themselves of their utility system assets without remuneration from the City, but would continue to exist as governmental entities to provide and fund utility infrastructure for those MUDs still in the development phase, to fund repayment of existing MUDs debt, and to continue to provide non-utility services (e.g., parks, roads, etc.). In this option, MUDs with outstanding development debt would continue to service that debt, and would continue to levy and collect at current levels the MUD property taxes necessary to fund the MUDs' administrative costs, remaining non-utility operating expenses, and existing and future utility debt service, which would not be assumed by the City. The analysis assumes that the City would initially continue the existing MUD utility rates in place, with annual adjustments to address inflated costs, but would not raise rates to fund the acquisition. The analysis also assumes that the MUDs will continue to collect for water/wastewater operating expenses imbedded in the MUDs property tax levy and transfer those funds to the City for the same purpose (i.e., to defray the water/wastewater operating expenses assumed by the City from the MUDs). For purposes of the financial analyses, we have assumed that the amount the MUD collects from property taxes in excess of its administrative costs, non-utility operating expenses, and debt service is equal to the portion of water/wastewater utility operating expenses currently used in addition to revenues from utility rates to fund its water/wastewater utility service (i.e., the subsidy). This available

property tax portion for funding water/wastewater utility operating costs would be transferred annually to the City to pay the water/wastewater operating costs not covered by rate revenues (mirroring the existing funding mechanism of the MUDs so that existing MUDs utility customers would see no utility financial change as a result of the acquisition). Note MUDs property tax transfers would **not** be used to offset or subsidize existing City water/wastewater system operating expenses, which would continue to be funded by the City utilities existing rates.[6]

Table 3-1 summarizes several of the key differences between an asset acquisition and an annexation or dissolution of the MUDs.

Table 3-1: Relevant Components for Each Option

Asset Acquisition	Annexation/Dissolution
Revenues • Water Service • Property Tax Support [1, 2] • Wastewater Service • Tap Connection & Inspection Fees • Participant Billings • Surface Water Fees	Revenues • Water Service • No Property Taxes • Wastewater Service • Garbage Service (if any) • Other Revenues • Tap Connection & Inspection Fees • Participant Billings • Surface Water Fees • Other Tax
Operating Expenses • Treated the same, except excludes "Other" operating expenses, which remain with the MUD	Operating Expenses • Treated the same, except includes "Other" operating expenses
Debt Service • Debt Service for new capital projects	Debt Service • Debt Service for new capital projects • Plus MUD Debt defeasance costs • Plus MUD developer reimbursement obligations

1. MUD Property Tax Revenue + Revenues for services retained by the MUD – MUD Debt Service – Expenses for services retained by the MUD = Portion of Tax Revenue Assigned to the City
2. Amount City receives in 2020 is constant throughout the 30-year forecast.

Net Present Value Analysis

NewGen developed a net present value ("NPV") analysis that calculates the payback, if any, from each option over a 30-year period based on the net income after debt service and operating expenses. The NPV analysis takes into account the relative timing of CIP and O&M expenditures and the impact they have on cash flow. If the NPV is negative, it indicates the existing water/wastewater utility revenues (even

[6] Alternatively, for the purposes of this analysis, the assumption could equally be that the City would be able to increase utility revenues equal to the subsidy in the first year of the forecast. However, factoring in political considerations we believe that option is less likely.

with customer growth and adjustments to rates for inflation) are not sufficient to keep the City from having to financially support the MUDs water/wastewater expenses from utility rate increases and/or general City revenues. In calculating the NPV analysis, NewGen utilized a 5% discount rate.

Tables 3-2, 3-3, and 3-4 summarize the NPV by scenario.

Table 3-2: Scenario 1 – MUDs with Annexation Agreements

Option	NPV	
Scenario 1.1 – Riverstone MUDs		
Asset Acquisition	($10,396,835)	unfavorable
Annexation	($71,398,108)	unfavorable
Scenario 1.2 – Sienna Plantation #1 MUDs		
Asset Acquisition	$6,178,851	favorable
Annexation	($269,621,643)	unfavorable
Scenario 1.3 – Sienna Plantation #5 MUDs		
Asset Acquisition [1]	$0	favorable
Annexation	($93,942,989)	unfavorable

1. Reflects unique assumptions regarding developer support and capital funding, without which the NPV would be negative $31.7 million

Table 3-3: Scenario 2 – Harris County MUDs

Option	NPV	
Asset Acquisition	$ 3,942,434	favorable
Dissolution	($12,393,853)	unfavorable

Table 3-4: Scenario 3 – Inside City MUDs

Option	NPV	
Scenario 3.1 – Inside City MUDs with No Property Tax Revenue		
Asset Acquisition	($16,058,088)	unfavorable
Dissolution	($8,018,183)	unfavorable [1]
Scenario 3.2 – Other Inside City MUDs		
Asset Acquisition	$11,779,472	favorable
Dissolution	($169,120,624)	unfavorable

1. Relatively close to breakeven

Key Findings

Based on our financial analysis, we make the following findings as part of the Study for consideration by the City.

Scenario 1 – MUDs with Annexation Agreements

1. The most feasible option from all three sub-scenarios in Scenario 1 (MUDs with Annexation Agreements) would be an Asset Acquisition from Sienna Plantation #1 and its participating subservient MUDs (Scenario 1.2). This is the only scenario/option in Scenario 1 that has a positive NPV without unique assumptions related to developer support or capital funding. The main concern with an asset acquisition is the necessity of negotiating a voluntary acquisition transaction with the MUDs' Boards in accordance with the transaction assumptions/parameters identified.

   One contributing factor to this outcome is that Participant Billings (i.e., revenues reported by Sienna Plantation #1 based on payments by the participant MUDs) were greater than the total of payments to Sienna Plantation #1 (aka, Connection Charges) reported by the participant MUDs in Scenario 1.2 in the most recent financial reports available to NewGen. If this happens to be atypical, or the result of a timing difference in reporting, then the results of this analysis may be misleading.

   In Scenario 1.3, Sienna Plantation #5 reported Participant Billings that were somewhat similar in magnitude to what was reported by Sienna Plantation #4 as payments to the master MUD.[7] However, Sienna Plantation #5 reported $735,247 in payments to a master MUD that were presumably paid to Sienna Plantation #1. This could be the source of (or a contributing factor to) the incremental Participant Billings reported by Sienna Plantation #1 in Scenario 1.2. The nature and magnitude of Participant Billings and Connection Charges should be more carefully studied and confirmed before the City makes any final decisions with regard to these results.

   It is also worth noting that the existing Sienna Plantation #2 debt is due to be paid in full in 2026 and NewGen received indications that Sienna Plantation #2 and Sienna Plantation #3 may be done issuing new debt.

2. An Asset Acquisition from Sienna Plantation #5 and its participating subservient MUDs (Scenario 1.3) could be financially feasible IF the unique assumptions regarding developer support and capital funding can be agreed to with the MUDs. Specifically, Sienna Plantation MUD #5 has an agreement with the developer (Toll-GTIS Property Owner) to make contributions to fund any operating shortfalls. This developer advance will be repaid in the future from cash or new debt issues. The MUDs in this scenario are only just beginning to be built out and, therefore, their revenues are understated as compared to what they should be in the future. Thus, the developer advances formulaically eliminate any operating shortfalls in this scenario.

3. All other options in Scenario 1 do not represent a viable financial transaction as they would require substantial increases in utility rates and/or general fund subsidies due to the negative NPV.

4. The requirement to repay all of the MUD's existing debt and developer reimbursement obligations, and the inability to supplement utility rate revenues via MUDs continuing property tax revenues, means that the City would require significant utility rate increases and/or subsidies from the City's general funds under any annexation scenarios (likely regardless of the timing).

5. The City should reexamine the analysis when the Annexation Agreement trigger date allowing annexation of each MUD approaches to evaluate the outstanding debt and developer

[7] Sienna Plantation MUD #6 and Sienna Plantation MUD #7 did not report any payments to a master MUD in the most recent financials available to NewGen

reimbursement obligations the MUD has at that time. If these obligations have been reduced at that time, it may alter the results of the financial analysis.

Scenario 2 – Harris County MUDs

1. An asset acquisition from the Harris County MUDs represents a viable financial transaction that is forecasted to avoid increases in utility rates or general fund subsidy. The NPV of this option is positive, meaning there is not forecasted to be a financial impact on the current MUDs water/wastewater customers or subsidy cost to the City of pursuing this option for this scenario. The main concern with an asset acquisition is the necessity of negotiating a voluntary acquisition transaction with the MUDs' Boards in accordance with the transaction assumptions/parameters identified. Absent the revenue sharing parameters between the MUDs and the City, which underlie this analysis, this option would be negatively impacted and the NPV would be approximately negative $7.3 million.
2. A dissolution of the Harris County MUDs does not represent a viable financial transaction as it would require increases in utility rates or general fund subsidies due to the negative NPV. The requirement to repay all of the MUDs' existing debt, and the inability to supplement utility rate revenues via MUDs' continuing property tax revenues, means that the City would require significant utility rate increases and/or subsidies from the City's general funds under the assumptions utilized.

Scenario 3 – Inside City MUDs

1. Although an asset acquisition for Scenario 3.1 has a negative NPV, this is due, in part, to programmatic operating under-recovery strategies by Quail Valley and Thunderbird and current rates not yet reflecting funding of anticipated CIP programs identified by these MUDs, which NewGen assumes will require rate increases in the coming years. Annual revenue increases (or expense reductions) of approximately $1.0 million per year would yield a breakeven NPV.
2. The dissolution option for Scenario 3.1 has a negative NPV, but is relatively close to breakeven on an NPV basis due, in part, to the absence of outstanding debt or developer reimbursement obligations. Quail Valley and Thunderbird had combined current assets net of liabilities of approximately $6.4 million on their balance sheets in 2017, so the current assets may substantially offset the negative NPV (if the balances are still similar to what they were in 2017, and these balances when transferred to the City in a dissolution would be available to fund the projected CIP costs for the MUDs).

   It is important to point out that the NPVs for the two options for Scenario 3.1 flip-flop depending on the assumptions made with respect to reserves and rate increases for future CIP program costs, such that either option could potentially be feasible depending on direct discussions with the MUDs to understand their anticipated future rate adjustments. There may, however, be a supplemental benefit to the City from the asset transfer option over the dissolution option in that the MUDs stay in existence and can continue to provide operational support for the City and the consolidated utility systems, which would not be available in a dissolution option.
3. An asset acquisition for Scenario 3.2 represents a viable financial transaction that is forecasted to avoid general fund support. The NPV of Scenario 3.2 is positive, meaning there is not forecasted to be a financial impact on the current MUDs water/wastewater customer or subsidy cost to the City of pursuing this option for this scenario. The main concern with an asset acquisition is the necessity of negotiating a voluntary acquisition transaction with the MUDs' Boards in accordance with the transaction assumptions/parameters identified above. Absent the revenue sharing

parameters between the MUDs and the City, which underlie this analysis, this option would be negatively impacted and the NPV would be approximately negative $112.9 million.

4. A dissolution of the Scenario 3.2 MUDs does not represent a viable financial transaction as it would require meaningful increases in utility rates or general fund subsidies due to the negative NPV. The requirement to repay all of the MUDs' existing debt and developer reimbursement obligations, and the inability to supplement utility rate revenues via MUDs' continuing property tax revenues, means that the City would require significant utility rate increases and/or subsidies from the City's general funds under the assumptions utilized.

City Financials

The City's financial condition also has a bearing on the analysis. As part of the Study, we solicited input from the City's Financial Adviser, Hilltop Securities, as to the ability of the City to absorb the MUDs' utility related debt and other obligations of the various utility service providers as part of a consolidation of the utility service providers utility systems into the City utility system. In particular we inquired as to the City's debt capacity to issue new debt to fund MUD consolidation transactions, and the effect of such transaction financing on the City's Bond Rating. The answer to these financial questions would be critical to the City Council's deliberations as to the advisability of moving forward with MUDs dissolution/annexation alternatives. Our team held an information gathering meeting with the Financial Adviser and the City's Director of Finance, after which the Financial Adviser provided its written analysis ("FA Analysis"). A copy of the FA Analysis is attached to this Study Report as Appendix J.

City's Debt Capacity

The Financial Adviser made the following determination regarding the City's capacity to issue new debt to finance a consolidation:

> There is not capacity to take on the additional [Municipal Utility District] debt and do the general-purpose Capital Improvement Plan of the City.

Bond Rating

The Financial Adviser made the following determination regarding the impact on the City's Credit Rating if it were to issue new debt to finance a consolidation:

> Moody's Investor Service lists increasing the net debt burden due to additional issuance absent tax base growth or a reduction in the support from the surface water utility as a factor that could lead to a downgrade [of the City's Credit Rating].

Ad Valorem Bonds vs Revenue Bonds

As noted above, the Financial Adviser determined the City does not have capacity to assume the current ad valorem debt of the MUDs. Under the MUD statutory authority, Title 4. General Law Districts, Chapter 54. Municipal Water Districts, Subchapter A. General Provisions, Section 54.501. Issuance of Bonds, a MUD can issue ad valorem debt to finance (and re-finance) water and wastewater utility infrastructure and levy ad valorem taxes on the properties within the MUD to support that utility financing. The MUDs may also

include water and wastewater utility operating expenses within the MUDs ad valorem tax levees. As noted previously, numerous MUDs in the Study have included some or all of their water and wastewater utility operating expenses in their general fund budgets to be collected through ad valorem taxes, leaving only a small portion of such expenses to be recovered through utility rates.

The City, however, does not have legal authority to continue to exercise a MUD's statutory tax levy authority over property within the MUD after dissolution or annexation of the MUD into the City. That means the City cannot continue levying the MUD tax to pay MUD debt service and operating obligations, but would instead, only be able to resort to general City-wide ad valorem taxes or user fees. In order to assume MUD obligations and refund MUD debt, the City would have to find surplus revenues in its existing ad valorem tax revenues or, if none was available, the City would have to raise the ad valorem taxes on all City residents and businesses to support new debt financing to assume the debt obligations of an annexed or dissolved MUD and to cover assumed MUD operating expenses.

Since the City cannot continue to exercise a MUD's statutory tax levy authority over property within the MUD, this also means that upon an annexation or dissolution of a MUD, the City could also not assume a MUD's outstanding ad valorem tax debt, as the MUD ad valorem taxes are pledged for payment of such MUD bonds (and those taxes disappear with the MUD). Instead, the City would have to issue new City debt financing to refund or defease the existing MUD ad valorem debt, and cannot continue to levy the existing MUD specific ad valorem tax to support that new City debt. The City's only options would be issuance of City-wide ad valorem tax supported bonds (with tax increases as discussed above), or issue non-tax revenue supported debt obligations where the City would have to derive a different alternative revenue source to pay the debt service on replacement bonds.

As the Financial Adviser identified that the City could not issue MUD property owner specific ad valorem tax bonds as a tool to consolidate a MUD's utility infrastructure into the City, the Financial Adviser next discussed the impact of utilizing an alternative non-ad valorem debt financing repayment source for acquiring a MUD's utility infrastructure in a consolidation (i.e., traditional municipal revenue bond financing supported by water and wastewater utility service rates, fees and charges):

> Most cities that have essential service utility systems treat them as a business. Therefore, the system is not supported from the levy of taxes but rather from user fees…Because the user fees currently being charged [by MUDs] are supplemented with ad valorem taxes, it is reasonable to assume a large rate increase in user fees would be required to cash flow the operations and debt of the system. This may not be an option the City would consider but it would allow the City to continue with its own capital improvement plan.

If the City were to consider the Financial Adviser's non-ad valorem tax based debt financing alternative supported by water and wastewater utility rates, fees and charges, the City has more structuring flexibility than with ad valorem taxation based debt financing. Unlike with ad valorem tax levees which must be City-wide at a uniform undifferentiated tax rate, the City could theoretically establish differential utility rates for different MUD utility systems to support assumption of the MUD's differential debt and other obligations. Such differential rate making would have to be justified under traditional utility rate making principles based on identifiable and demonstrable distinctions between customers from one MUD system as against other MUD systems (and the City's own existing utility customers). If differential rates could be justified, then the City could issue separate municipal revenue bonds specific to a particular MUD's utility customers net revenue available for debt service, and accordingly keep the financial impact of a

consolidation of a particular MUD isolated to the MUD's utility customers, rather than supported by the tax revenues from all of the City's residents and businesses.

However, as cautioned by the Financial Adviser, the increased utility rate impact on the MUD utility customers arising from such a municipal revenue bond financing plan could place a significant additional burden on the residents and businesses within the MUD. Theoretically, such an increase in utility rates should be offset to a degree by a proportional removal of the MUDs ad valorem tax levy on those same utility customers upon the City refund or defeasance of the MUD's outstanding utility related ad valorem debt. However, as noted by the Financial Adviser, a MUD utility customer might not view such an ad valorem tax offset as financially equivalent to a utility rate increase. It should be noted that there will likely be utility customers whose overall cost burden decreases and others whose overall cost burden increases as a result of such changes, which may raise equity concerns.

Impact of Financial Adviser Conclusions on Feasibility of Consolidation Structure Alternatives

The conclusions of the Financial Adviser regarding the limited City debt capacity and potential bond rating downgrade would suggest that annexations or dissolution of MUDs with significant outstanding debt service may not be financially feasible until that outstanding debt is retired or reaches a de minimis level. The financial analyses by NewGen discussed above supports the conclusions of the Financial Adviser. At this time NewGen has identified six MUDs with no debt as of the date of review (Quail Valley UD, Thunderbird UD, Meadowcreek, Palmer Plantation #1, Sienna Plantation #6, and Sienna Plantation #7) and one MUD with de minimis debt (Fort Bend County #49).

Section 4
LEGAL

In-City MUDs

The City operates under a home rule charter adopted pursuant to provisions of the Texas Constitution and Chapter 9 of the Texas Local Government Code.

There are several distinct types of MUDs that operate within the corporate boundaries of the City. Some of those MUDs existed before the City was incorporated and some of the districts were created after the City incorporated. No matter when the MUD was created, state law provides that the City has the authority to abolish the MUD if the City determines that:

1. The MUD is no longer needed or the services furnished and functions performed by the MUD can be furnished and performed by the City; and
2. the abolition of the MUD is in the best interest of the residents and property of the City and MUD.[8]

These provisions grant the City the ability to make a general determination on what provision of utility service is in the best interest of the residents of the City. However, the law also provides that if the City receives a petition requesting a vote on whether the MUD should be abolished, the City must call an election on the issue and allow the residents of the City to vote to decide whether the MUD should be abolished.[9] The petition requesting an election must be received before the effective date of the ordinance adopted by the City Council that abolished the MUD; or the petition requesting an election must be received within 30 days after the effective date of the ordinance or publication of the ordinance.

After receiving the petition, the City Council must reconsider the ordinance that abolished the MUD. If the council does not repeal the ordinance, it must schedule an election for the residents to vote on the issue of whether the MUD should be abolished. The election must be held on the next municipal election or at a regular election called by the council. The ordinance abolishing the MUD must receive a majority vote in the election to be effective.

ETJ MUDs

The City has also entered into several Strategic Partnership Agreements ("SPA") with MUDs in the City's ETJ.[10] These voluntary development agreements are entered in lieu of annexation and specifically set out the terms and conditions of when and how the City will annex and abolish those MUDs. The legislature created a detailed legislative scheme for cities and MUDs to follow when entering into these types of agreements. As a result, these MUDs are not subject to any citizen voting requirements on whether the MUDs can be annexed and abolished.

Further, if there are other MUDs in the City's ETJ that have not entered into a SPA with the City, those MUDs and their residents will be governed by state annexation laws. Texas annexation laws were completely revised in 2017 to provide that for most annexations the residents or landowners of the area to be annexed will be required to vote in favor of annexation before the area can be annexed into a city.[11]

[8] Tex. Local Government Code, Section 43.074

[9] Note-Tex. Local Government Code, Section 43.074 **only** applies to WCIDs, Fresh Water Supply Districts, MUDs

[10] Tex. Local Government Code, Section 43.0751

[11] See, Tex. Local Government Code, Section 43.0205 through 43.0699

If an area contains a MUD and the residents or landowners in the areas refuse to vote in favor of annexation the MUD could not be brought into the City and therefore could not be abolished by the City. SPAs do not negate the statutory annexation vote provisions. Before 2017, the general rule was that the City had the unilateral right to bring the residents and landowners into the City and abolish the MUD.

Note that the discussion above addresses the abolishment and/or annexation of MUDs into the City. That discussion would not be applicable if the City elected a consolidation option where a MUD voluntarily transferred its utility assets to the City without the City abolishing or annexing the MUD. The City Charter, Section 2.01. General Powers, specifically empowers the City to acquire property inside and outside the City's boundaries, and to cooperate with any other governmental entity to accomplish such lawful purposes.

Sienna Plantation MUDs

The City entered into the Sienna Plantation Joint Development Agreement on February 18, 1996, with the developer of Sienna Plantation ("SP") to address the Sienna Plantation Master Plan, Land Use and Infrastructure requirements (the "SPJDA"). In Section IV of the SPJDA, the parties agreed on a plan for the ultimate annexation of the SP development into the City. That contractual plan, which remains in effect, governs the City's options with respect to annexations of the SP MUDs (aka Sienna MUDs), and limits the availability of options for consideration by the City in this Study. In particular, Section 4.02 of the SPJDA provides:

> The City … will not annex or attempt to annex, in whole or in part, a Sienna MUD until the following conditions have been met:
>
> 1) At least 90% of the developable acreage within the Sienna MUD has been developed with water, wastewater treatment, and drainage facilities. Developable acreage means the total acreage in Sienna less acreage associated with land uses 43, 44, 61, 62, 63, 64, and 65 in the Parcelization Plan attached hereto as Exhibit D-13; and
> 2) The landowner developing within the Sienna MUD has been reimbursed by the Sienna MUD to the maximum extent permitted by the rules of the TNRCC [now called the Texas Commission on Environmental Quality or TCEQ] or the City assumes any obligation for reimbursement of the Sienna MUD under such rules.

The SP MUDs utility service structure comprises a master infrastructure MUD (SP #1), which provides wholesale utility service to SP #2, #3, #4, #5, #10, #12, and the SP Management District with various utility infrastructure (temporary and permanent) located throughout the other SP MUDs. At the current time, two SP MUDs (SP #2 and SP #3) have reached Annexation criteria 1. Representatives of the developer and SP have estimated that the remaining SP MUDs will begin meeting the Annexation criteria in 2020 (SP #12) with the remaining MUDs reaching build-out incrementally starting in 2025 (SP #10), 2040 (SP #12) and beyond 2040 (SP #1, #4, #5, #6, and #7). See Table 2-1 of the 2018 eHT Plan.

Fort Bend County #149

The City entered into a SPA with Fort Bend County #149 and the Riverstone community developer. This agreement governs the City's relationship with respect to annexations, and limits the availability of options for consideration by the City in this Study. In particular, Section 3.01 provides:

> The City … will not annex or attempt to annex…the District until the following conditions have been met:
>
> 1) At least 90% of the developable acreage within the District has been developed with water, wastewater treatment, and drainage facilities….
> 2) The Developer developing within the District has been reimbursed by the District to the maximum extent permitted by the rules of the TCEQ or the City assumes any obligation for such reimbursement of the District under the rules.

At the current time, Fort Bend County #149 has not met either annexation criteria. Estimates by representatives of the developer and the MUD have estimated that the MUD is not anticipated to meet both annexation criteria until approximately 2021 or 2022. See Table 2-1 of the 2018 eHT Plan.

Fort Bend County #129

The City entered into a SPA with Fort Bend County #129 and the Riverstone community developer. This Agreement governs the City's relationship with respect to annexations, and limits the availability of options for consideration by the City in this Study. In particular, Section 3.01 provides:

> The City … will not annex or attempt to annex…the District until the following conditions have been met:
>
> 1) At least 90% of the developable acreage within the District has been developed with water, wastewater treatment, and drainage facilities….
> 2) The Landowner developing within the District has been reimbursed by the District to the maximum extent permitted by the rules of the TCEQ or the City assumes any obligation for such reimbursement of the District under such rules.

At the current time, eHT does not forecast any additional connections in Fort Bend County #129. Further, representatives of the developer and the MUD indicate the developers have all been reimbursed. Thus, Fort Bend County #129 appears to meet the annexation criteria. See Table 2-1 of the 2018 eHT Plan.

Overlapping Non-Utility MUDs Infrastructure Facilities

In this Study, the Study team was charged to analyze consolidation of the MUDs water and wastewater facilities and service with the City's water and wastewater facilities. However, most of the MUDs in the Study provide additional infrastructure services and maintain non-utility infrastructure, including drainage facilities and, in some instances, levees and water detention/drainage facilities. As noted previously, the MUDs annexation statutes and SPAs do not provide a mechanism for only annexing or consolidating the water and wastewater infrastructure while leaving the drainage/levees infrastructure in place under MUD operations. Accordingly, any MUDs water and wastewater consolidation options that contemplate formal annexation of the MUDs into the City must also include consideration of consolidation of these additional infrastructure facilities and obligations.

Section 5
IMPLEMENTATION OPTIONS

Present to 10 Year Plan Horizon

Update City Code Regarding MUD Life Cycle/Consolidation Planning

As part of the Study we reviewed the existing City Code to determine what guidelines the City currently has in place to facilitate and administer MUD consolidation as a component part of the natural MUD life cycle absent a consolidation plan. We did not find any such Code provisions and believe that developing consolidation planning and administrative guidelines would be beneficial for the City regardless of what consolidation plan the City Council may determine to implement. An example of such guidelines could be:

1) Preferably, all MUD debt should be fully paid. At a minimum, the City's annual costs of paying the MUD's bond debt and recurring operation and maintenance expenses after dissolution should be no greater than the amount of revenues the City gains through the ad valorem value of property within the MUD and user fees for infrastructure services to be provided by the City.
2) The MUD has fully reimbursed the developer for the developer's cost of installing MUD infrastructure as permitted by Texas law and regulations. At a minimum, the MUD should have already issued debt to fully pay such developer's cost and have cash reserves for such payment that would be transferred to the City upon dissolution of the MUD.
3) The MUD is not delinquent in the payment of any other financial obligation that is due prior to the date of dissolution.
4) The MUD did not finance and does not own or operate any drainage detention facilities that the City did not specifically approve as a public drainage facility that would become part of the City's public drainage system upon the MUD's dissolution.

Option 1: Maintain the Status Quo

The first option the Study team analyzed was to maintain the status quo during this Study Plan Horizon. The data collected revealed that the current decentralized individual MUDs utility operations work efficiently and maintain utility service related customer charges that are satisfactory. Maintaining the status quo would mean eschewing the potential opportunities that consolidation could bring in the form of economies of scale and uniformity of utility rates and charges throughout the City and ETJ for residents and businesses. On the positive side, maintaining the status quo would also allow the MUDs to complete their build-out of utility infrastructure and eventual retirement of debt associated with the development and build-out of the areas served by the MUDs, making an eventual consolidation program in later years more financially feasible.

Option 2: Implement Systematic Dissolution/Annexation Program

The second option the Study team analyzed was to begin implementation of a systematic MUD dissolution/annexation program. As MUDs jurisdictional areas build-out, utility infrastructure is completed through such build-out, and utility infrastructure debt is retired, the City could dissolve (for in-

City districts) or annex (for ETJ districts) the MUDs into the City and assume ownership and operation of the MUDs water and wastewater infrastructure. Under this option, the City would also implement ETJ annexation agreements as their annexation trigger conditions occur over time. This option would also require the City to assume not only water and wastewater infrastructure and service, but also all other MUD obligations, including any MUDs's non-water and non-wastewater infrastructure (e.g., drainage, levees, parks, etc.).

There are currently a few MUDs that have built-out their utility infrastructure, and have no (or minimal) current utility infrastructure debt which would meet the criteria for dissolution/annexation at this time (Quail Valley UD, Thunderbird UD, Meadowcreek, Palmer Plantation #1, and Fort Bend County #49).

The other MUDs retire their current infrastructure debt (other than de minimis amounts) on the timetable identified in Tables 5-1, 5-2, and 5-3. These tables reflect current values, which may not reflect obligations incurred subsequent to the date of financial statement review. The debt amounts outstanding are subject to change for those MUDs not yet built-out, like many of the SP MUDs, that are likely to issue additional debt in the future through build-out of their utility infrastructure, and for those MUDs financing renewal/replacement capital projects. The debt maturities are also subject to change over time to the extent that MUDs refinance or re-structure their existing debt with longer maturities.

Table 5-1: Current Obligations – Scenario 1 (MUDs with Annexation Agreements)

Scenario	MUD	Debt Maturity Year	Principal Outstanding [1, 2]	Total Remaining Debt Service Payments [1, 3]	Current Developer Reimbursement Obligations [1, 4]
1.1	Fort Bend County #129	2035	$ 19,065,000	$ 25,605,157	$ 824,070
1.1	Fort Bend County #149	2041	25,145,000	36,068,280	-
1.2	Sienna Plantation #1 (master)	2049	25,010,000	34,622,418	497,982
1.2	Sienna Plantation #2	2026	14,335,000	16,403,300	-
1.2	Sienna Plantation #3	2032	31,890,000	41,724,860	-
1.2	Sienna Plantation #10	2040	56,985,000	80,377,351	1,936,170
1.2	Sienna Plantation #12	2041	55,030,000	78,424,481	14,861,749
1.2	Sienna Plantation #13 [5]				
1.2	Sienna Plantation Management District	2042	31,280,000	45,551,572	11,410,210
1.3	Sienna Plantation #4	2043	27,800,000	40,150,280	17,860,294
1.3	Sienna Plantation #5 (master)	2043	9,645,000	14,225,449	21,034,992
1.3	Sienna Plantation #6		-	-	-
1.3	Sienna Plantation #7		-	-	-
			$296,185,000	$413,153,148	$ 68,425,467

Notes:
1) As of the most recent financial statement available for NewGen's review
2) Sum of all future principal payments from 2020 until maturity
3) Sum of all future principal and interest payments from 2020 until maturity
4) Does not include committed developer reimbursement obligations that are not yet reflected on the MUDs' balance sheets (because the projects are not yet complete)
5) Financials for "the Woods" are consolidated and reported with the financials for Sienna Plantation #1

Table 5-2: Current Obligations – Scenario 2 (Harris County MUDs)

Scenario	MUD	Debt Maturity Year	Principal Outstanding [1, 2]	Total Remaining Debt Service Payments [1, 3]	Current Developer Reimbursement Obligations [1, 4]
2	Harris County Fondren Road	2030	$ 2,255,000	$ 2,619,711	$ -
2	Southwest Harris County #1	2027	1,450,000	1,729,841	-
2	Harris County #122	2031	1,220,000	1,534,535	-
			$ 4,925,000	$ 5,884,087	$ -

Notes:
1) As of the most recent financial statement available for NewGen's review
2) Sum of all future principal payments from 2020 until maturity
3) Sum of all future principal and interest payments from 2020 until maturity
4) Does not include committed developer reimbursement obligations that are not yet reflected on the MUDs' balance sheets (because the projects are not yet complete)

Table 5-3: Current Obligations – Scenario 3 (Inside City MUDs)

Scenario	MUD	Debt Maturity Year	Principal Outstanding [1, 2]	Total Remaining Debt Service Payments [1, 3]	Current Developer Reimbursement Obligations [1, 4]
3.1	Quail Valley Utility District		$ -	$ -	$ -
3.1	Thunderbird Utility District		-	-	-
3.2	Meadowcreek		-	-	-
3.2	Palmer Plantation #1		-	-	-
3.2	Palmer Plantation #2	2026	4,525,000	5,233,775	-
3.2	Fort Bend County #26	2029	8,800,000	9,877,256	1,096,156
3.2	Fort Bend County #42	2026	6,155,000	6,859,300	-
3.2	Fort Bend County #46	2027	9,790,000	10,525,262	3,051,002
3.2	Fort Bend County #47	2034	5,390,000	6,940,003	4,179,370
3.2	Fort Bend County #48	2038	15,010,000	19,024,256	7,083,109
3.2	Fort Bend County #49	2030	470,000	626,529	-
3.2	Fort Bend County #115	2028	8,740,000	10,141,167	-
3.2	First Colony #9	2035	6,645,000	7,637,088	-
3.2	Blue Ridge West	2041	2,250,000	3,230,587	-
			$ 67,775,000	$ 80,095,223	$ 15,409,637

Notes:
1) As of the most recent financial statement available for NewGen's review
2) Sum of all future principal payments from 2020 until maturity
3) Sum of all future principal and interest payments from 2020 until maturity
4) Does not include committed developer reimbursement obligations that are not yet reflected on the MUDs' balance sheets (because the projects are not yet complete)

A key factor for a successful implementation of this option will be transition planning. Each of the MUDs currently operate their utilities (and other infrastructure) through seasoned internal operations employees (e.g., Quail Valley UD) or through experienced contract operations with third party providers (e.g., Si Environmental, Municipal District Services, Inframark). In contrast, the City has a small utility

management/operations staff, and as a result has elected to contract with Quail Valley UD's experienced utilities team to operate a number of the City's existing utility facilities. Accordingly, any acquisition will necessarily require an initial interim operations transition of a minimum of three to five years, where the City would contract to have the current MUDs' utilities operators continue operations of the dissolved/annexed utilities acquired by the City on a status quo basis. During the interim period, the City could consider the economic and technical feasibility of the City developing its own robust fully-staffed internal utility operations group, versus continuing with contract operations past the interim period.

Such interim period contract operations would have the benefit of assuring continuity of level of service for the MUD residents and businesses. It would also have the added benefit of assisting the City in normalizing utility cost recovery methodologies among and between utility systems (a small number of MUDs use only utility rates to meet utility expenses, while the majority of MUDs use ad valorem taxes or a combination of ad valorem taxes and utility rates to meet utility expenses).

Option 3: Implement a Voluntary Dissolution/Annexation Program

A third option the Study team analyzed was a variation on the second option. In this option, each MUD Board would determine the optimal time to dissolve their districts or annex their districts into the City, and to transition to City ownership and control of the utility systems. For ETJ MUDs with annexation agreements with the City, the transitions would occur over time as set forth under the terms of the annexation agreements. The same transition planning as under Option 2 would be implemented. Under this option the City would continue to engage with the MUDs in regional water and wastewater infrastructure development/operations programs when the opportunity arises. The City would continue to facilitate cooperation and consolidation of utility infrastructure by and among existing MUDs in the natural progression of their MUD life cycles.

Under this option, the MUD Boards would continue to provide utility service, continue to build-out their utility infrastructure, and continue to finance development growth and expansion as anticipated in their original charters throughout build-out of the MUDs jurisdictional territories while implementing planned capital improvements programs. As noted above, each MUD Board would determine if and when the MUD had outlived its statutory usefulness to its residents/constituents, and at the end of the MUD's life cycle, the MUD could petition the City to annex/dissolve/consolidate the MUDs infrastructure and services into the City.

Under this option, the City would not mandate any MUD annexation or dissolution, but would set up a transition planning program to be prepared to accept voluntary annexations or dissolutions of MUDs upon the MUD Board's determination. From City sponsored meetings with MUD representatives in the course of this Study, the consensus of those MUDs present at the meeting was to support this option. Some general comments from the MUD representatives echoed the same refrain that the current system works well for the residents/constituents of the MUDs, provides quality service, and fairly allocates the costs among the residents/constituents receiving the services without subsidizing other residents/constituents or putting any additional financial burdens on the City General Fund. This option, however, would tend not to optimize the regionalization program identified by eHT, with the benefits of regionalization deferred or more slowly implemented.

Option 4: Negotiate a Voluntary Asset Transfer

A forth option the Study team reviewed is the possibility of MUDs voluntarily transferring their water and wastewater utility assets to be consolidated by the City in furtherance of the eHT regionalization program. The MUDs would not be dissolved or annexed, but would continue in operation, and the City would continue having the existing MUD utility operators (e.g., Quail Valley Utility District, Si Environmental, Municipal District Services, Inframark) operate the transferred utility infrastructure during a transition period (e.g., 5 to 10 years), while the City determined whether to create a fully-staffed City utility or continue with privatized operations. The MUDs would continue to service outstanding water/wastewater debt, would continue to levy and collect at current levels the MUD property taxes to fund the MUDs' administrative costs, remaining non-utility operating expenses, and existing and future utility debt service, which would not be assumed by the City, and would continue providing the MUD residents the non-utility services currently being provided. As with Option 3, the MUD Boards would determine the optimal timing of any eventual voluntary annexation/dissolution process. The analysis assumes that the City would initially continue the existing MUD utility rates in place, with annual adjustments to address inflated costs, but would not raise rates to fund the acquisition. The analysis also assumes that the MUD will continue to collect the water/wastewater operating expenses imbedded in the MUDs property tax levy and transfer those funds to the City for the same purpose.

Option 5: Create Wholesale Treatment Utility/Utility Service Providers

A fifth option the Study team reviewed is the implementation of a City-wide "wholesale" treatment/supply facilities utility. This option would contemplate each MUD retaining its retail utility customer facilities (e.g., water distribution and wastewater collection systems), and customer relationships while transferring water supply, water and wastewater treatment and storage facilities, and major transmission/force main systems to the City. The MUDs' "wholesale" facilities would be added to the existing City "wholesale" facilities (e.g., Steep Bank/Flat Bank, Surface Water Treatment Plant, Mustang Bayou), with the City providing wholesale utility service to each MUD's retained retail utility service. The MUDs would fund the operating, maintenance, capital program, and renewal and replacement costs of the City's "wholesale" facilities through MUD ad valorem taxes, retail utility charges, or a combination of both, which would be paid to the City, as currently done for the existing City "wholesale" facilities. This option would allow implementation of the eHT regional consolidated capital improvement plan, and benefit from the economies of scale identified by eHT. Under this option, MUD Boards would remain active and would not necessitate dissolution or annexation of any MUDs, though MUD Boards could voluntarily elect to dissolve or be annexed on their own timeline pursuant to the Option 3 protocol.

Under this "wholesale" program, the City could consider transferring its existing City "retail" utility systems to an appropriate abutting MUD utility service provider, leaving the City with only the "wholesale" utility service obligation. Under this option, the City would continue having the existing MUD utility operators (e.g., Quail Valley Utility District, Si Environmental, Municipal District Services, Inframark) operate the transferred "wholesale" facilities under the direction of the City (like it currently does with Quail Valley Utility District).

Option 6: Public Private Partnership to Facilitate Consolidation

A sixth option the Study team reviewed would implement a Public Private Partnership ("P3") to facilitate a consolidation of utility infrastructure and the provision of utility service. This option would contemplate the City granting a long-term concession to a private operator to operate and finance consolidated utility facilities obtained by the City through any of the other consolidation options. This option does not require the dissolution or annexation of any MUD, but does require the City obtain title to the MUDs' utility facilities from the MUDs for inclusion in the public private partnership concession offering.

The City Council charged us to review opportunities for use of a P3 as a mechanism for facilitating consolidation of the MUDs utility systems for the City. A P3 is a contractual mechanism in which a private sector participant partners with a governmental entity to jointly accomplish a public infrastructure project. A P3 is not technically a legal partnership in the sense that two or more parties join as co-owners of a business and share in the businesses profits and losses, but generally is a contractual arrangement where a private enterprise with expertise in public infrastructure design, development, operations and/or finance undertakes a project for a governmental entity in lieu of the governmental entity utilizing a traditional project procurement method (e.g., design, bid, build, finance, operate). P3s, in appropriate circumstances, can provide a mechanism to accomplish a public project that otherwise could not be implemented as a result of technical, structural, risk or financial limitations of the governmental entity.

As noted previously, the City's Financial Adviser advised that the City has financial limitations that would negatively impact the City's ability to assume the debts and obligations of the MUDs in a consolidation. As noted in the 2018 eHT Plan, implementation of the consolidation in conjunction with regionalizing the water treatment and wastewater treatment facilities would yield operational savings and would yield capital savings over anticipated capital costs of non-consolidated operations.

Those two factors suggest that a P3 could be potentially advantageous as a component part of a MUDs' consolidation. However, a private participant in a P3 could not likely implement a consolidation without the participation of the City, because only the City could exercise the governmental rights to trigger a consolidation of MUDs' water and wastewater utility infrastructure and customers, or negotiate a voluntary transfer of infrastructure from the MUDs to the City. Given that, a potential P3 could likely only be practical in conjunction with, and subsequent to, the City triggering a consolidation in accordance with one of the potential options identified above. The P3 options discussed below make the assumption that the City would first acquire the consolidated MUDs' water and wastewater utility infrastructure and customers as the first step in a P3 transaction implementation.

Energy Savings Performance Contract

An energy savings performance contract ("ESPC") is a P3 that utilizes operational energy savings resulting from constructing upgrades and improvements to existing infrastructure and technologies (in this instance the regionalization projects identified by eHT). Those energy savings (and other indirect attendant operational savings) can be used as revenues to support private financing of the regionalization projects. The Texas Local Government Code, Title 9, Subtitle C, Chapter 302, provides a mechanism for local governments to implement ESPCs. Whether an ESPC would be effective in the City's MUDs consolidation would be identified through an ESPC procurement process as outlined in Chapter 302.

Design/Build/Finance/Operate

A design/build/finance/operate ("DBFO") form of P3 could be an advantageous option for consideration by the City to implement the MUDs consolidation and simultaneously implement the regionalization of utility infrastructure proposed by eHT as the most cost advantageous alternative for the MUDs utility

customers and the City. As the DBFO sounds, this form of P3 would entail a privately owned entity or team of entities that would contract with the City in a single agreement to design the regionalization infrastructure, provide private project financing to pay the cost of building the infrastructure, provide the private construction contractor to build the infrastructure, and then provide the private utility operator to operate the new regionalized utility system (and potentially operate the consolidated system acquired from the MUDs during construction of the regionalized utility system).

If proposals were deemed feasible, technically and financially, then the City could award a DBFO contract (sometimes also referred to as a "concession") to the proposer that presented the best value to the City. Note that a component part of the DBFO process would be the requirement that a stable and predictable revenue stream be identified to support the financial objectives of the selected DBFO vendor (project finance debt service, operations and maintenance costs, renewal and replacement costs, and return on equity). This predicable revenue stream could be in the way of guaranteed levels of utility rates, fees, and charges, or limited ad valorem backed subsidies or "shadow rates" payable from the City's General Fund.

Note also that typically the City would have a lower cost of capital than would a private P3 participant. Tax-exempt debt issued by the City would likely be 150 to 300 basis points (100 basis points equals 1%) lower than taxable debt issued by the P3 participant. Likewise, the P3 participant would be looking for a reasonable return on the equity portion of its investment, typically 8% to 12% on utility transactions. The P3 participant would generally also be subject to sales taxes on all construction materials/equipment and operations/maintenance supplies/chemicals, which the City would generally not be subject to. Blending the P3 participant's higher taxable debt cost and required return on equity could yield a blended cost of capital of up to 400 to 500 basis points higher than the City's cost of capital. This means that a P3 participant would have to be able to realize a significantly lower cost of design, construction and operations than the City could otherwise realize to overcome the higher cost of capital and taxes. Whether that could be accomplished would be revealed during the P3 procurement process.

For instance, Mr. Yanke of NewGen was involved in a P3 analysis for the City of Fort Worth several years ago. He assisted in the drafting of the procurement document requesting private water companies to submit proposals to takeover operation and control of the City of Fort Worth's water and wastewater utility. He then managed the evaluation of the proposals that were received from the private vendors. During the conduct of the analysis it was determined the privatization of the Fort Worth water and wastewater utility would require the defeasance of over $700 million in debt that was currently on the utility's balance sheet, with the debt replaced with bonds that were 150 to 250 basis points (or more) greater in cost. Based on the analysis of the bids from the private vendors, when compared to the City of Fort Worth's cost of operating the utility, it did not make financial sense for the City of Fort Worth to move forward with considering privatization of the water and wastewater system. It should also be noted that none of the private vendors challenged the analysis as completed by Mr. Yanke.

10 Year to 30 Year Plan Horizon

Assuming that the City Council determined not to exercise any of the global MUD options identified in the 10 Year Plan Horizon, then for the options for the 10 to 30 Year Plan Horizon remain the same, with the exception that some of the outstanding MUDs' debt will have matured (see Tables 5-1, 5-2, and 5-3 for the current debt maturity dates for each MUD with outstanding debt), at various times in the next planning horizon.

Maintain Status Quo

The City Council can continue to maintain the status quo as previously discussed.

Enter into Strategic Partnership Agreements with MUDs to Effectuate Consolidation of Maturing District to Core City Utility System

As noted previously, a large number of MUDs' currently outstanding debt is scheduled to come due in the 10 to 30 year plan horizon, and build-out of the MUDs development is also anticipated to occur. Under this option, the City could enter into current negotiations with each of the MUDs to develop strategic partnerships to effectuate the consolidation of the maturing MUDs to the core City utility system, as (and when) development is complete and development debt is fully retired or reduced to a manageable amount that could be absorbed by the City without materially negatively impacting then existing City residents and utility customers.

Execute Existing ETJ Annexation Agreement as They Mature

As noted previously, the City entered into a number of ETJ annexation agreements, which have contractual triggers as to when the City can annex the ETJ MUDs into the City. Most of these ETJ annexation agreements are expected to mature in the 10 to 30 year plan horizon. Under this scenario, as ETJ annexation agreement triggers occur, the City would undertake the financial analysis of impacts on the City from such annexations and determine an appropriate timeframe for effecting the annexations. Depending on the amount of then outstanding MUD debt for the community represented by the ETJ, the timing of such annexation may be immediately financially feasible, or may require deferral until all or most of the outstanding debt is retired.

Section 6
NEXT STEPS

This Study has provided the City with a comprehensive analysis of a variety of options that are available to the City with regard to how the City may wish to approach any potential consolidation discussions with some of the MUDs, whether located within the City or for those within the City's ETJ. Based on our analysis and experience the Study team would provide the City with the following next steps for consideration:

1. **Prioritization of Scenarios, MUDs, etc. to be Considered for Consolidation Purposes.** Based on the Study, the City staff and City Council (with input from the Study team as needed) should evaluate and prioritize those opportunities where a consolidation of MUD(s) with the City water and wastewater utility system may potentially make operational, engineering and financial sense. These decisions should be made in a manner that are consistent with the goals of the City concerning long-term planning for residential and commercial buildout within the City and its ETJ.

2. **Preliminary Discussions with MUDs Identified in Step 1.** Based on any Scenarios and/or MUDs identified in Step 1 above, the City should schedule a series of meetings with any MUDs identified as potential candidates for consolidation to discuss whether there is an interest on the part of the MUDs to consider a consolidation, or under what set of conditions such a consolidation might make sense for both parties to consider such an endeavor.

3. **Develop a Detailed Financial Plan for any Opportunities Identified in Steps 1 and 2.** The analysis completed as part of this Study was conducted at a high-level and relied, in many cases, upon financial data that was available via public information, and the Study team may not have had access to the most detailed, accurate, or recent data that is relevant to the current status of each of the 30 MUDs evaluated as part of this Study. Therefore, if based on Steps 1 and 2 there are certain MUD consolidation options that appear to create a "win-win" for both entities (City and the MUD), the Study team would strongly encourage that a more in-depth financial analysis be conducted to evaluate the following key assumptions to ensure that all information is as accurate and current as practical:

    - Revenues Assumptions (all revenue streams)
    - Operating Expenses (including any savings)
    - Capital Expenditures (both by MUD and City)
    - Capital Financing
    - Growth and Buildout Assumptions
    - Timing
    - Other, as appropriate

    It is a necessity that there would be a detailed timeline of key project deliverables, as well as numerous financial, operational and capital related meetings and planning sessions, to ensure that such a consolidation opportunity is successful for all parties.

4. **Develop a Long-Term Plan for Continued Monitoring of Consolidation Opportunities.** Regardless of whether any opportunities are identified in Steps 1 through 3 that would identify any potential MUD consolidation options, the Study team would strongly

encourage a long-term plan be put in place to continue to monitor consolidation opportunities on an annual or biennial basis. This plan would put in place a methodology and check-list that would allow the City to identify when certain criteria have been achieved that may make a MUD consolidation scenario feasible (e.g. MUD debt is paid off, or de minimis; certain buildout percentages are achieved; etc.).

Appendix A
Map of MUDs in the City of Missouri City and its Extra-Territorial Jurisdiction

Municipal Utility Districts & Service Areas

Legend

- City Limits
- ETJ
- Water Feature
- Marsh
- Council District A
- Council District B
- Council District C
- Council District D

HARRIS COUNTY MUD #122
OUT OF DISTRICT (HC WCID FONDREN RD)
SOUTHWEST HARRIS CO MUD #1
HARRIS COUNTY WCID - FONDREN ROAD
FORT BEND COUNTY WCID #2
OUT OF DISTRICT (FBC WCID 2)
BLUE RIDGE WEST MUD
FORT BEND COUNTY WC & ID #2
FORT BEND COUNTY MUD #26
NORTHEAST OYSTER CREEK UTILITY SERVICE AREA (QVUD)
FORT BEND COUNTY MUD #42
MEADOWCREEK MUD
QUAIL VALLEY UTILITY DISTRICT
THUNDERBIRD UTILITY DISTRICT
FIRST COLONY MUD #9
FORT BEND COUNTY MUD #115
FORT BEND COUNTY MUD #46
PALMER PLANTATION MUD #1
PALMER PLANTATION MUD #2
FORT BEND COUNTY MUD #47
FORT BEND COUNTY MUD #48
FORT BEND COUNTY MUD #49
FORT BEND COUNTY MUD #129
FORT BEND COUNTY MUD #149
Missouri City Management District 1
Missouri City Management District 2
FORT BEND COUNTY MUD #24
FORT BEND COUNTY MUD #23
SIENNA PLANTATION MUD #10
SIENNA PLANTATION MANAGEMENT DISTRICT
SIENNA PLANTATION MUD #13
SIENNA PLANTATION MUD #12
SIENNA PLANTATION MUD #2
SIENNA PLANTATION MUD #3
SIENNA PLANTATION MUD #4
SIENNA PLANTATION MUD #7
SIENNA PLANTATION MUD #1
SIENNA PLANTATION MUD #5
SIENNA PLANTATION MUD #6
MUSTANG BAYOU SERVICE AREA

Map By:
GIS Division
March 2018

missouri CITY TEXAS

0 2,000 4,000 8,000 12,000 Feet

Geographic Coordinate System North American Datum 1983 (NAD83)

The information on this map is provided and maintained by various agencies, including county departments, municipal governments, state and federal agencies.The map is designed to serve as a secondary representation of real property found within this jurisdiction, and is compiled from the recorded deeds, plats, and other public records, which are primary sources for this public information. The data layers do not take the place of a legal survey or other primary source documentation.The City and its vendors assume no legal responsibility for the information on this map.

Appendix B
2011 Regional Water and Wastewater Planning Study by eHT

Missouri City
TEXAS
the show me city

2011 REGIONAL WATER & WASTEWATER PLANNING STUDY

Prepared by:

Enprotec / Hibbs & Todd

402 Cedar I Abilene, TX 79601
(325) 698-5560 tel I (325) 691-0058 fax
www.e-ht.com
Firm Registration No. 1151

January, 2012

Enprotec / Hibbs & Todd

Missouri City Texas
the show me city

2011 REGIONAL WATER & WASTEWATER PLANNING STUDY

Keith P. Kindle, PE
Project Director

Jonathan Baum, PE
Project Manager

Joshua Berryhill, PE
Project Engineer

Table of Contents

Acknowledgements

Executive Summary

Section 1: Existing Conditions
- 1.1 Background
- 1.3 Project Scope
- 1.4 Participants
- 1.5 Infrastructure Overview
- 1.6 Current and Projected Connections
- 1.7 Current and Projected Population
- 1.8 Current and Projected Water Demand
- 1.9 Current and Projected Wastewater Production
- 1.10 Existing Water Facilities
- 1.11 Existing Wastewater Facilities
- 1.12 Projected Growth Patterns
- 1.13 Current Billing Rates

Section 2: Water Distribution and Water Treatment Alternatives
- 2.1 Current City Water Regionalization Plans
- 2.2 Water Treatment System Alternatives
- 2.3 Water Distribution System Alternatives
- 2.4 Comparison of O&M Costs for Small Surface WTPs Versus Regional SWTPs

Section 3: Wastewater Collection and Treatment Alternatives
- 3.1 Current City Wastewater Regionalization Efforts
- 3.2 Wastewater Collection System Alternatives
- 3.3 Wastewater Treatment System Alternatives
- 3.4 Wastewater Operation and Maintenance Alternatives
- 3.5 Process Alternatives for Regional WWTP Scenarios
- 3.6 Use of Reclaimed Water

Section 4: Costs for Recommended Consolidation Projects
- 4.1 Costs for Recommended Water Projects
- 4.2 Costs for Potential Wastewater Projects

Section 5: Environmental Assessment
5.1 Environmental Setting
5.2 Future Environment without Project Options
5.3 Potential Impacts to Social, Economic and Environmental Resources
5.4 Adverse Impacts which cannot be Avoided Should the Projects be Implemented
5.5 Trade Offs between Short-term Environmental Losses and Long-term Gains or Vice Versa
5.6 Future of the Environment without Proposed Projects

Section 6: Funding and Consolidation Alternatives
6.1 Funding Alternatives
6.2 Consolidation Alternatives

Section 7: Proposed Implementation Schedule
7.1 Water & Wastewater Implementation Schedule

Section 8: Public Meetings
8.1 Public Meeting #1: Kick-Off Presentation
8.2 Public Meeting #2: 50% Completion
8.3 Public Meeting #3: 100% Completion

Appendices
Appendix A City of Missouri City Joint Groundwater Reduction Plan
Appendix B MUD Descriptions
Appendix C Water Conservation and Drought Contingency Plan
Appendix D List of Acronyms and Abbreviations
Appendix E Environmental Figures
Appendix F Additional WWTP Consolidation Scenario
Appendix G Technical Memorandum - Task II
Appendix H Technical Memorandum - Task III
Appendix I Technical Memorandum - Task IV
Appendix J Technical Memorandum - Task V
Appendix K Technical Memorandum - Task VI
Appendix L Technical Memorandum - Task VII
Appendix M Technical Memorandum - Task VIII
Appendix N Technical Memorandum - Task IX
Appendix O Technical Memorandum - Task X
Appendix P Technical Memorandum - Task XI

Acknowledgements

The City of Missouri City Regional 2011 Water and Wastewater Planning Study (Study), covering such a large geographic area including numerous and diverse participants and interests, cannot be successfully accomplished without the assistance of a number of individuals and organizations. The Enprotec / Hibbs & Todd, Inc. (eHT) team would like to recognize those who made important contributions to our efforts over the past 15 months.

First, the eHT team would like to acknowledge the important contributions by the approximately 30 utility districts included in this Study. Your patience in answering our questions and requests for data, sometimes more than once, is gratefully acknowledged by the eHT team.

Second, we would like to acknowledge the contributions of our subconsultants: Costello, Inc.; LJA Engineering & Surveying, Inc.; and Jones & Carter, Inc. Your representation of over 70% of the utility districts in this Study allowed us to quickly coordinate and communicate with the majority of our planning participants. Most importantly, your local familiarity and detailed knowledge of the water and wastewater infrastructure in the Study area was invaluable to the development of the existing conditions and proposed consolidation projects described in this Study.

Last but certainly not least, we would like to thank the Texas Water Development Board (TWDB) Project Manager Mr. Lann Bookout, P.E. for your guidance and support and the City of Missouri City for the opportunity to perform this Study. We especially acknowledge Mr. Scott Elmer, P.E. for establishing the goals and parameters of the Study and our Project Manager Ms. Jing Chen, P.E. for ensuring timely communication and availability of resources. A special thank you goes to Greg Arnold and your colleagues in the Geographic Information System (GIS) Department of the City. Your efforts in developing the maps and exhibits were critical to the success of this Study and will be invaluable to the future planning and design of the projects identified in this Study.

Enprotec / Hibbs & Todd

Executive Summary

To: City of Missouri City and Texas Water Development Board
From: Keith P. Kindle, P.E.
Date: January 30, 2012
Subject: Final City of Missouri City Regional Water & Wastewater Plan

BACKGROUND

This Executive Summary summarizes the findings of each task and the consolidation recommendations included in the City of Missouri City Regional Water and Wastewater Planning Study (the Study). This Study is not a blueprint for the dissolution of the variety of utility districts in the area. Rather, the Study was conducted to identify regional win-win projects. The terms "Regional or Regionalization" have political connotations that infer a single, regional authority which is not the intent when the term is used in this Study. The direction and goal for this Study has been to establish the existing infrastructure and conditions of the region to identify win-win consolidation opportunities for infrastructure between the participants that benefit the area and its ratepayers in a regional manner.

The Study had several tasks to accomplish which included the following:

- Establish existing conditions for water and wastewater facilities of the 30 entities in the Study area;
- Identify specific water and wastewater consolidation projects and their associated costs and implementation schedule;
- Prepare an environmental assessment of the recommended consolidation projects;
- Analyze regional opportunities and the potential funding mechanisms; and,
- Develop a stand-alone Water Conservation and Drought Contingency Plan for the proposed Regional Water Treatment Plant (RWTP).

The development of data for the Study included direct and indirect communication with the utility districts while other key sources of data included the City's GIS department, the TCEQ Water Utilities Database, U.S. 2010 Census data, the SB 1 Region H Water Plan and the Joint Groundwater Reduction Plan (Joint GRP). It should be noted that the Joint GRP was used as the basis for establishing the existing and projected connections, population, water demand and wastewater flows. The Joint GRP plan was used because the data was specific to the Study area and the utility districts included therein; whereas the Region H and 2010 Census data included overlapping areas and utility districts outside the Study boundaries.

The Study, in geographic terms, includes the current city limits of Missouri City, as well as its ETJ. As stipulated by Chapter 42 of the Texas Local Government Code, based on city population size, Missouri City's ETJ extends 3.5 miles beyond the City limits. Exhibit 1-1 in Section 1 shows the Study area and participants. It should be noted that Fort Bend County MUD #23 and #24 are not included since they are outside of the City's ETJ. Fort Bend County WC&ID #2 is also not included due to the fact that it is in three separate jurisdictions (Missouri City, Stafford and Sugar Land). The Study participants are shown in the table below from Section 1.

Table 1-2
Regional Planning Participants

Blue Ridge West MUD	Palmer Plantation MUD #2
City of Missouri City, Texas	Quail Valley Utility District
First Colony MUD #9	Sienna Plantation Management District
Fort Bend County MUD #26	Sienna Plantation MUD #1
Fort Bend County MUD #42	Sienna Plantation MUD #2
Fort Bend County MUD #46	Sienna Plantation MUD #3
Fort Bend County MUD #47	Sienna Plantation MUD #4
Fort Bend County MUD #48	Sienna Plantation MUD #5
Fort Bend County MUD #49	Sienna Plantation MUD #6
Fort Bend County MUD #115	Sienna Plantation MUD #7
Fort Bend County MUD #129	Sienna Plantation MUD #10
Fort Bend County MUD #149	Sienna Plantation MUD #12
Harris County MUD #122	Sienna Plantation MUD #13
Harris County WC&ID – Fondren Road	Southwest Harris County MUD #1
Meadowcreek MUD	Thunderbird Utility District
Palmer Plantation MUD #1	

The following summarizes each Section of the Study as shown in the Table of Contents.

SECTION 1

Section 1 is referred to as the "Existing Conditions" section. In this section all of the existing information for the Study area such as existing water and wastewater utilities, population, water demand, treatment capacity and others factors are identified and mapped as appropriate. In addition to identifying the current conditions, factors such as population, numbers of connections, water demand, wastewater demand, and water and wastewater treatment capacity were projected to the horizon of the Study (Year 2040) and through build-out. The table below provides a summary of these findings.

Existing & Projected Conditions for Study Area								
Study Parameter	**Current (2010)**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**Build Out**
Connections	29,019	33,332	39,835	47,603	54,622	59,133	60,539	62,064
Population	89,088	102,329	122,293	146,141	167,690	181,538	185,855	190,536
Total Water Demand (MGD)	12.4	14.4	17.3	20.8	23.9	26.0	26.7	27.3
Total Wastewater Demand (MGD)	7.5	8.6	10.4	12.5	14.4	15.6	16.0	16.4

Connections

The current 2010 connections for the Study participants vary from 18 to 4,423 for a total of 29,019 connections for the Study area. Using the updated actual connection counts collected from the utility districts rather than the 2010 projected counts from the Joint GRP, but following the same expected growth patterns used in the Joint GRP, the projected connection counts were estimated in 5-year increments to the year 2040 and ultimate build-out. The 2010 total connections for the Study area are 29,019 and increase to 60,539 by 2040. Table 1-3 in Section 1 shows the current and projected connection counts for each utility district and the total for the Study area. Currently the Study area is at 47% build-out and increases to 98% build-out by 2040.

Population

Using the projected connection counts discussed above and assuming the average persons per housing unit will remain the same over time, the projected population was estimated in 5-year increments to the year 2040 and build-out. From year 2010 to 2040 the Study area is projected to increase from 89,088 to 185,855 persons – an additional 96,767 persons over the next 30 years or approximately 3,225 persons per year. Table 1-4 in Section1 shows the current and projected population for each utility district and the total for the Study area.

Water Demand

The expected water demand was obtained by multiplying the number of connections by the average usage per connection per month. The average usage per connection per month was calculated in the Joint GRP by dividing the annual pumpage by the connection count times 12 months. Those districts that are not included in the Joint GRP directly provided their average usage per connection per month.

The current water demand is 12.4 MGD for the Study area with a projected water demand in year 2040 of 26.7 MGD and a build-out demand of 27.3 MGD. Table 1-6 in Section 1 shows the current and projected water demand for each utility district and the total for the Study area.

Wastewater Demand

To determine the current and projected wastewater demands, the information on the wastewater treatment plant (WWTP) flows gathered from the utility districts was divided by the connection counts. This wastewater usage per connection was compared to the average water usage per connection. It was determined that the average wastewater usage per connection is approximately 60% of the water usage per connection. The current wastewater demand for the Study area is 7.5 MGD and more than doubles by year 2040 to 16.4 MGD. Table 1-8 in Section 1 shows the current and projected wastewater demand for each utility district and the total for the Study area.

Groundwater Wells

The majority of the water supplied to the utility districts within the Study area comes from groundwater. Currently, only a few of the northernmost utility districts are receiving surface water from the City of Houston, which include Harris County WC&ID - Fondren Road, Southwest Harris County MUD #1 and Harris County MUD #122. Almost all of the districts operate their own well, or wells, as a means to supply this groundwater. There are a total of 28 existing public wells within the planning area. Data on the wells was obtained from the Joint GRP and the utility districts and is presented in Table 1.9 of Section 1 of this Study.

Water Treatment

There are currently 24 WTPs operating within the Study area. In addition to these, the City is currently constructing a RWTP located in Sienna Plantation. This RWTP will begin operations in 2012. Exhibit 1-4 shows the location of the existing WTPs within the Study area. Total water treatment capacity currently available is 49.54 MGD. All of the WTPs use groundwater as a source. The smallest water treatment plant (WTP) is Fort Bend County MUD #149 at 0.648 MGD while the largest belongs to the Quail Valley UD with a total capacity of 8.524 MGD. Table 1-10 in Section 1 shows the existing WTPs and their associated service areas.

Water Distribution

The existing water distribution system for the Study area consists of approximately 410 miles of water transmission and distribution piping of various sizes, types and ages. Each utility district is responsible for construction and maintenance of its individual distribution system. Age, condition, type and sizing of water lines were evaluated in this Study only to the extent of determining necessary improvements when considering potential consolidation alternatives.

In addition to the normal distribution piping for each utility district water system, interconnects have been constructed between many of the existing distribution systems. These interconnects provide the capability to transfer treated water from one utility district to another. See Exhibit 1-4 for a map of the existing distribution lines and Exhibit 1-5 for the locations of existing system interconnects and major transmission lines throughout the Study area. Each interconnect on Exhibit 1-5 has been numbered and information about each interconnect can be found in Table 1-11 in Section 1of this Study.

Wastewater Treatment

There are 11 existing WWTPs within the Study area. Two of the WWTPs are owned by the City of Missouri City (Steep Bank/Flat Bank and Mustang Bayou). The remaining WWTPs are owned by utility districts. The service area for each WWTP is shown on Exhibit 1-7 of this Study.

Each WWTP was evaluated in this Study with respect to rated capacity versus average loading, treatment performance, remaining useful life of structures and equipment, treatment and potential expansion capabilities, potential for reuse and observed level of annual O&M efforts. The total wastewater treatment capacity for the Study area is 14 MGD. The largest existing WWTP is the Quail Valley UD/Thunderbird WWTP at 4.0 MGD capacity. A brief summary of information for each WWTP is shown in Tables 1-12 through 1-15 of Section 1 in this Study.

Wastewater Collection System

The existing wastewater collection system for the Study area consists of approximately 360 miles of gravity lines and 35 miles of force mains, of various sizes, types and ages. Each utility district is responsible for construction and maintenance of its collection system. Because some of the utility districts share capacity in regional WWTPs, several systems are interconnected. Some of the interconnects are direct gravity lines to a WWTP and some are force mains that transfer wastewater flows from one utility district's lift station into another utility districts collection system to ultimately travel to a regional WWTP. See Exhibit 1-6 for a map of the existing wastewater collection system lines, lift stations and existing system interconnects.

Billing Rates

An evaluation of the rate structure for each utility district was done to develop a comparison of the monthly average billing amount for water, wastewater and combined. A monthly usage of 10,000 gallons was used to compare residential rates and a monthly usage of 50,000 gallons was used to compare commercial rates. The average water billing rate for residential was $25.39 and commercial was $160.87. The average wastewater billing rate for residential was $35.81 and commercial was $152.04. The average combined billing rate for residential was $61.20 and commercial was $312.91. The residential rates were somewhat uniform across the Study participants while commercial amounts varied more widely.

GIS Mapping of Existing Facilities

A significant achievement of the Study was the development of GIS maps for the existing water and wastewater infrastructure, including transmission lines, WTPs, interconnects, water and wastewater service areas, WWTPs, lift stations and so forth. The update of the facilities mapping and review and revision of the GIS maps via comments from the various participants will provide a valuable tool for future planning. The GIS maps are referenced throughout the Study sections.

SECTIONS 2 - 4

Consolidation Project Recommendations and Costs

The Study identified various water projects for interconnects, elevated storage tanks (ESTs), SWTP expansion and water transmission lines. There are 9 interconnect projects totaling $4,795,000. There are 6 ESTs recommended at a total cost $22,302,000. The two expansions required for the RWTP total $77,880,000. Finally, there are 2 transmission line projects associated with the RWTP for a total cost of $16,540,000. The total cost for the recommended water projects is $121,517,000, as shown in Table 4-20.

Table 4-20 Summary of Cost Estimates for Water Improvements				
Project Description	**Projected Total Capital Cost for New Interconnects**	**Projected Total Capital Cost for New ESTs**	**Projected Total Capital Cost for New WTPs**	**Projected Total Capital Cost for New Transmission Lines**
Interconnect First Colony MUD #9 with Fort Bend County MUD #115	$607,000	-	-	-
Mustang Bayou WTP System and Sienna Plantation System Interconnect No. 2	$799,000	-	-	-
Mustang Bayou WTP System and Sienna Plantation System Interconnect No. 3	$683,500	-	-	-
Sienna Plantation Water System Internal Interconnect	$458,000	-	-	-
Sienna Plantation System and Palmer Plantation System Interconnect No. 1	$927,500	-	-	-
Silver Ridge Development and Sienna Plantation Water System Interconnect No. 1	$154,000	-	-	-
Fort Bend County MUD #149 and Sienna Plantation MUD #1 Water System Interconnect No. 1	$579,000	-	-	-
Mustang Bayou and Palmer Plantation Interconnect	$298,000	-	-	-
Mustang Bayou and Quail Valley Interconnect	$289,000	-	-	-
New EST at Sienna Plantation No. 1 GWTP	-	$4,602,000	-	-
New EST at Mustang Bayou WTP	-	$1,947,000	-	-
New EST at Fort Bend County MUD #149 GWTP	-	$6,372,000	-	-
New EST at Palmer Plantation MUD No. 2 GWTP	-	$3,717,000	-	-
New EST at Thunderbird Utility District System 1 GWTP No. 2	-	$3,717,000	-	-
New EST at Harris County WC&ID – Fondren Road GWTP No. 2	-	$1,947,000	-	-
RWTP Phase II	-	-	$35,400,000	$13,850,000
RWTP Phase III	-	-	$42,480,000	$2,690,000
Total Cost Per Category	**$4,795,000**	**$22,302,000**	**$77,880,000**	**$16,540,000**
Total Projected Cost	**$121,517,000**			

The Study did not identify any stand-alone wastewater collection or conveyance projects that would benefit the Study area; however, the single recommendation to consolidate the existing WWTPs into a super-regional WWTP does include costs for conveyance and pumping to re-route wastewater flows and convey re-use water. The total cost for the super-regional WWTP project is $82,689,000. A summary of the five WWTP consolidation scenarios reviewed are provided in Table 4-38.

Table 4-38
Summary of Capital and O&M Costs for WWTP Scenarios

Scenario Description	WWTPs Online in This Scenario	Projected Total Capital Cost	Projected Annual O&M Cost	Projected 30-Year Life Cycle Cost
Rehab/Expand all existing WWTPs as needed and construct new South Regional WWTP to continue use for 30 years (11 existing WWTPs plus 1 new WWTP)	SWHCMUD #1, HCMUD #122, HCMUD-Fondren Road, BRWMUD, FBCMUD #26, Palmer, QVUD, SB-FB, Vicksburg, Sienna North, Sienna South, New South Regional (Hillwood)	$113,603,000	$3,475,000	$181,722,000
Consolidate WWTPs based on MUD engineering firm recommendations (7 existing WWTPs plus 1 new WWTP)	SWHCMUD #1, HCMUD-Fondren Road, BRWMUD, QVUD, SB-FB, Vicksburg, Sienna North, New South Regional (Hillwood)	$105,191,000	$2,662,100	$157,378,000
Consolidate WWTPs to reduce total number of WWTPs using QVUD as a regional facility (4 existing WWTPs plus 1 new WWTP)	HCMUD-Fondren Road, QVUD, SB-FB, Vicksburg, New South Regional (Hillwood)	$99,036,000	$1,896,900	$136,224,000
Consolidate WWTPs to reduce total number of WWTPs using BRWMUD as a regional facility (4 existing WWTPs plus 1 new WWTP)	BRWMUD, QVUD, SB-FB, Vicksburg, New South Regional (Hillwood)	$99,874,000	$2,280,700	$144,586,000
Consolidate WWTPs to reduce total number of WWTPs using Steep Bank - Flat Bank as the only regional WWTP facility (1 existing WWTP)	**SB-FB**	**$82,689,000**	**$1,331,400**	**$108,792,000**

In addition to comparison of the life cycle costs in the table above, a full cash flow analysis was developed for the wastewater improvements (Refer to Table 4-40), to provide a basis for comparison of existing/future WWTP O&M costs, along with the impact of the potential debt service to be incurred from consolidating the various existing WWTPs. Note that a cumulative loss/gain analysis was also completed and was included in Table 4-40 which reflects a potential net gain in revenue from wastewater fees during the course of the project due to reduced WWTP O&M cost as each existing WWTP would be consolidated into the proposed super-regional WWTP.

Based on the potential revenue/cost streams evaluated, it appears that the savings in O&M by consolidating WWTPs may allow for the wastewater revenues to start paying for the O&M and debt service as early as 2021 (the first year with an annual net gain of revenue), using the implementation schedule included in this section. However, depending on actual current O&M costs attributed to each WWTP, the likely “break even” point in the proposed implementation schedule could happen earlier or later than 2021.

Table 4-40
Projected Cash Flow Analysis for Proposed Wastewater Improvements

Year	Wastewater Improvements Project	Annual Debt Service Cost for WWTP Projects [1]	Total O&M Cost for Super-regional WWTP and Transfer PS Operation [2]	Total O&M Cost for Existing WWTP Operations [2]	Total Annual Cost for Wastewater Improvements and Operations	Total Annual Revenue for Utility Districts for WWTP Operations [3]	Cumulative Net Loss/Gain During Project
2011	-	-	-	$6,261,000	$6,261,000	$6,371,000	$110,000
2012	Reroute Harris County MUD #122 WWTP to Harris County WC&ID-Fondren Rd WWTP	$4,219,000	$397,000	$5,662,000	$10,278,000	$6,575,000	($3,593,000)
2013	Construct new transfer PS at Palmer Plantation WWTP and transfer all plant flow to SB-FB WWTP	$4,219,000	$508,000	$5,207,000	$9,934,000	$6,786,000	($6,741,000)
2014	Construct new transfer PS at Sienna North WWTP and transfer all plant flow to SB-FB WWTP	$4,219,000	$630,000	$4,802,000	$9,651,000	$7,004,000	($9,388,000)
2015	-	$4,219,000	$653,000	$4,971,000	$9,843,000	$7,229,000	($12,002,000)
2016	Construct 4.0 MGD expansion at SB-FB WWTP	$4,219,000	$488,000	$5,145,000	$9,852,000	$7,461,000	($14,393,000)
2017	Construct new transfer PS at Fort Bend County MUD #26 WWTP and transfer all plant flow to Palmer WWTP PS	$4,219,000	$621,000	$4,551,000	$9,391,000	$7,700,000	($16,084,000)
2018	Construct new transfer PS at Sienna South WWTP and transfer all plant flow to Sienna North WWTP PS	$4,219,000	$872,000	$3,282,000	$8,373,000	$7,947,000	($16,510,000)
2019	-	$4,219,000	$903,000	$3,397,000	$8,519,000	$8,202,000	($16,827,000)
2020	-	$4,219,000	$935,000	$3,516,000	$8,670,000	$8,465,000	($17,032,000)
2021	Construct new transfer PS at Quail Valley UD WWTP and transfer all plant flow to SB-FB WWTP	$4,219,000	$1,294,000	$2,472,000	$7,985,000	$8,736,000	($16,281,000)
2022	Construct 4.0 MGD expansion at SB-FB WWTP	$4,219,000	$1,187,000	$2,559,000	$7,965,000	$9,016,000	($15,230,000)
2023	Construct new transfer PS at Blue Ridge West WWTP and transfer all plant flow to Fort Bend County MUD #26 WWTP PS	$4,219,000	$1,523,000	$1,718,000	$7,460,000	$9,305,000	($13,385,000)
2024	Construct new transfer PS in Hillwood development and transfer all plant flow to Sienna South WWTP PS	$4,219,000	$1,742,000	$1,779,000	$7,740,000	$9,603,000	($11,522,000)
2025	-	$4,219,000	$1,803,000	$1,842,000	$7,864,000	$9,911,000	($9,475,000)
2026	Construct new transfer PS at Harris County WC&ID-Fondren Rd WWTP and transfer all plant flow to Blue Ridge West WWTP PS	$4,219,000	$1,991,000	$1,463,000	$7,673,000	$10,229,000	($6,919,000)

Year	Wastewater Improvements Project	Annual Debt Service Cost for WWTP Projects [1]	Total O&M Cost for Super-regional WWTP and Transfer PS Operation [2]	Total O&M Cost for Existing WWTP Operations [2]	Total Annual Cost for Wastewater Improvements and Operations	Total Annual Revenue for Utility Districts for WWTP Operations [3]	Cumulative Net Loss/Gain During Project
2027	Construct 4.0 MGD expansion at SB-FB WWTP	$4,219,000	$2,061,000	$1,515,000	$7,795,000	$10,557,000	($4,157,000)
2028	Construct new transfer PS at Fort Bend County MUD #1 WWTP and transfer all plant flow to Harris County WC&ID-Fondren Rd WWTP PS	$4,219,000	$2,039,000	$1,338,000	$7,596,000	$10,895,000	($858,000)
2029	-	$4,219,000	$2,111,000	$1,385,000	$7,715,000	$11,244,000	$2,671,000
2030	-	$4,219,000	$2,185,000	$1,434,000	$7,838,000	$11,604,000	$6,437,000
2031	Construct new transfer PS at Mustang Bayou WWTP and transfer all plant flow to Palmer Plantation WWTP PS	$4,219,000	$2,390,000	$0	$6,609,000	$11,976,000	$11,804,000
2032	-	$4,219,000	$2,474,000	$0	$6,693,000	$12,360,000	$17,471,000
2033	-	$4,219,000	$2,561,000	$0	$6,780,000	$12,756,000	$23,447,000
2034	-	$4,219,000	$2,651,000	$0	$6,870,000	$13,165,000	$29,742,000
2035	Construct 4.0 MGD expansion at SB-FB WWTP	$4,219,000	$2,316,000	$0	$6,535,000	$13,587,000	$36,794,000
2036	-	$4,219,000	$2,398,000	$0	$6,617,000	$14,022,000	$44,199,000
2037	-	$4,219,000	$2,482,000	$0	$6,701,000	$14,471,000	$51,969,000
2038	-	$4,219,000	$2,569,000	$0	$6,788,000	$14,935,000	$60,116,000
2039	-	$4,219,000	$2,659,000	$0	$6,878,000	$15,413,000	$68,651,000
2040	-	$4,219,000	$2,753,000	$0	$6,972,000	$15,907,000	$77,586,000
Total Debt Service (Principal and Interest)		**$122,351,000**					

Notes:
1 - This debt service cost is based on a 30-year payment period.
2 - This O&M cost includes a 3.5% annual cost escalation factor to account for anticipated increases in inflation in the future.
3 - The WWTP operations revenue based on allocating 75% of the annual wastewater revenue to WWTP operations. Revenue based on average utility district wastewater fee of $3.58 per 1,000 gallons. Revenue increases annually by approximately 3% due to increased development and growth in the City, resulting in a proportional increase in wastewater flows.

The total cost for all of the projects identified in the Study is $204,206,000. The table below shows all of the water and wastewater consolidation projects and their individual costs that are recommended in this Study.

Summary of Recommended Project Costs	
Project Description	**Cost**
Interconnects	$4,795,000
Elevated Storage	$22,302,000
Water Transmission	$16,540,000
Water Treatment	$77,880,000
Wastewater Conveyance / Treatment	$82,689,000
Total	**$204,206,000**

SECTION 5

Environmental Assessment (EA)

An EA was prepared for the projects that were identified and is included in Section 5 of the Study. Many of the components such as USGS Quad maps, FEMA maps, Aerial Photos and others are included, as well as a rudimentary discussion of each component of the EA per the Texas Water Development Board (TWDB) guidelines. These foundation elements of this EA will be valuable for future environmental investigations. However, the EA is only intended for a very preliminary planning level and is not intended to provide environmental clearance for any of the projects recommended herein. Additional environmental investigations should be conducted, as warranted, for those projects that proceed beyond the planning level of this Study.

SECTION 6

Project Funding and Consolidation

The Study identified various water projects for interconnects, ESTs, RWTP expansion and water transmission lines. The total cost for the recommended water projects is $121,517,000. The Study did not identify any stand-alone wastewater collection or conveyance projects that would benefit the Study area; however, the single recommendation to consolidate the existing WWTPs into a super-regional WWTP does include costs for conveyance and pumping to re-route wastewater flows and convey re-use water. The total cost for the super-regional WWTP project is $82,689,000. The total cost for all of the projects identified in the Study is $204,206,000.

Obviously not all of the funding would be needed at the same time but with the current tightening of the bond market and the fact that the requests for water and wastewater funding is always greater than the funding available, the identification of funding sources is crucial. Section 6 describes a variety of funding sources available from the TWDB in addition to private bonds and funding agreements.

The conclusions regarding the funding of consolidation or regional projects are listed below.

- Municipalities can typically issue bonds at lower interest rates than utility districts or IOUs.
- Using the Joint GRP financing model for the RWTP is applicable to the super-regional WWTP recommended in this Study.
- The smaller consolidation water distribution projects and interconnects are best financed via interlocal agreements between the affected utility districts.

Water Consolidation

In regard to regional water treatment and supply, the City and the utility districts have managed to achieve what was unthinkable just a few years ago with the agreement for the new RWTP. In response to requirements to reduce the usage of groundwater, the City and the utility districts agreed to fund, design and construct a surface WTP (SWTP) to provide surface water to a portion of the area. By converting a portion of the area to surface water, the entire region was able to meet the stringent groundwater reduction requirements that go into effect in 2013 with further reductions in 2025.

The City and the utility districts have successfully implemented the steps to achieve regionalization for water supply and treatment to meet the reduction in groundwater withdrawals. This living example of cooperation and success can and should be a model for future regionalization or consolidation efforts. There are still opportunities remaining for storage and pumping, especially as the distribution systems become mature and the use of hydro-pneumatic pressure tanks is lessened and elevated storage use is increased. The recommendation for ESTs may be met by resistance due to NIMBY – Not in My Back Yard; and, the fact that in the short-term, ESTs are more expensive than hydropnuematic tanks.

Wastewater Consolidation

The consolidation of any current wastewater treatment facilities will probably require a similar regulatory driver as the groundwater reduction requirements in the form of stricter TMDLs for the affected streams that receive discharge effluent from the WWTPs in the region. Overall, the concept of wastewater regionalization, or consolidation, is adverse to the development attitudes and practices of the Study area. However, from a long-term cost standpoint this Study has established the case for a single, super-regional WWTP at the Steep Bank-Flat Bank WWTP.

A total of over 60 scenarios were completed to evaluate capital, O&M and life-cycle costs. The result was surprising in that consolidation to a single, super-regional WWTP was the most cost effective scenario despite the costs for re-routing and pumping of flows from other service areas. The various methods of analysis and conclusions are discussed in detail in Section 4.

The recommended scenario of consolidating all flows to the Steep Bank-Flat Bank WWTP will have its share of challenges for the reasons listed below.

- Agreements and contracts among political subdivisions are much harder to complete once independent service areas are established.

- Determination of an overall rate structure for combined service areas is very difficult to establish once single-service areas and rate schedules have been established - especially when trying to consolidate an older utility district and a newer utility district that typically has a much higher debt service component.

- Individual Control. While costs are important, control is paramount. Generally speaking, the number one problem of regionalization involves the fear of losing autonomy, including concerns about loss of control or power by one group or another and not being able to control their own destiny.

- Occupational Resistance. With the proliferation of utility districts in the Study area and the nature of providing wastewater services, there are numerous professions involved in the industry through the operation and maintenance, billing, engineering, financial and legal services. In addition to resistance to regionalization by a utility district board due to control reasons, resistance is also encountered from those who work for the utility districts. With a reduced number of plants and plant owners through regionalization or consolidation, there may be the perception that the wastewater industry will turn into a "winner take all" system of engineering, financial, legal and maintenance contracts.

However, after exhaustive analyses of cost comparisons, it is the most cost effective alternative for the long-term wastewater treatment needs of the Study area.

The recommendation to establish a super-regional WWTP at Steep Bank-Flat Bank could follow the same model as the RWTP by allowing the various utility districts to retain their autonomy. However, the issues of costs to divert the flows, of control, and of how costs are apportioned in accordance with utility rates will play a major role in deciding whether or not a regional approach is taken. One thing is certain – 8 of the current WWTPs only have 5-10 years of life remaining. Subtract the time for permitting, design and possible acquisition of land necessary for expansion and a decision will have to be made in the very near future on which direction the small package plants will take.

SECTION 7

An implementation schedule for various water and wastewater consolidation projects that are identified in Sections 4 of this Study was prepared. The timing of the implementation for these projects was based on information from the utility districts and the inherent nature and characteristics of the projects. However, it should be noted that a number of factors can and will impact the schedule presented in the flow chart in Section 7.1 of this Study and is shown on the following page.

These include but are not limited to the following factors.

- The projects identified are at a pre-planning level at this point. Preliminary design may delay or accelerate the projects once begun.

- Implementation of the projects is dependent on available funding.

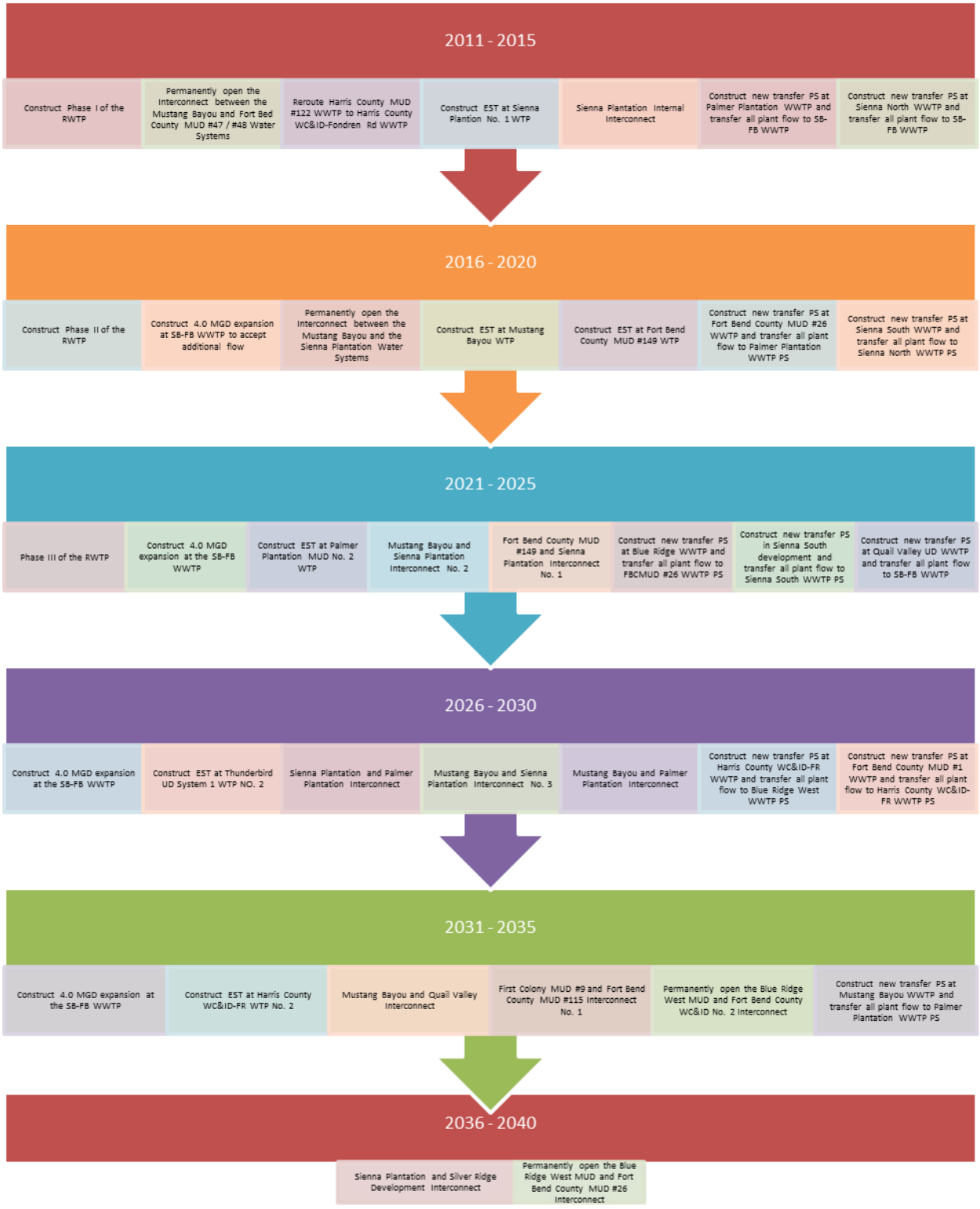
- Utility conflicts, Rights-Of-Way (ROW) and easement acquisition can substantially delay projects.

- Many of the recommended consolidation projects will involve agreements and contracts between the individual utility districts, including project costs and payment agreements. These negotiated agreements may delay implementation.

- A slow down or acceleration in projected growth within the Study area may impact the implementation schedule.

- Stricter water or wastewater treatment regulations could accelerate the implementation schedule.

Implementation Schedule



SECTION 8

Public Outreach

A key part of the Study's effort was coordination with the 30 utility districts within the Study area. Communication included retrieving existing information on their facilities, recommendations for consolidation projects and regional projects and a schedule of implementation, in addition to requesting comments on the overall Study. Four types of communication to facilitate this effort were utilized.

1. Three subconsultants were hired to assist with this Study that serve as the Engineer of Record for approximately 70% of the utility districts in the Study. This allowed rapid dissemination and gathering of information from a majority of the utility districts.

2. The utility districts were contacted directly for information and were provided the opportunity to review and comment on the information in the Study via the creation of FTP sites as the Study progressed.

3. On-site visits to the utility district water and wastewater treatment facilities were conducted.

4. Three public meetings were held and invitations were sent to each utility district requesting them to attend, in addition to the public posting of the meeting date and subject. One meeting was held at the start of the Study, a second meeting was held at the 50% completion level of the Study and a third meeting was held after the final draft of the report had been distributed.

Water Conservation Plan and Drought Contingency Plan (WCP/DCP)

The WCP/DCP has been drafted for the RWTP and is included in the appendices of this Study. The WCP/DCP is formatted per the TCEQ requirements. In addition to these basic requirements, the WCP/DCP also acknowledges the successive requirements by the raw water provider, GCWA, and the wholesale customer, Sienna. The current drafts are preliminary in that the Joint GRP, GCWA, the City and Sienna will need to fine tune the trigger points, stages and associated agreements and other WCP/DCP affected by the adoption of the WCP/DCP for the RWTP. The WCP/DCP will become a stand-alone document upon adoption prior to the start-up of the RWTP.

Section 1: Existing Conditions

1.1 Background

The City of Missouri City is located to the southwest of Houston with its boundaries primarily within Fort Bend County, but also within Harris County toward the northern border. The area began to be populated in the late 1800s as a railroad settlement. The settlement was officially registered in Texas in 1894. It became an important railroad shipping point for the Blue Ridge Oil Field and Salt Mine. In 1926, a gas pipeline was constructed through the area and the City became the first town in Fort Bend County to use natural gas. Growth was slow at first, with the official United States (US) Census count in 1940 showing only 100 residents.

However, as the automobile became more dependable, the area began to appeal to commuters who could work in Houston and live in the Missouri City area. As rumors grew of possible annexation by the City of Houston, a plan was developed to incorporate Missouri City itself. On March 13, 1956, voters approved the incorporation of the area as the City of Missouri City (City).

Currently, the City covers approximately 32 square miles (sq mi) of land and the extraterritorial jurisdiction (ETJ) covers approximately 25 sq mi. The estimated population within the City's planning area (both the incorporated limits and the ETJ) is 81,079 residents based on the 2010 US Census. As stipulated by Chapter 42 of the Texas Local Government Code, based on the City's population size, the City's ETJ extends 3.5 miles beyond the City limits, as referenced in Exhibit 1-1 found at the end of this Section. However, because other cities abut the City, the City's ETJ only exists primarily to the south.

Situated as it is on Texas' flat coastal plain, the City is a spread out community, separated in places by major highway and corridors established for rail, utilities and drainage. The City also developed over time as a community of numerous subdivisions and associated utility districts. Adjacent to the Brazos River, major watersheds include Mustang Bayou and Lower Oyster Creek.

The City is a rapidly growing community that encompasses a diverse range of built environments. Quiet cul-de-sacs and busy arterial transportation corridors exist in close proximity. Originating from the assemblage of multiple utility districts and straddling two counties, the City gains much of its character from the local political geography. The City was incorporated as a combination of many areas, and this background still produces areas of special character today. Currently, the City is widely known as a community of neighborhoods although it maintains a rapidly developing economic base. Additionally, it is important to note the major thoroughfares in the City and its ETJ: US 90-A; Beltway 8

(Sam Houston Tollway); State Highway (SH) 6; Farm-to-Market (FM) 2234 (Texas Parkway); FM 1092 (Murphy Road); and Fort Bend Parkway; as well as US Hwy 59 nearby.[1]

1.2 Project Scope

One of the primary functions of municipalities is to ensure public health and safety through the provision of basic utility services, particularly potable water and sanitary sewer. However, in the City's case, nearly all of its growth over the last 50 years, until the last decade or so, has been accommodated through utility districts associated with individual subdivision development and various master-planned developments. This method of utility service development has resulted in a very unusual and complex utilities situation.

The City's historical reliance on individual utility districts to provide basic water and wastewater services ensured more local oversight of utility operations and associated taxes and fees. However, this dispersed approach to utilities provision and management has also resulted in inevitable duplication and inefficiencies as the overall community has grown. For example, there are currently 24 ground WTPs (GWTPs) and 11 WWTPs operating in and around the City, whereas many similar-sized communities function efficiently and cost-effectively with only one large treatment facility for each type of service.

Such economies of scale in other communities provide benefits such as:

- More unified administration, operations, purchasing;
- Cost sharing for staff training and certification;
- Substantially reduced number of State discharge permits and points of effluent discharge into area waterways;
- Substantially reduced paperwork, monitoring, reporting and enforcement activity associated with each treatment plant; and,
- Typically much lower cost of treatment per gallon.

Additionally, the City's property tax rate applies on top of various other taxing and service providers with jurisdictions in the area (e.g., utility districts, levee improvement districts, county, etc.). Most residents also pay fees to their respective homeowners' associations for supplemental neighborhood services. A current rule of thumb in the City

[1] City of Missouri City Web Site

is that a residential property must reach a minimum value of $260,000 before it pays for itself in terms of tax revenue generated relative to the cost of necessary services.[2] The potential benefits of "regionalization" or "consolidation" of utility providers are important enough that unique opportunities should be monitored and pursued where they make sense and have a good chance to benefit all parties. Such opportunities will gradually come about as the overall community approaches build-out, as debt assumption becomes less of a factor, and through attrition as older systems face difficulties in meeting maintenance and rehabilitation needs or more stringent State and Federal regulatory mandates.

This Study addresses the fundamental questions of how particular consolidations might be accomplished and whether they are feasible when considering technical challenges and costs. The recommendations found in this Study should lead to technically sound engineering master plans to guide ongoing water and wastewater system investments and management activities by the City and others.

The proposed regional planning area in this Study includes both the incorporated limits and City's ETJ (refer to Exhibit 1-1). The tasks included in this Study are as follows:

Table 1-1
Study Tasks

Task	Description
Task I	Service Area Description
Task II	Determination of Water System Demands
Task III	Prepare Water Distribution System Alternatives
Task IV	Prepare Water Treatment System Alternatives
Task V	Water Operation Alternatives
Task VI	Determination of Sewerage System Flows
Task VII	Prepare Collection System Alternatives
Task VIII	Prepare Wastewater Treatment System Alternatives
Task IX	Wastewater Operation Alternatives
Task X	Implementation Schedule
Task XI	Determination of Costs and Recommendations
Task XII	Evaluation of Funding Options and Alternative District Consolidations/Regional Structure
Task XIII	Development of Regional Water Conservation and Drought Management Plans
Task XIV	Reports
Task XV	Environmental Assessment
Task XVI	Meetings

[2] Missouri City1997 Municipal Utility District Study

1.3 Participants

The Study area includes approximately 30 individual entities as planning participants that are listed in Table 1-2. See Exhibit 1-2 for a map of the Study area participants. On Exhibit 1-2 the City-owned districts, Mustang Bayou Utility Service Area (USA) and Northeast Oyster Creek USA, have been shown separately. Fort Bend County Municipal Utility District (MUD) #23 and Fort Bend County MUD #24 are not included since they are out of the City's ETJ, except for a very small section of Fort Bend County MUD #23. Fort Bend County Water Control & Improvement District (WC&ID) #2 was not included since it is under three controlling jurisdictions.

Table 1-2
Regional Planning Participants

Blue Ridge West MUD	Palmer Plantation MUD #2
City of Missouri City, Texas	Quail Valley Utility District
First Colony MUD #9	Sienna Plantation Management District
Fort Bend County MUD #26	Sienna Plantation MUD #1
Fort Bend County MUD #42	Sienna Plantation MUD #2
Fort Bend County MUD #46	Sienna Plantation MUD #3
Fort Bend County MUD #47	Sienna Plantation MUD #4
Fort Bend County MUD #48	Sienna Plantation MUD #5
Fort Bend County MUD #49	Sienna Plantation MUD #6
Fort Bend County MUD #115	Sienna Plantation MUD #7
Fort Bend County MUD #129	Sienna Plantation MUD #10
Fort Bend County MUD #149	Sienna Plantation MUD #12
Harris County MUD #122	Sienna Plantation MUD #13
Harris County WC&ID – Fondren Road	Southwest Harris County MUD #1
Meadowcreek MUD	Thunderbird Utility District
Palmer Plantation MUD #1	

1.4 Infrastructure Overview

City residents are supplied water by one of the many individual utility districts operating within the area. Historically, the source of raw water for these utility districts has been groundwater, though some utility districts also have the capability to purchase treated surface water from other utilities. In 2008, the Fort Bend County Subsidence District (FBCSD) issued a requirement to reduce groundwater usage in the City by a minimum of 30% by 2013 and a minimum of 60% by 2025.

To meet the FBCSD groundwater reduction goal for 2013, the City and a group of the utility districts joined together in a plan to construct the first phase of a new RWTP and begin the process of converting water supplies from groundwater to surface water. This consolidation plan will first convert the utility districts in the southern portion of the City and its ETJ to surface water by sending treated surface water to several utility district GWTPs, which will then be distributed through the City's system using the existing distribution system components.

The source of surface water for this initial phase of surface water conversion will be 15 million gallons per day (MGD) of raw water purchased from the Gulf Coast Water Authority (GCWA), which diverts water from the Brazos River. The RWTP is intended to be expanded in the future, as needed, to convert additional utility district entities within the City to surface water use.

The proposed future expansions of the RWTP and the increasing requirements for reduction of groundwater usage will require additional sources of surface water. The City has identified several possible options for developing necessary additional surface water sources with the City of Houston and the Brazos River Authority (BRA), and continues to explore options to develop other potential surface water sources. Information on potential water supply sources was taken from the City Joint Groundwater Reduction Plan (Joint GRP). An abbreviated copy of this Joint GRP without the associated contracts and agreements is contained in Appendix A of this Study.

City residents are also supplied wastewater service by individual utility districts within the area. Many of the existing WWTPs within the City only serve a single utility district; however, there are a few regional WWTPs within the City. The current existing conditions of the wastewater treatment systems adequately serve the area, but as the City grows, the ultimate goal is to focus on regionalization of wastewater treatment whenever feasible.

1.5 Current and Projected Connections

During the initial development of this Study, the current number of connections for each utility district was taken from the 2010 connection projections in the Joint GRP which

was prepared in 2008. When current connection counts were provided by the utility districts, the up-to-date connection totals were used in place of the Joint GRP projections. However, the assumptions of build-out timing from the Joint GRP are used and extended to the year 2040. Table 1-3 shows the projected connection counts for each district in five-year increments.

Table 1-3
Current and Projected Connection Counts

District	Current Connections (2010)	2015	2020	2025	2030	2035	2040	Build Out Connection Count
Sienna Plantation Management District	69	84	150	225	300	375	450	453
Sienna Plantation MUD #1	18	18	19	20	21	23	25	25
Sienna Plantation MUD #2	1,784	1,784	1,784	1,784	1,784	1,784	1,784	1,784
Sienna Plantation MUD #3	2,455	2,455	2,455	2,455	2,455	2,455	2,455	2,455
Sienna Plantation MUD #4, 5, 6, 7	0	600	2,600	5,600	8,600	10,000	10,000	10,000
Sienna Plantation MUD #10	1,376	1,796	1,996	2,196	2,396	2,433	2,433	2,433
Sienna Plantation MUD #12	151	235	547	1,087	1,423	1,439	1,439	1,439
Sienna Plantation MUD #13	0	0	165	440	715	990	1,194	1,194
Fort Bend County MUD #129	1,015	1,463	1,550	1,550	1,550	1,550	1,550	1,550
Fort Bend County MUD #149	125	970	1,700	1,700	1,700	1,700	1,700	1,700
Blue Ridge West MUD	2,494	2,503	2,507	2,507	2,507	2,507	2,507	2,509
First Colony MUD #9	2,677	2,727	2,777	2,827	2,877	2,927	2,977	3,300
Fort Bend County MUD #115	548	567	580	580	580	580	580	580
Fort Bend County MUD #26	1,484	1,484	1,490	1,500	1,510	1,520	1,530	2,145
Fort Bend County MUD #42	1,303	1,408	1,507	1,507	1,507	1,507	1,507	1,507
Fort Bend County MUD #46	771	960	1,035	1,035	1,035	1,035	1,035	1,073
Fort Bend County MUD #47	533	825	942	942	942	942	942	1,000
Fort Bend County MUD #48	634	641	716	837	957	1,077	1,197	1,370
Fort Bend County MUD #49	340	356	364	370	375	380	385	396
Meadowcreek MUD	888	933	943	953	963	973	983	985
Palmer Plantation MUD #1	599	680	702	707	712	717	722	798
Palmer Plantation MUD #2	813	872	894	904	914	924	934	1,000
Quail Valley Utility District	4,423	4,423	4,431	4,514	4,514	4,514	4,514	4,514
Thunderbird Utility District	1,916	1,916	1,922	1,932	1,942	1,952	1,962	1,986
Mustang Bayou USA	649	1,340	2,050	2,760	3,044	3,044	3,044	3,178
Mustang Bayou USA Phase 2	0	0	1,365	3,640	5,915	8,190	9,095	9,095
Harris County MUD #122	410	480	550	622	693	714	714	714
Southwest Harris County MUD #1	527	684	842	1,000	1,157	1,315	1,315	1,315
Harris County WC&ID - Fondren Road	1,017	1,128	1,252	1,409	1,534	1,566	1,566	1,566
Total Estimated Connections	**29,019**	**33,332**	**39,835**	**47,603**	**54,622**	**59,133**	**60,539**	**62,064**

1.6 Current and Projected Population

The Joint GRP assumption was "3.04 persons per connection (2000 Census total of 52,913 divided by a total of 17,481 housing units)". Many of the utility districts are using 3.00 persons per connection which is approximately the same estimate for their purposes. The 2010 Census data was recently released and the new totals for the City are 81,079 persons and 26,433 occupied housing units (including totals for both the Missouri City and Sienna Plantation areas), resulting in an updated population density of 3.07 persons per connection. For this Study, the current 3.07 rate was multiplied by the actual number of connections to determine the current population totals for each district. In order to verify that these assumptions are correct the population numbers were compared to the 2010 Census totals and the TWDB regional planning estimates. There were some notable differences between these estimates and the Census total which are discussed below.

- The totals included in the Joint GRP included Fort Bend County MUD #23 and #24. These MUDs were not included in this Study and therefore were removed from this estimate.

- Harris County MUD #122, Harris County WC&ID-Fondren Road, and Southwest Harris County MUD #1 were not included in the Joint GRP.

- There is a large section of Fort Bend County WC&ID #2 within the incorporated limits of the City. This district is not part of the Study and, therefore, was not accounted for in this estimate. It is assumed that the population within this area is accounted for in the TWDB estimates and in the Census count.

- The TWBD Region H estimates identify separate totals for First Colony MUD #9, Missouri City (Fort Bend County), Missouri City (Harris County), and Sienna Plantation MUD #2. These individual totals were summed to reach the numbers listed in Table 1-5. There were no other areas except for Sienna Plantation MUD #2 identified within the ETJ. Therefore it is not clear whether these numbers cover the entire ETJ included in this Study.

- The 2010 Census data used was for the City - listed as "Missouri City (City)" and the Sienna Plantation was listed with the qualifier "Census Designated Place (CDP)". Because the Census tract boundaries do not match directly with the Study area limits, there is likely to be additional population accounted for in these totals, which is not included in this Study.

Table 1-4
Current and Projected Population Counts

District	Current Population (2010)	2015	2020	2025	2030	2035	2040	Build Out Population Estimate
Sienna Plantation Management District	212	258	461	691	921	1,151	1,382	1,391
Sienna Plantation MUD #1	55	55	58	61	64	71	77	77
Sienna Plantation MUD #2	5,477	5,477	5,477	5,477	5,477	5,477	5,477	5,477
Sienna Plantation MUD #3	7,537	7,537	7,537	7,537	7,537	7,537	7,537	7,537
Sienna Plantation MUD #4, 5, 6, 7	0	1,842	7,982	17,192	26,402	30,700	30,700	30,700
Sienna Plantation MUD #10	4,224	5,514	6,128	6,742	7,356	7,469	7,469	7,469
Sienna Plantation MUD #12	464	721	1,679	3,337	4,369	4,418	4,418	4,418
Sienna Plantaion MUD #13	0	0	507	1,351	2,195	3,039	3,666	3,666
Fort Bend County MUD #129	3,116	4,491	4,759	4,759	4,759	4,759	4,759	4,759
Fort Bend County MUD #149	384	2,978	5,219	5,219	5,219	5,219	5,219	5,219
Blue Ridge West MUD	7,657	7,684	7,696	7,696	7,696	7,696	7,696	7,703
First Colony MUD #9	8,218	8,372	8,525	8,679	8,832	8,986	9,139	10,131
Fort Bend County MUD #115	1,682	1,741	1,781	1,781	1,781	1,781	1,781	1,781
Fort Bend County MUD #26	4,556	4,556	4,574	4,605	4,636	4,666	4,697	6,585
Fort Bend County MUD #42	4,000	4,323	4,626	4,626	4,626	4,626	4,626	4,626
Fort Bend County MUD #46	2,367	2,947	3,177	3,177	3,177	3,177	3,177	3,294
Fort Bend County MUD #47	1,636	2,533	2,892	2,892	2,892	2,892	2,892	3,070
Fort Bend County MUD #48	1,946	1,968	2,198	2,570	2,938	3,306	3,675	4,206
Fort Bend County MUD #49	1,044	1,093	1,117	1,136	1,151	1,167	1,182	1,216
Meadowcreek MUD	2,726	2,864	2,895	2,926	2,956	2,987	3,018	3,024
Palmer Plantation MUD #1	1,839	2,088	2,155	2,170	2,186	2,201	2,217	2,450
Palmer Plantation MUD #2	2,496	2,677	2,745	2,775	2,806	2,837	2,867	3,070
Quail Valley Utility District	13,579	13,579	13,603	13,858	13,858	13,858	13,858	13,858
Thunderbird Utility District	5,882	5,882	5,901	5,931	5,962	5,993	6,023	6,097
Mustang Bayou USA	1,992	4,114	6,294	8,473	9,345	9,345	9,345	9,756
Mustang Bayou USA Phase 2	0	0	4,191	11,175	18,159	25,143	27,922	27,922
Harris County MUD #122	1,259	1,474	1,689	1,910	2,128	2,192	2,192	2,192
Southwest Harris County MUD #1	1,618	2,100	2,585	3,070	3,552	4,037	4,037	4,037
Harris County WC&ID - Fondren Road	3,122	3,463	3,844	4,326	4,709	4,808	4,808	4,808
Total Estimated Population	**89,088**	**102,329**	**122,293**	**146,141**	**167,690**	**181,538**	**185,855**	**190,536**

The comparisons between population numbers from the various sources of population data are presented in Table 1-5. As shown in this table the population estimates only vary slightly from each other and the Census total; therefore, given the reasons for the differences as noted previously, the population numbers were assumed to be accurate.

Table 1-5
Comparison of Population Estimates

Population Source	2010	2015	2020	2025	2030	2035	2040
Joint GRP Population Estimate	94,100	110,796	127,887	147,732	166,282	N/A	N/A
TWDB Population Estimate[1]	97,432	N/A	119,825	N/A	140,479	N/A	161,405
Study Population Estimates	89,088	102,329	122,293	146,141	167,690	181,538	185,855
2010 Census Count	81,079						

Notes:
1 - TWDB Population Estimates were taken from the 2011 Regional Water Plan for Region H. Available online at http://www.twdb.state.tx.us/wrpi/rwp/rwp.asp

1.7 Current and Projected Water Demand

A key step in this Study is the development of population/water demands projections for each entity in the Study area. Data on existing water usage was collected from several sources to form the basis of the projections for future demand. Data from the Joint GRP was used, along with additional data acquired from the utility districts not participating in the Joint GRP, to prepare the existing and projected water demands within the Study area.

In using the same process as the Joint GRP, the average water usage per connection per month was multiplied by the total number of connections. The monthly water usage for all districts was summed and multiplied by 12 months to obtain the annual water usage. The data for the average water usage per connection was obtained from the Joint GRP, or directly from the utility districts, if provided.

Table 1-6
Current and Projected Monthly Water Demand

District	Average Usage Per Connection Per Month (Gallons)	Current Water Demand (2010)	2015	2020	2025	2030	2035	2040	Build Out Water Demand
Sienna Plantation Management District	64,350	4,440,150	5,405,400	9,652,500	14,478,750	19,305,000	24,131,250	28,957,500	29,150,550
Sienna Plantation MUD #1	81,425	1,465,650	1,465,650	1,547,075	1,628,500	1,709,925	1,872,775	2,035,625	2,035,625
Sienna Plantation MUD #2	14,618	26,078,512	26,078,512	26,078,512	26,078,512	26,078,512	26,078,512	26,078,512	26,078,512
Sienna Plantation MUD #3	14,618	35,887,190	35,887,190	35,887,190	35,887,190	35,887,190	35,887,190	35,887,190	35,887,190
Sienna Plantation MUD #4, 5, 6, 7	14,618	0	8,770,800	38,006,800	81,860,800	125,714,800	146,180,000	146,180,000	146,180,000
Sienna Plantation MUD #10	14,618	20,114,368	26,253,928	29,177,528	32,101,128	35,024,728	35,565,594	35,565,594	35,565,594
Sienna Plantation MUD #12	14,618	2,207,318	3,435,230	7,996,046	15,889,766	20,801,414	21,035,302	21,035,302	21,035,302
Sienna Plantation MUD #13	14,618	0	0	2,411,970	6,431,920	10,451,870	14,471,820	17,453,892	17,453,892
Fort County Bend MUD #129	22,008	22,338,120	32,197,704	34,112,400	34,112,400	34,112,400	34,112,400	34,112,400	34,112,400
Fort Bend County MUD #149	11,873	1,484,125	11,516,810	20,184,100	20,184,100	20,184,100	20,184,100	20,184,100	20,184,100
Blue Ridge West MUD	11,538	28,775,772	28,879,614	28,925,766	28,925,766	28,925,766	28,925,766	28,925,766	28,948,842
First Colony MUD #9	12,372	33,119,844	33,738,444	34,357,044	34,975,644	35,594,244	36,212,844	36,831,444	40,827,600
Fort Bend County MUD #115	22,008	12,060,384	12,478,536	12,764,640	12,764,640	12,764,640	12,764,640	12,764,640	12,764,640
Fort Bend County MUD #26	8,393	12,455,212	12,455,212	12,505,570	12,589,500	12,673,430	12,757,360	12,841,290	18,002,985
Fort Bend County MUD #42	12,825	16,710,975	18,057,600	19,327,275	19,327,275	19,327,275	19,327,275	19,327,275	19,327,275
Fort Bend County MUD #46	16,620	12,814,020	15,955,200	17,201,700	17,201,700	17,201,700	17,201,700	17,201,700	17,833,260
Fort Bend County MUD #47	12,783	6,813,339	10,545,975	12,041,586	12,041,586	12,041,586	12,041,586	12,041,586	12,783,000
Fort Bend County MUD #48	12,783	8,104,422	8,193,903	9,152,628	10,699,371	12,233,331	13,767,291	15,301,251	17,512,710

District	Average Usage Per Connection Per Month (Gallons)	Current Water Demand (2010)	2015	2020	2025	2030	2035	2040	Build Out Water Demand
Fort Bend County MUD #49	26,448	8,992,320	9,415,488	9,627,072	9,785,760	9,918,000	10,050,240	10,182,480	10,473,408
Meadowcreek MUD	8,762	7,780,656	8,174,946	8,262,566	8,350,186	8,437,806	8,525,426	8,613,046	8,630,570
Palmer Plantation MUD #1	26,448	15,842,352	17,984,640	18,566,496	18,698,736	18,830,976	18,963,216	19,095,456	21,105,504
Palmer Plantation MUD #2	14,003	11,384,439	12,210,616	12,518,682	12,658,712	12,798,742	12,938,772	13,078,802	14,003,000
Quail Valley Utility District	10,940	48,387,620	48,387,620	48,475,140	49,383,160	49,383,160	49,383,160	49,383,160	49,383,160
Thunderbird Utility District	10,344	19,819,104	19,819,104	19,881,168	19,984,608	20,088,048	20,191,488	20,294,928	20,543,184
Mustang Bayou USA	11,873	7,705,577	15,909,820	24,339,650	32,769,480	36,141,412	36,141,412	36,141,412	37,732,394
Mustang Bayou USA Phase 2	11,873	0	0	16,206,645	43,217,720	70,228,795	97,239,870	107,984,935	107,984,935
Harris County MUD #122	8,190	3,357,900	3,931,200	4,504,500	5,094,180	5,675,670	5,847,660	5,847,660	5,847,660
Southwest Harris County MUD #1	5,310	2,798,370	3,632,040	4,471,020	5,310,000	6,143,670	6,982,650	6,982,650	6,982,650
Harris County WC&ID - Fondren Road	6,750	6,864,750	7,614,000	8,451,000	9,510,750	10,354,500	10,570,500	10,570,500	10,570,500
Total Monthly Water Demand (Gallons)		**377,802,489**	**438,395,182**	**526,634,269**	**631,941,840**	**728,032,690**	**789,351,799**	**810,900,096**	**828,940,442**
Total Water Demand (MGD)		**12.4**	**14.4**	**17.3**	**20.8**	**23.9**	**26.0**	**26.7**	**27.3**

1.8 Current and Projected Wastewater Production

Wastewater production was estimated as a percentage of the average water demand and was assumed to remain at a constant rate through the Study period. To determine the percentage of wastewater returned to the collection system, the average daily flow of each WWTP was collected from the operators. This average daily flow was divided by the total number of connections served by each WWTP and converted to a monthly usage per connection. This was divided by the average water usage per connection previously used to determine the water demands. The wastewater demand was determined as a percentage of the water demand. These results are summarized in Table 1-7.

Table 1-7
Wastewater Demand as a Percentage of Water Demand

WWTP	Average Daily Wastewater Flow (MGD)	Current Connections Served	Wastewater Average Usage per Connection (GPD)	Wastewater Average Usage per Connection (Gallons/Month)	Water Average Usage per Connection (Gallons/Month)	Percentage of Wastewater Returned to Sewer System
Blue Ridge West MUD WWTP	0.725	2,494	291	8,721	11,538	76%
Fort Bend County MUD #26 WWTP	0.300	1,484	202	6,065	8,393	72%
Harris County MUD #122 WWTP	0.115	410	280	8,415	8,190	103%
Harris County WC&ID - Fondren Rd. WWTP	0.187	1,017	184	5,516	6,750	82%
Mustang Bayou Regional WWTP	0.325	1,816	179	5,369	11,873	45%
Palmer Plantation WWTP	0.325	1,752	186	5,565	22,300	25%
Quail Valley UD WWTP	1.500	7,227	208	6,227	10,015	62%
Sienna North WWTP	0.400	1,445	277	8,304	14,618	57%
Sienna South WWTP	1.100	4,408	250	7,486	14,618	51%
Steep Bank/Flat Bank Regional WWTP	1.500	6,439	233	6,989	16,285	43%
Southwest Harris County MUD #1 WWTP	0.100	527	190	5,693	5,310	107%
Total		**29,019**				
Average			**225**	**6,759**	**11,808**	**57%**

The average wastewater flow is approximately 60 percent of the water demand. This percentage was multiplied by the current and projected water demands from Table 1-6 to reach the current and projected wastewater demands. These wastewater demands are presented in Table 1-8.

Table 1-8
Current and Projected Monthly Wastewater Demand

District	% of Water Returned to Sewer Collection System	Current Wastewater Demand (2010)	2015	2020	2025	2030	2035	2040	Build Out Wastewater Demand
Sienna Plantation Management District	60	2,664,090	3,243,240	5,791,500	8,687,250	11,583,000	14,478,750	17,374,500	17,490,330
Sienna Plantation MUD #1	60	879,390	879,390	928,245	977,100	1,025,955	1,123,665	1,221,375	1,221,375
Sienna Plantation MUD #2	60	15,647,107	15,647,107	15,647,107	15,647,107	15,647,107	15,647,107	15,647,107	15,647,107
Sienna Plantation MUD #3	60	21,532,314	21,532,314	21,532,314	21,532,314	21,532,314	21,532,314	21,532,314	21,532,314
Sienna Plantation MUD #4, 5, 6, 7	60	0	5,262,480	22,804,080	49,116,480	75,428,880	87,708,000	87,708,000	87,708,000
Sienna Plantation MUD #10	60	12,068,621	15,752,357	17,506,517	19,260,677	21,014,837	21,339,356	21,339,356	21,339,356
Sienna Plantation MUD #12	60	1,324,391	2,061,138	4,797,628	9,533,860	12,480,848	12,621,181	12,621,181	12,621,181
Sienna Plantation MUD #13	60	0	0	1,447,182	3,859,152	6,271,122	8,683,092	10,472,335	10,472,335
Fort Bend County MUD #129	60	13,402,872	19,318,622	20,467,440	20,467,440	20,467,440	20,467,440	20,467,440	20,467,440
Fort Bend County MUD #149	60	890,475	6,910,086	12,110,460	12,110,460	12,110,460	12,110,460	12,110,460	12,110,460
Blue Ridge West MUD	60	17,265,463	17,327,768	17,355,460	17,355,460	17,355,460	17,355,460	17,355,460	17,369,305
First Colony MUD #9	60	19,871,906	20,243,066	20,614,226	20,985,386	21,356,546	21,727,706	22,098,866	24,496,560
Fort Bend County MUD #115	60	7,236,230	7,487,122	7,658,784	7,658,784	7,658,784	7,658,784	7,658,784	7,658,784
Fort Bend County MUD #26	60	7,473,127	7,473,127	7,503,342	7,553,700	7,604,058	7,654,416	7,704,774	10,801,791
Fort Bend County MUD #42	60	10,026,585	10,834,560	11,596,365	11,596,365	11,596,365	11,596,365	11,596,365	11,596,365
Fort Bend County MUD #46	60	7,688,412	9,573,120	10,321,020	10,321,020	10,321,020	10,321,020	10,321,020	10,699,956
Fort Bend County MUD #47	60	4,088,003	6,327,585	7,224,952	7,224,952	7,224,952	7,224,952	7,224,952	7,669,800
Fort Bend County MUD #48	60	4,862,653	4,916,342	5,491,577	6,419,623	7,339,999	8,260,375	9,180,751	10,507,626
Fort Bend County MUD #49	60	5,395,392	5,649,293	5,776,243	5,871,456	5,950,800	6,030,144	6,109,488	6,284,045
Meadowcreek MUD	60	4,668,394	4,904,968	4,957,540	5,010,112	5,062,684	5,115,256	5,167,828	5,178,342
Palmer Plantation MUD #1	60	9,505,411	10,790,784	11,139,898	11,219,242	11,298,586	11,377,930	11,457,274	12,663,302
Palmer Plantation MUD #2	60	6,830,663	7,326,370	7,511,209	7,595,227	7,679,245	7,763,263	7,847,281	8,401,800
Quail Valley Utility District	60	29,032,572	29,032,572	29,085,084	29,629,896	29,629,896	29,629,896	29,629,896	29,629,896
Thunderbird Utility District	60	11,891,462	11,891,462	11,928,701	11,990,765	12,052,829	12,114,893	12,176,957	12,325,910
Mustang Bayou USA	60	4,623,346	9,545,892	14,603,790	19,661,688	21,684,847	21,684,847	21,684,847	22,639,436
Mustang Bayou USA Phase 2	60	0	0	9,723,987	25,930,632	42,137,277	58,343,922	64,790,961	64,790,961
Harris County MUD #122	60	2,014,740	2,358,720	2,702,700	3,056,508	3,405,402	3,508,596	3,508,596	3,508,596
Southwest Harris County MUD #1	60	1,679,022	2,179,224	2,682,612	3,186,000	3,686,202	4,189,590	4,189,590	4,189,590
Harris County WC&ID - Fondren Road	60	4,118,850	4,568,400	5,070,600	5,706,450	6,212,700	6,342,300	6,342,300	6,342,300
Total Monthly Wastewater Demand (Gallons)		**226,681,493**	**263,037,109**	**315,980,561**	**379,165,104**	**436,819,614**	**473,611,079**	**486,540,058**	**497,364,265**
Total Wastewater Demand (MGD)		**7.5**	**8.6**	**10.4**	**12.5**	**14.4**	**15.6**	**16.0**	**16.4**

1.9 Existing Water Facilities

The existing water production and distribution facilities vary throughout the Study area. This is largely because each entity was created and developed at different times, with different growth rates, and with different design criteria. The various ages, technologies and design methods can also be attributed to these reasons. The data for the existing infrastructure described herein, was developed from information provided by each utility district, the City's GIS database and from the Texas Commission on Environmental Quality (TCEQ).

However, more detailed information on the age, condition and remaining useful life of the individual water plants and various distribution system components was not readily available during the development of this Study. The City is in the process of updating their GIS database with specific data on the age and capacity of all the existing components and it will be available in the future for more detailed master planning and design efforts. Data that was collected and considered on the existing water wells, WTPs and the various utility district distribution systems is presented in this section.

1.9.1 Existing Water Wells

The majority of the water supplied to the utility districts within the Study area comes from groundwater. Currently only a few of the northernmost utility districts are receiving surface water from the City of Houston, which include Harris County WC&ID - Fondren Road, Southwest Harris County MUD #1 and Harris County MUD #122. Almost all of the districts operate their own wells as a means to supply this groundwater. There are a total of 28 existing public wells within the Study area. Data on the wells was obtained from the Joint GRP and the utility districts and is presented in Table 1-9. A map of these wells is contained in Exhibit 1-3. The wells located in Fort Bend County are identified by the FBSD well number and the wells located in Harris County are identified by the TWDB state well number.

Table 1-9 Existing Water Wells							
	District	**Well #**	**Location**	**Drill Date**	**Depth**	**Tested GPM**	**Rated GPM**
1	Sienna Plantation MUD #1	812	Murray Ct.	N/A	N/A	N/A	N/A
2	"	958	McMahon Way	N/A	N/A	N/A	N/A
3	"	1194	Scanlan Trace	7/20/2005	1930	1200	1200
4	"	1078	Mckever Rd.	1/15/2004	1311	1566	1500
5	"	1258	7738 ½ Fallen Leaf	7/23/2008	1930	1520	1500
6	Blue Ridge West MUD	105	1415 FM 2234	1/10/1975	1262	1461	1400
7	"	106	903 Manor Glen	1980	772	542	500
8	First Colony MUD #9	279	Ringrose Dr.	5/15/1984	1205	2170	2100
9	Fort Bend MUD #115	1025	20425 University Blvd.	9/12/2001	923	1510	1905
10	Fort Bend MUD #149	1335	5603 1/2 Rising Walk Lane	11/18/2009	1140	0	1711
11	Fort Bend MUD #26	1228	1812 Fresh Meadows	1/9/2006	1150	1694	1600
12	Fort Bend MUD #42	234	1819 1/2 Lake Winds	10/23/1984	1092	1595	1700
13	Fort Bend MUD #46	170	4835 Thompson Ferry Rd.	5/17/1985	1065	1000	1000
14	Fort Bend MUD #47 & #48	149	Senior Rd.	10/24/1983	600	1000	1000
15	Meadowcreek MUD	944	3100 N. Park	9/11/2000	1106	815	800
16	Palmer Plantation MUD #1	264	4335 Crown Valley	5/13/1983	1225	1168	1000
17	Palmer Plantation MUD #2	867	1603 Lake Olympia Pkwy	1983	1225	1200	1200
18	Quail Valley Utility District	257	2935 Blue Lakes Ln.	1977	1320	1300	2100
19	"	258	2935 Blue Lakes Ln.	1969	1200	0	500
20	"	259	2143 Cartwright	1972	1077	1353	1400
21	"	260	1930 Rothwell	1978	1325	2252	2300
22	Thunderbird Utility District	261	6605 Highway 6	1972	1074	1170	1200
23	"	262	3003 Glenn Lakes Dr.	1976	1157	849	850
24	"	263	1455 Turtle Creek	1975	1314	674	800
25	Southwest Harris County MUD #1	6520912	7843 LaRochelle	5/13/1980	772	520	500
26	Harris County WC&ID - Fondren Road	6520909	11802 McClain	11/12/1970	1167	1234	1260
27	"	6520915	13455 Beltway 8	3/13/1987	980	855	850
28	Missouri City	1203	Watts Plantation Dr.	9/1/2005	1384	2163	2200

1.9.2 Existing Water Plants

There are currently 24 WTPs operating within the Study area. In addition to these plants, the City is currently constructing a RWTP located in Sienna Plantation. This plant will begin operations around the first of the year 2012. As the City works toward regionalizing water treatment in the southern part of the City as per the recommendations from the Joint GRP, some of the existing utility district GWTPs will convert from groundwater to surface water usage. It is intended that the converting utilities will still maintain operation of their respective GWTPs. However, instead of pumping and treating groundwater, the converting GWTPs will now receive treated surface water from the City's new RWTP, though the remaining storage and pumping efforts at each WTP will remain the same. Therefore, while the southern utility district WTPs will no longer operate on groundwater continuously, the administration and operation of these WTPs will still remain the responsibility of the existing utility districts. A detailed plan for the RWTP is presented in Section 2.1.1. Exhibit 1-4 shows the location of the existing WTPs within the Study area.

Table 1-10
Existing WTPs

Number	Name	Location	Current Permitted Capacity
1	Blue Ridge West MUD WTP #1	1415 FM 2234	3.168 MGD
2	Blue Ridge West MUD WTP #2	903 Manor Glen	
3	First Colony MUD #9 WTP	Ringrose Dr.	3.024 MGD
4	Fort Bend County MUD #26 WTP	1812 Fresh Meadows	2.728 MGD
5	Fort Bend County MUD #42 WTP	1819 1/2 Lake Winds	2.304 MGD
6	Fort Bend County MUD #46 WTP	4835 Thompson Ferry Rd.	1.440 MGD
7	Fort Bend County MUD #115 WTP	20425 Universtiy Blvd.	2.174 MGD
8	Fort Bend County MUD #149 WTP	Maverick Bend Ln.	0.648 MGD
9	Harris County WC&ID - Fondren Road WTP #1	11802 1/2 McClain Blvd.	3.760 MGD
10	Harris County WC&ID - Fondren Road WTP #2	9380 S. Sam Houston Pkwy. W.	
11	Meadowcreek MUD WTP	3100 N. Park	1.158 MGD
12	Mustang Bayou WTP	Watts Plantation	3.159 MGD
13	Palmer Plantation MUD #1 WTP	4335 Crown Valley	2.138 MGD
14	Palmer Plantation MUD #2 WTP	1603 Lake Olympia Pkwy.	1.728 MGD
15	Quail Valley Utility District WTP #1	2935 Blue Lakes Ln.	8.524 MGD
16	Quail Valley Utility District WTP #2	2143 Cartwright	
17	Quail Valley Utility District WTP #3	1930 Rothwell	

Number	Name	Location	Current Permitted Capacity
18	Sienna WTP #1	Murray Ct.	7.380 MGD
19	Sienna WTP #2	Mckeever	
20	Southwest Harris County MUD #1 WTP	7843 Larochelle Cr.	0.748 MGD
21	Thunderbird Utility District (System 1) WTP #1	6605 Highway 6	3.060 MGD
22	Thunderbird Utility District (System 1) WTP #2	3003 Glenn Lakes Dr.	
23	Thunderbird Utility District (System 2) WTP #1	1455 Turtle Creek	0.959 MGD
24	Vicksburg Joint Powers WTP	2775 Senior Rd.	1.440 MGD
Total Permitted Capacity = 49.540 MGD			

1.9.3 Existing Water Distribution System

The existing water distribution system throughout the Study area consists of approximately 410 miles of water transmission and distribution piping of various sizes, types and ages. Each utility district is responsible for construction and maintenance of its individual distribution system. Age, condition, type and sizing of water lines were evaluated in this Study only to the extent of determining necessary improvements when considering potential consolidation alternatives. Further evaluation of the individual systems would require the development of a City-wide system model, which was not included in the scope of this Study.

In addition to the normal distribution piping for each utility district water system, interconnections have been constructed between many of the existing distribution systems. These interconnections provide the capability to transfer treated water from one utility district to another. An interconnection to another utility district could be utilized as the main source of treated water for a district, or it could be utilized only in case of emergency. See Exhibit 1-4 for a map of the existing distribution lines and Exhibit 1-5 for the locations of existing system interconnections and major transmission lines throughout the Study area. Each interconnection on Exhibit 1-5 has been numbered and information about each interconnection can be found in Table 1-11.

Storage was also evaluated throughout the City's water system with regard to other potential improvements in efficiency and/or safety. The TCEQ has specific requirements with regard to minimum provided ground storage and elevated or pressure storage for water systems in Texas. TCEQ has a minimum requirement of 200 gallons of total storage per connection, with half of the storage capacity (100 gallons per connection) being provided either as elevated storage (from an elevated storage tank) or as pressure storage (from a hydropneumatic tank).

Two issues were observed in the review of water storage in the existing utility district WTPs located throughout the Study area. The first issue is that insufficient ground storage was available at several of the WTPs though construction and active operation of interconnections with nearby systems can alleviate the demand for individual ground storage in many cases.

A second issue is the observation that almost all of the existing WTPs in the Study area utilize pressure storage via hydropneumatic tanks, which tend to be energy-intensive to operate, whereas ESTs require very little energy to operate. Currently, only the Blue Ridge West MUD and Quail Valley UD own and operate EST tanks. Further discussion of ground and pressure/elevated storage is included in Section 2.

Table 1-11
Existing Water System Interconnects

	District		District	Metered Connection (Y or N)	Valved Connection (Y or N)	Valve Position (Open or Closed)	Size	Water Type
1	Mustang Bayou USA	to	Fort Bend County MUD #47 & #48	Y	Y	Closed	12"	GW
2	Mustang Bayou USA	to	Sienna Plantation MUD #1	Y	Y	Closed	24"	GW
3	Fort Bend County MUD #129	to	Fort Bend County MUD #149	N	Y	Open	12"	GW
4	Fort Bend County MUD #129	to	Fort Bend County MUD #149	N	Y	Open	12"	GW
5	Fort Bend County MUD #49	to	Palmer Plantation MUD #1 & #2	N	N	Open	12"	GW
6	Fort Bend County MUD #129	to	Fort Bend County MUD #115	N	Y	Open	12"	GW
7	Fort Bend County MUD #46	to	Palmer Plantation MUD #1 & #2	N	Y	Closed	8"	GW
8	Palmer Plantation MUD #1 & #2	to	Thunderbird Utility District	N	Y	Closed	10"	GW
9	Palmer Plantation MUD #1 & #2	to	Thunderbird Utility District	N	Y	Closed	12"	GW
10	Quail Valley Utility District	to	Thunderbird Utility District #1	N	Y	Closed	12"	GW
11	Quail Valley Utility District	to	Palmer Plantation MUD #1 & #2	N	Y	Closed	12"	GW
12	Palmer Plantation MUD #1 & #2	to	Quail Valley Utility District	N	Y	Closed	8"	GW
13	Palmer Plantation MUD #1 & #2	to	Quail Valley Utility District	N	Y	Closed	12"	GW
14	Quail Valley Utility District	to	Thunderbird Utility District #2	N	Y	Closed	8"	GW
15	Quail Valley Utility District	to	Thunderbird Utility District #2	N	Y	Closed	8"	GW
16	Quail Valley Utility District	to	Thunderbird Utility District #2	N	Y	Closed	6"	GW
17	Quail Valley Utility District	to	Thunderbird Utility District #1	N	Y	Closed	8"	GW
18	Quail Valley Utility District	to	Thunderbird Utility District #1	N	Y	Closed	8"	GW
19	Quail Valley Utility District	to	Thunderbird Utility District #1	N	Y	Closed	6"	GW
20	Thunderbird Utility District	to	First Colony MUD #9	N	Y	Open	12"	GW
21	Fort Bend County MUD #46	to	Fort Bend County MUD #115	N	Y	Open	12"	GW

	District		District	Metered Connection (Y or N)	Valved Connection (Y or N)	Valve Position (Open or Closed)	Size	Water Type
22	Fort Bend County MUD #115	to	First Colony MUD #9	N	Y	Open	12"	GW
23	First Colony MUD #9	to	City of Sugar Land	N	Y	Open	12"	GW
24	Quail Valley Utility District	to	Fort Bend WC&ID No. 2	N	Y	Closed	8"	SW
25	Fort Bend County MUD #42	to	First Colony MUD #9	N	Y	Open	12"	GW
26	Meadowcreek MUD	to	Quail Valley Utility District	N	Y	Closed	8"	GW
27	Meadowcreek MUD	to	Quail Valley Utility District	N	Y	Closed	12"	GW
28	Meadowcreek MUD	to	Quail Valley Utility District	N	Y	Closed	12"	GW
29	Meadowcreek MUD	to	Fort Bend County MUD #26	N	Y	Closed	8"	GW
30	Fort Bend County MUD #26	to	Thunderbird Utility District	N	Y	Closed	8"	GW
31	Fort Bend County MUD #26	to	Blue Ridge West MUD	Y	Y	Closed	12"	GW
32	Blue Ridge West MUD	to	Fort Bend County MUD #26	Y	Y	Closed	12"	GW
33	Fort Bend County MUD #42	to	Quail Valley Utility District	N	Y	Closed	12"	GW
34	Fort Bend County MUD #42	to	Quail Valley Utility District	N	Y	Closed	8"	GW
35	Fort Bend County MUD #42	to	Quail Valley Utility District	N	Y	Closed	12"	GW
36	Fort Bend County MUD #42	to	First Colony MUD #9	N	Y	Open	12"	GW
37	Blue Ridge West MUD	to	Fort Bend County WC&ID No. 2	Y	Y	Closed	10"	SW
38	Harris County MUD #122	to	Fort Bend County WC&ID No. 2	Y	Y	Open	12"	SW
39	Harris County MUD #122	to	City of Houston	Y	Y	Closed	12"	SW
40	Southwest Harris County MUD #1	to	Harris County WC&ID - Fondren Road	N	Y	Closed	6"	GW
41	Southwest Harris County MUD #1	to	City of Houston	Y	Y	Open	12"	SW
42	Harris County WC&ID - Fondren Road	to	City of Houston	Y	Y	Open	12"	SW
43	Southwest Harris County MUD #1	to	Harris County WC&ID - Fondren Road	Y	Y	Closed	8"	GW

As more systems change from groundwater sources to surface water sources, the interconnects between the systems should be evaluated. Fort Bend County WC&ID #2 has recently converted from groundwater sources to surface water sources, and the City of Sugar Land is in the process of converting to surface water sources. The disinfection residual in the distribution system for systems using surface water sources is generally chloramines. Many of the systems that utilize groundwater sources use free chlorine in their distribution system. An interconnection between a distribution system utilizing free chlorine with one utilizing chloramines is not advisable since the disinfection residual in the distribution system can no longer be tracked correctly once the chemicals are mixed.

Therefore, interconnects to either Fort Bend County WC&ID #2 or City of Sugar Land would be advisable only with systems that utilize chloramines in their distribution system. Section 2 will include further discussion on the potential disinfection conversion from free chlorine to chloramines at some of the utility districts within the Study area, including the associated costs for conversion.

1.10 Existing Wastewater Facilities

The wastewater infrastructure is similar to the water infrastructure in that each utility district constructs and maintains its own wastewater collection system. However, not all utility districts have an independent WWTP. Some utility districts share capacity in regional WWTPs that are identified in the discussions below.

1.10.1 Existing Wastewater Collection System

The existing wastewater collection system throughout the City consists of approximately 360 miles of gravity lines and 35 miles of force mains. Each utility district is responsible for construction and maintenance of its collection system. Because some of the utility districts share capacity in regional WWTPs, several systems are interconnected. Some of the interconnections are direct gravity lines to a WWTP and some are force mains that transfer wastewater flows from one utility district's lift station into another utility district's collection system to ultimately travel to a regional WWTP. See Exhibit 1-6 for a map of the existing wastewater collection system lines, lift stations and existing system interconnections.

Age, condition, type and sizing of wastewater lines were evaluated in this Study only to the extent of determining necessary improvements when considering potential consolidation alternatives. As with the water systems, further evaluation of the individual wastewater systems would require the development of a City-wide system model, which was not included in the scope of this Study.

One concern brought to our attention during the course of this Study was regarding excessive nutrient loading to the WWTPs. Excessive nutrient loading to WWTPs generally occur in one of two ways. The most common cause of excessive nutrient loading comes from agricultural, commercial and/or industrial wastewater producers, who discharge wastewater with concentrations of nutrients far exceeding those of normal residential wastewater producers. Therefore, when it is determined that a non-residential wastewater producer is discharging wastewater with excessive nutrient loads, either onsite pretreatment requirements should be mandated to that producer, or a pretreatment surcharge needs to be developed for that user, to account for the increased cost of treatment to the specific WWTP as a result of handling that wastewater.

In addition, the TCEQ typically requires a utility-wide pretreatment program to be developed when a utility's wastewater production increases above 5 MGD. In the case of

the City, a pre-treatment program would not be required unless multiple utility district WWTPs were consolidated into a single facility. However, since the current total daily wastewater produced within the Study area already exceeds 5 MGD, development of a pretreatment program by the City and coordinated with the various utility districts may help address excessive nutrient loadings in the wastewater system if the excessive nutrient loading is coming from individual wastewater producers.

The second most common cause of excessive nutrient loading in a wastewater system occurs due to overly conservative pipeline design. When designing gravity collection pipelines, a fine balance must be maintained between sizing large enough to handle projected maximum design flows and ensuring that pipelines provide sufficient velocity at lower flow. A minimum pipeline velocity of 2.0 feet per second (ft/s) or greater (per TCEQ Chapter 217 design criteria) usually keeps all of the solids in the wastewater stream entrained in the liquid stream. If solids dropout occurs due to insufficient velocity, the normal nutrient load in the liquid stream is reduced, which makes the WWTP acclimate to a lower loading rate. When flows increase (frequently during the day or during storm events), the solids that had previously dropped out in the pipelines are now moved downstream to the WWTP which results in a nutrient overload at the WWTP.

1.10.2 Existing Wastewater Lift Stations

Wastewater lift stations have been constructed, where needed, to transfer wastewater flows to the various regional WWTPs from service areas that are not feasible for gravity flow to a WWTP. There are a total of 87 wastewater lift stations currently within the Study area. The City owns 8 lift stations throughout the Study area and the remaining lift stations are owned by the utility districts. Age, condition, type and sizing of wastewater lift stations were evaluated in this Study only to the extent of determining necessary improvements when considering potential consolidation alternatives.

1.10.3 Existing WWTPs

There are 11 existing WWTPs within the Study area. Two of the regional WWTPs are owned by the City (Steep Bank-Flat Bank and Mustang Bayou). The remaining WWTPs are owned by utility districts. Refer to Table 1-12 for a list of these WWTPs and their current permitted capacities. The service area for each WWTP is shown on Exhibit 1-7.

As with many other developer-planned and constructed WWTPs, the majority of the WWTPs in the Study area consist of package treatment plants. Package WWTPs are typically used for small flow (less than 1 MGD) and allow for rapid design and construction. Because package plants are usually designed for a small service area, they are not well suited for larger WWTP demands since multiple treatment trains are usually required for larger demands. For example, the Sienna South Regional WWTP is currently rated for an average flow of 1.2 MGD, though it is based on the operation of 4 simultaneously-operated 0.3 MGD package treatment plants. As a result, the existing

Sienna South WWTP has fairly limited treatment flexibility and requires substantially higher than normal daily operation and maintenance (O&M) efforts.

In addition, package treatment plants typically have much shorter operating lives than more conventional or advanced treatment facilities. Most conventional treatment facilities are designed based on using concrete structures, which typically have a 40-50 year operating life, and equipment is designed for 30-40 years of operation. However, in package treatment plants, the anticipated operating life are frequently intended only for 10-20 years, especially when structures are designed using painted carbon steel.
Each WWTP was evaluated in this Study with respect to rated capacity versus average loading, treatment performance, remaining useful life of structures and equipment, treatment and potential expansion capabilities, potential for reuse, and observed level of annual O&M efforts. Summary tables comparing current conditions at each WWTP within the Study area are provided. Table 1-12 provides an overview of each WWTP. Table 1-13 contains WWTP process summaries of each WWTP. Table 1-14 lists the current operating parameters at each WWTP.

Table 1-12
Existing WWTPs General Summary

Name	General Location	Adjacent WWTPs	WWTP Age (years)	Operating Entity
Blue Ridge West MUD WWTP	Independence Blvd.	None	25	Southwest Water Company (SWWC)
Fort Bend County MUD #26 WWTP	Lazy Spring Dr	Blue Ridge West MUD WWTP	30	Quail Valley UD
Harris County MUD #122 WWTP	Sunset Lane	None	20	Severn Trent Services
Harris County WC&ID - Fondren Road WWTP	East Hampton Cr	Southwest Harris County MUD #1 WWTP	30	Quail Valley UD
Mustang Bayou Regional WWTP	Trammel Fresno Rd	None	20	SWWC
Palmer Plantation WWTP	Lake Olympia Parkway	Steep Bank / Flat Bank WWTP	25	Quail Valley UD
Quail Valley UD/Thunderbird UD WWTP	Blue Lakes Lane	None	35	Quail Valley UD
Sienna North WWTP	Discovery Lane	None	10	SWWC
Sienna South WWTP	Waters Lake Blvd	None	20	SWWC
Southwest Harris County MUD #1 WWTP	Hwy 90a	Harris County WC&ID	20	Severn Trent Services
Steep Bank/Flat Bank Regional WWTP	Oil Field Rd	Palmer Plantation WWTP	10	Quail Valley UD

Table 1-13
Existing WWTP Treatment Process Summary

Name	Process Type	Solids Handling Type	Effluent Reuse Potential[1] (acre-ft per year)	Recent Rehabilitative Work
Blue Ridge West MUD WWTP	Contact stabilization Package[3]	Aerobic digestion, off-site liquid sludge hauling[2]	1,064	None
Fort Bend County MUD #26 WWTP	Conventional Complete-Mix Activated Sludge (CMAS) Package	Aerobic digestion and off-site liquid sludge hauling[2]	336	Emergency conversion to CMAS
Harris County MUD #122 WWTP	CMAS Package	Aerobic digestion and off-site liquid sludge hauling[2]	224	Cleaning & minor repairs
Harris County WC&ID - Fondren Road WWTP	CMAS Package	Aerobic digestion and off-site liquid sludge hauling[2]	112	Cleaning & minor repairs
Mustang Bayou Regional WWTP	3 CMAS Package Trains	Aerobic digestion and off-site liquid sludge hauling[2]	448	New CMAS train added
Palmer Plantation WWTP	CMAS Conventional	Aerobic digestion and off-site liquid sludge hauling[2]	336	None
Quail Valley UD/Thunderbird UD WWTP	Pure O_2	Belt filter press & off-site dewatering sludge hauling[4]	1,232[5]	Cleaning & minor repairs
Sienna North WWTP	3 CMAS Package Trains	Aerobic digestion and off-site liquid sludge hauling[2]	336	None
Sienna South WWTP	4 CMAS Package Trains	Aerobic digestion and off-site liquid sludge hauling[2]	1,232	None
Southwest Harris County MUD #1 WWTP	CMAS Package	Aerobic digestion and off-site liquid sludge hauling[2]	112	Cleaning & minor repairs
Steep Bank/Flat Bank Regional WWTP	Extended aeration conventional	Belt filter press & off-site dewatering sludge hauling[4]	1,680	Expansion from 1.5-3.0 MGD

Notes:
1 - Available amount listed does not include evaporative losses.
2 - This process is energy and O&M intensive.
3 - TCEQ prohibits contact-stabilization process for nitrification.
4 - This process has low energy and O&M usage.
5 - Currently 0.4 MGD is used via Section 210 authorization for golf course irrigation.

Table 1-14
Existing WWTP Operating Parameters

Name	Current Permitted Capacity (MGD)[1,2]	Current Average Loading (MGD)[3]	Treatment Efficiency[4]
Blue Ridge West MUD WWTP	1.3	0.75	58%
Fort Bend County MUD #26 WWTP	0.5	0.3	60%
Harris County MUD #122 WWTP	0.25	0.1	40%
Harris County WC&ID - Fondren Road WWTP	0.6	0.2	33%
Mustang Bayou Regional WWTP	0.95	0.4	40%
Palmer Plantation WWTP	0.6	0.3	50%
Quail Valley UD/Thunderbird UD WWTP	4.0	1.5	38%
Sienna North WWTP	0.9	0.3	33%
Sienna South WWTP	1.2	1.1+	92%
Southwest Harris County MUD #1 WWTP	0.4	0.1	25%
Steep Bank/Flat Bank Regional WWTP	3.0	1.5	50%
Total	**13.75**	**6.55**	

Notes:
1 - Current permitted design capacity based on current average flow rating from TPDES discharge permit on file with TCEQ. However, in some cases, the permitted treatment capacity may be above the actual treatment capability of a specific WWTP.
2 - The permitted effluent limitations for all WWTPs are 10 milligrams per liter (mg/L) biochemical oxygen demand (BOD), 15 mg/L total suspended solids (TSS) and 2-4 mg/L ammonia (NH_3) (ammonia limit added in this permit cycle for several of the WWTPs). NH_3 limit is anticipated to be tightened to 2 mg/L or less for all WWTPs.
3 - Current average loading based on average daily flow rates to each WWTP. Typical peaking factor for influent flows ranges from 1.5-2.0.
4 - The Treatment Efficiency is based on the percentage of the rated capacity. Optimal efficiency (in utilizing operator effort and in energy and chemical usage) is 60-80% of the plant capacity.

Table 1-15
Projected Life of Existing WWTP

Name	Remaining Life of Structures (years)	Remaining Life of Equipment (years)	Remaining Life of WWTP[1, 2] (years)
Blue Ridge West MUD WWTP	10-15	5-10	5-10
Fort Bend County MUD #26 WWTP	10-15	5-10	5-10
Harris County MUD #122 WWTP	5-10	5-10	5-10
Harris County WC&ID - Fondren Road WWTP	10-15	5-10	5-10
Mustang Bayou Regional WWTP	10-15	10-15	10-15
Palmer Plantation WWTP	10-15	5-10	5-10
Quail Valley UD/Thunderbird UD WWTP	5-10	5-10	5-10
Sienna North WWTP	10-15	10-15	10-15
Sienna South WWTP	5-10	5-10	5-10
Southwest Harris County MUD #1 WWTP	10-15	5-10	5-10
Steep Bank/Flat Bank Regional WWTP	30-40	25-30	25-30

Notes:
1 - Overall WWTP useful life without major WWTP rehabilitation or replacement. Limiting factor for package plants with concrete structures is the equipment. Limiting factors for package plants with steel structures are both the structure and the equipment.
2 - Remaining useful life of each existing WWTP listed above does not take into account capability to meet current and/or future permit limits. For example, Harris County MUD #122 WWTP will likely become noncompliant with its new ammonia permit limit once that permit limit goes into effect next summer. So the remaining useful life for that WWTP is actually shorter than what is shown above.

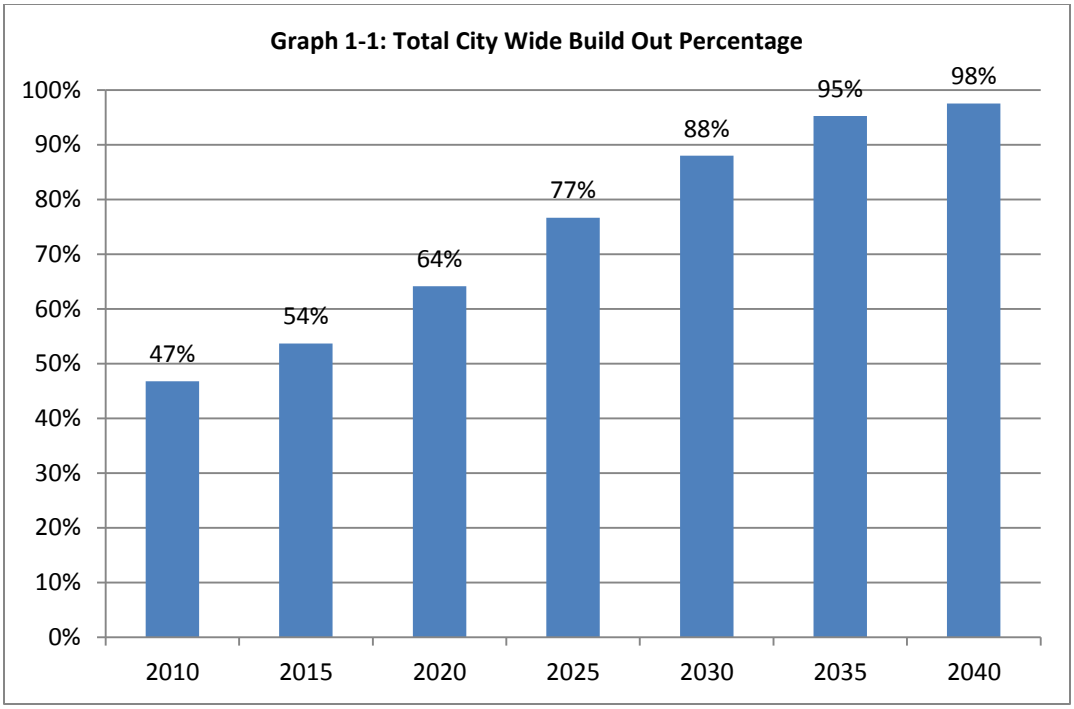
1.11 Projected Growth Patterns

As previously discussed, the City is considered a community of neighborhoods. While many of the older neighborhoods in the northern portions of the City are already built out, many of the southern neighborhoods are still rapidly growing. The City Planning Department has established Development Ordinances along with the City's Zoning and Subdivision Ordinances, which set the guidelines for future growth and redevelopment within the City. The Planning Department has developed a Comprehensive Plan which designates the pattern and intended character of future development. Table 1-16 presents the projected land area of each character district.

Table 1-16 Missouri City Future Land Use & Character		
Designation	**Acreage**	**Percent of Total**
Rural	1,120.6	6.8%
Estate	2,048.7	12.4%
Suburban Residential	2,989.8	18.1%
Single-Family Residential	2,703.4	16.4%
Multi-Family Residential	324.2	2.0%
Suburban Commercial	1,005.4	6.1%
Commercial	1,067.3	6.5%
Urban	98.8	0.6%
Business Park	2,213.9	13.4%
Community Facility	486.5	2.9%
Park & Recreation	1,326.1	8.0%
Water	1,144.3	6.9%
Total	**16,529**	**100.0%**

The majority of the future development within the City will occur in the southern portion of the City within three major subdivisions. These subdivisions are Riverstone, Sienna Plantation and the Sienna South development. These developments have adopted individual master plans in accordance with the City's Comprehensive Plan. In order to estimate areas of future development for each of the Study's five year increments, copies of these master plans were obtained along with traffic impact analyses and discussions with the City's Planning Department Staff. Using this information, Exhibit 1-8 was prepared, which shows the project growth areas throughout the City.

A graphic representation of the City-wide build out percentage was also put together based on the projected connection counts presented in Table 1-3. The build out percentage was determined by dividing the build out connection count by each of the five year planning study increments. The current build out percentage of the City is 46% and is estimated to reach 96% by the year 2040. Complete results are presented in Graph 1-1.

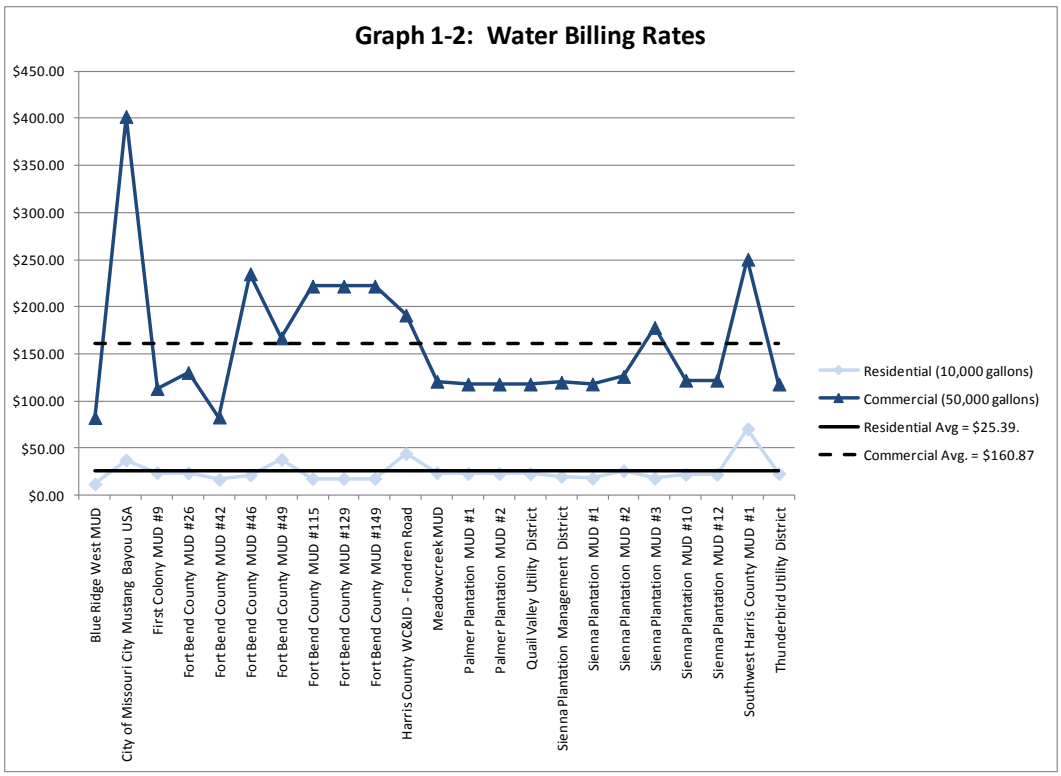


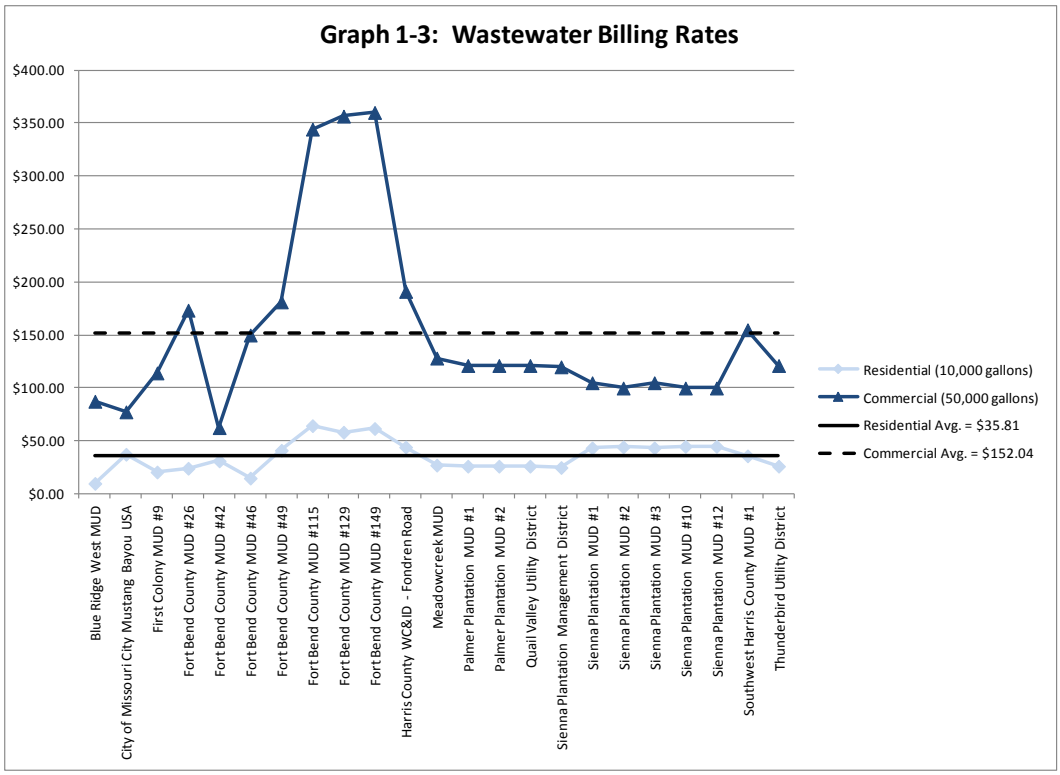
1.12 Current Billing Rates

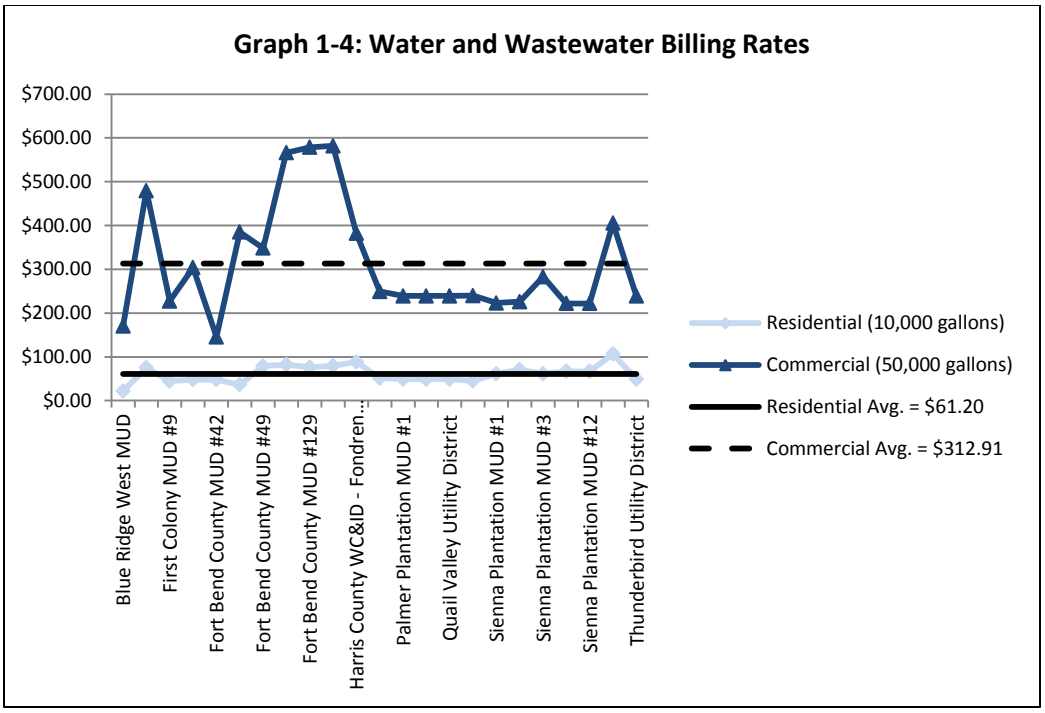
Each utility district individually sets its rates for water and sewer service. Because each district is currently at a different stage of build out, the rates paid by customers vary within the Study area. Newer utility districts that are still constructing additional facilities as they grow and are also continuing to pay back debt on recently constructed facilities have higher rates than the older utility districts which have been completely built out and have repaid all or a large portion of their debt. Each utility district provided its billing rates from water and wastewater, as well as their average monthly usage and amount billed.

1.12.1 Average Water and Wastewater Billed Usage

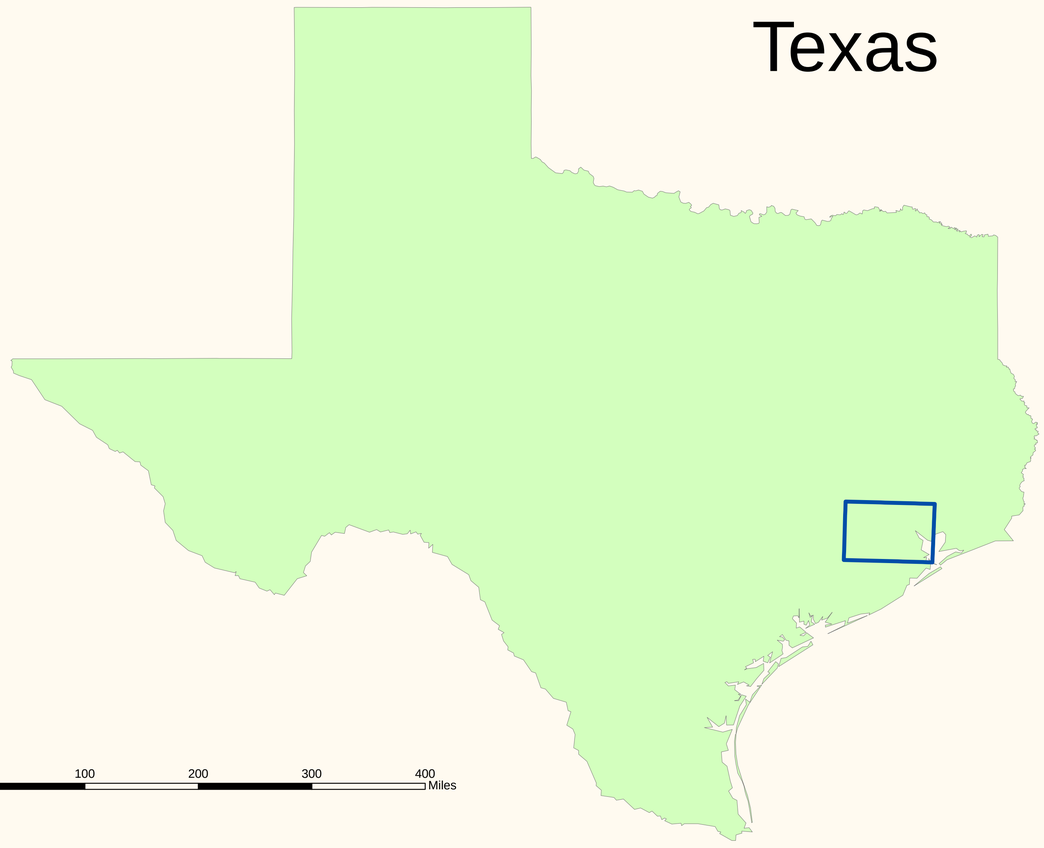
The average monthly water and wastewater usage throughout the Study area was calculated as 10,000 gallons per month for a residential connection and 50,000 gallons per month for a commercial connection. Using the current billing rates for each utility district, the monthly cost for the average usage was calculated to use as a comparison between individual districts. Graph 1-2 and Graph 1-3 show the varying costs in each district for water and wastewater billing rates, respectively. Graph 1-4 shows the combined water and wastewater billing rates for each district.


Graph 1-2: Water Billing Rates
$450.00
$400.00
$350.00
$300.00
$250.00
$200.00
$150.00
$100.00
$50.00
$0.00
Blue Ridge West MUD
City of Missouri City Mustang Bayou USA
First Colony MUD #9
Fort Bend County MUD #26
Fort Bend County MUD #42
Fort Bend County MUD #46
Fort Bend County MUD #49
Fort Bend County MUD #115
Fort Bend County MUD #129
Fort Bend County MUD #149
Harris County WC&ID - Fondren Road
Meadowcreek MUD
Palmer Plantation MUD #1
Palmer Plantation MUD #2
Quail Valley Utility District
Sienna Plantation Management District
Sienna Plantation MUD #1
Sienna Plantation MUD #2
Sienna Plantation MUD #3
Sienna Plantation MUD #10
Sienna Plantation MUD #12
Southwest Harris County MUD #1
Thunderbird Utility District
Residential (10,000 gallons)
Commercial (50,000 gallons)
Residential Avg = $25.39.
Commercial Avg. = $160.87

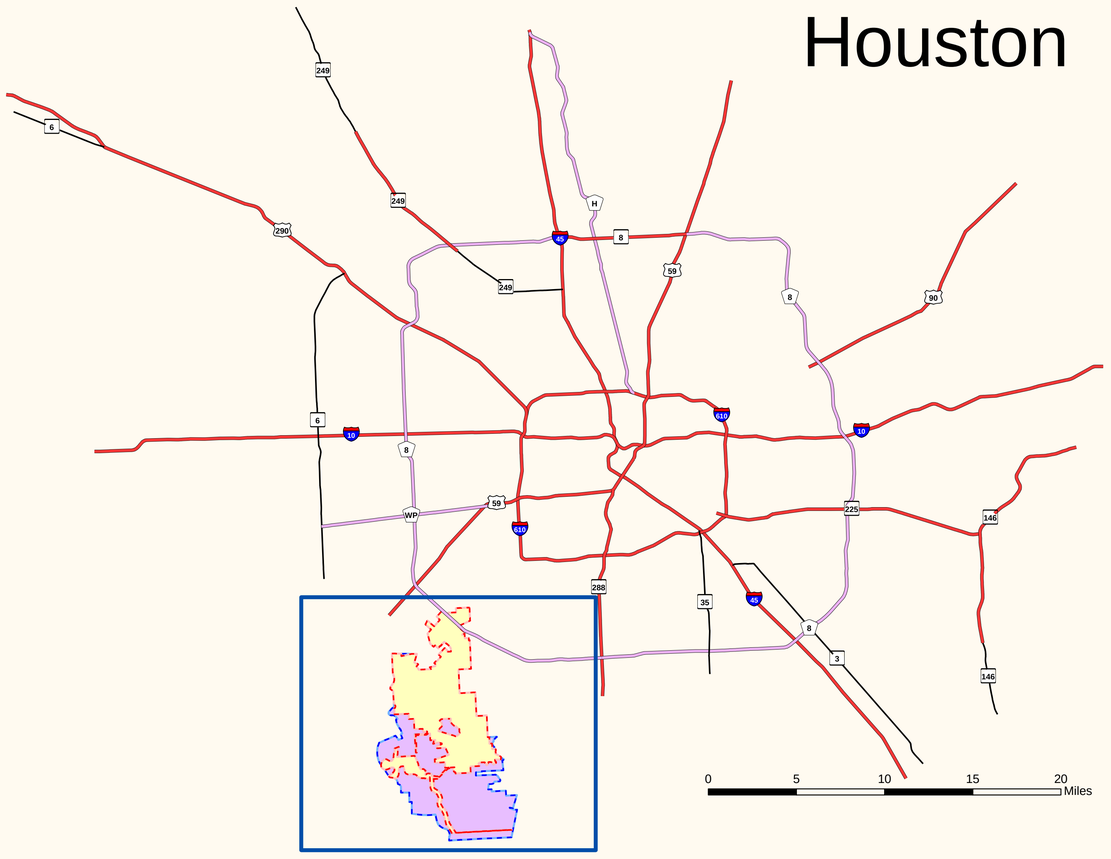

Graph 1-3: Wastewater Billing Rates
$400.00
$350.00
$300.00
$250.00
$200.00
$150.00
$100.00
$50.00
$0.00
Blue Ridge West MUD
City of Missouri City Mustang Bayou USA
First Colony MUD #9
Fort Bend County MUD #26
Fort Bend County MUD #42
Fort Bend County MUD #46
Fort Bend County MUD #49
Fort Bend County MUD #115
Fort Bend County MUD #129
Fort Bend County MUD #149
Harris County WC&ID - Fondren Road
Meadowcreek MUD
Palmer Plantation MUD #1
Palmer Plantation MUD #2
Quail Valley Utility District
Sienna Plantation Management District
Sienna Plantation MUD #1
Sienna Plantation MUD #2
Sienna Plantation MUD #3
Sienna Plantation MUD #10
Sienna Plantation MUD #12
Southwest Harris County MUD #1
Thunderbird Utility District
Residential (10,000 gallons)
Commercial (50,000 gallons)
Residential Avg. = $35.81
Commercial Avg. = $152.04

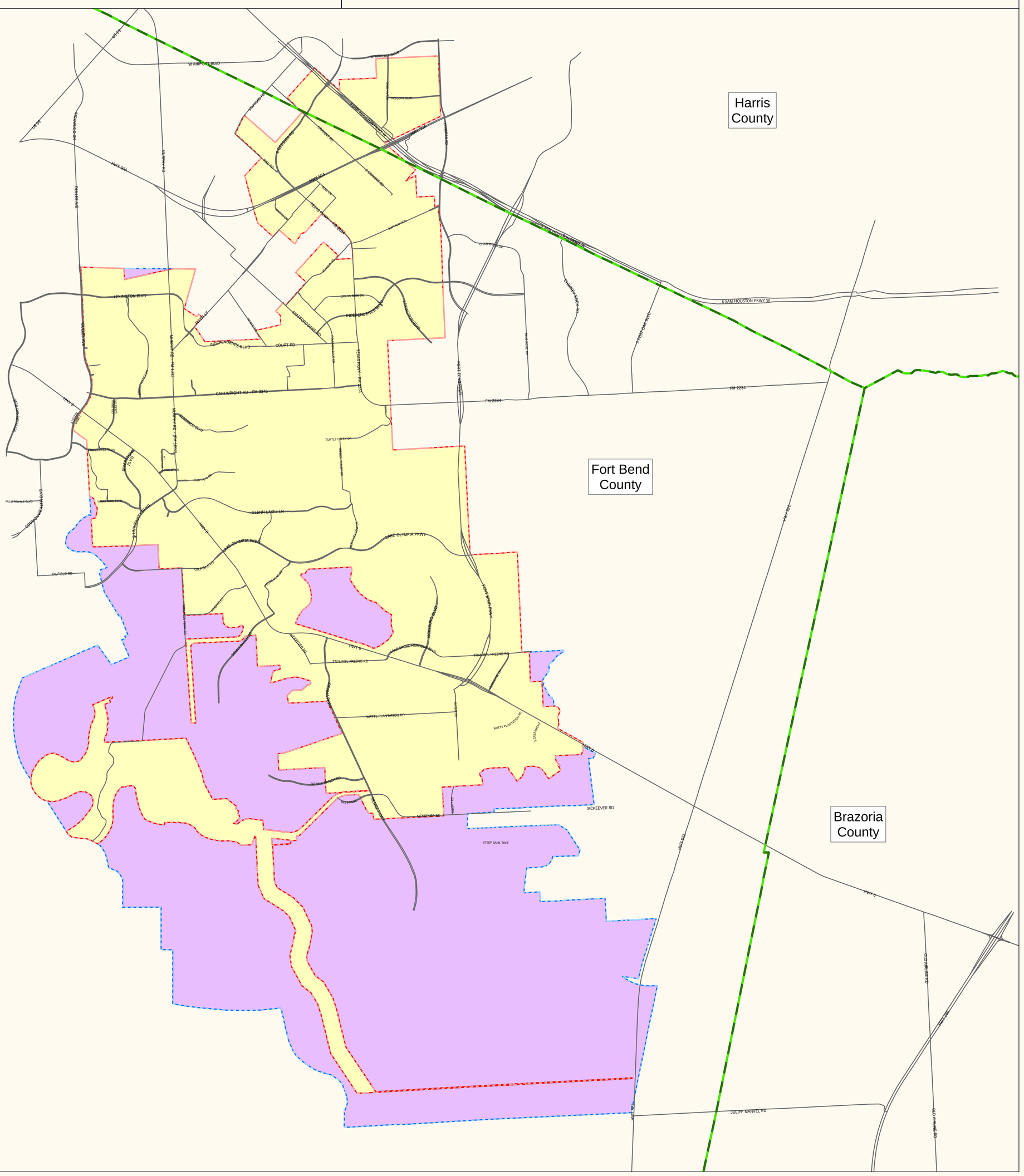

Graph 1-4: Water and Wastewater Billing Rates
$700.00
$600.00
$500.00
$400.00
$300.00
$200.00
$100.00
$0.00
Blue Ridge West MUD
First Colony MUD #9
Fort Bend County MUD #42
Fort Bend County MUD #49
Fort Bend County MUD #129
Harris County WC&ID - Fondren...
Palmer Plantation MUD #1
Quail Valley Utility District
Sienna Plantation MUD #1
Sienna Plantation MUD #3
Sienna Plantation MUD #12
Thunderbird Utility District
Residential (10,000 gallons)
Commercial (50,000 gallons)
Residential Avg. = $61.20
Commercial Avg. = $312.91

Texas



Houston





Map By:
GIS Division
September 2011

Exhibit 1-1 Missouri City Location Map

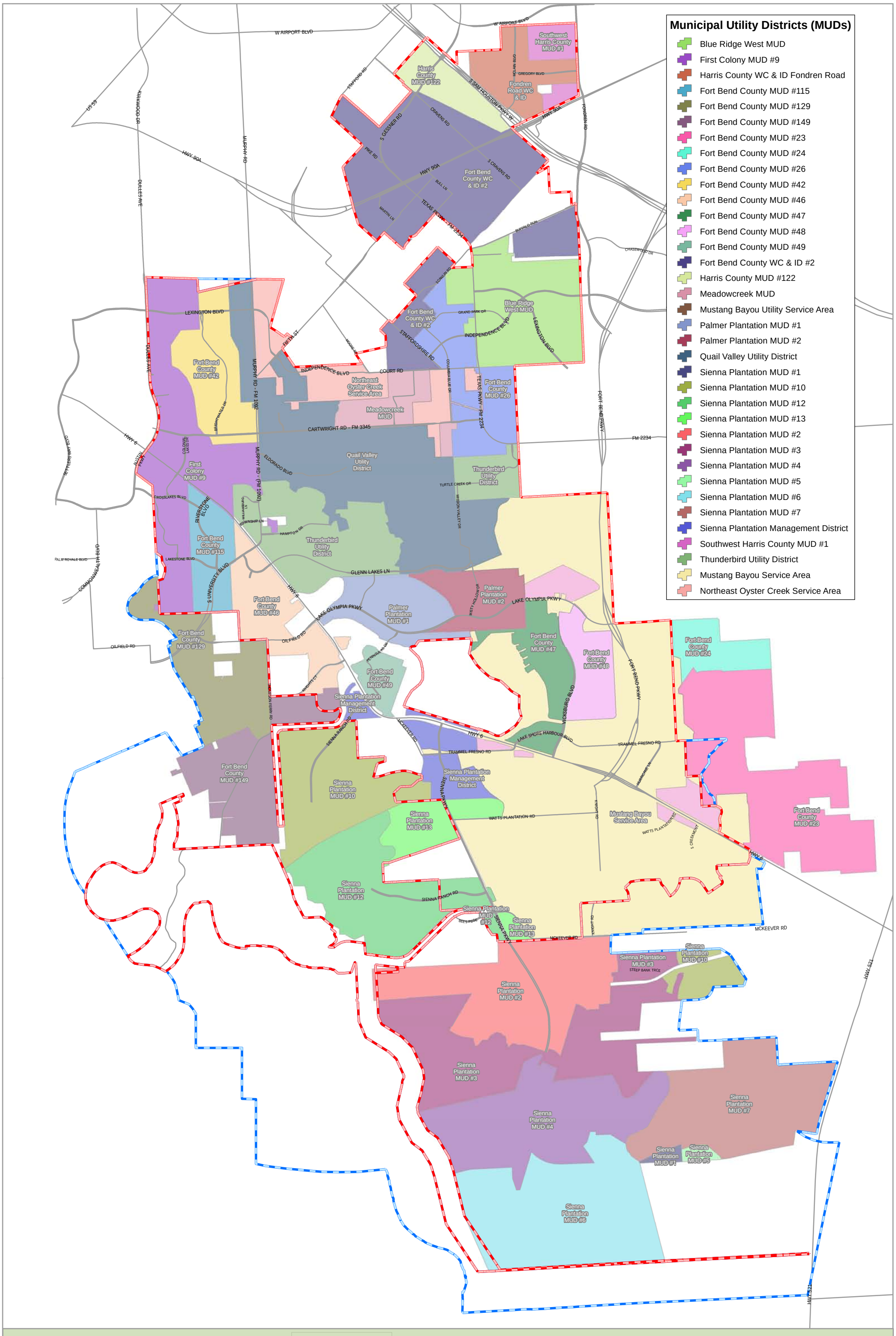
Legend

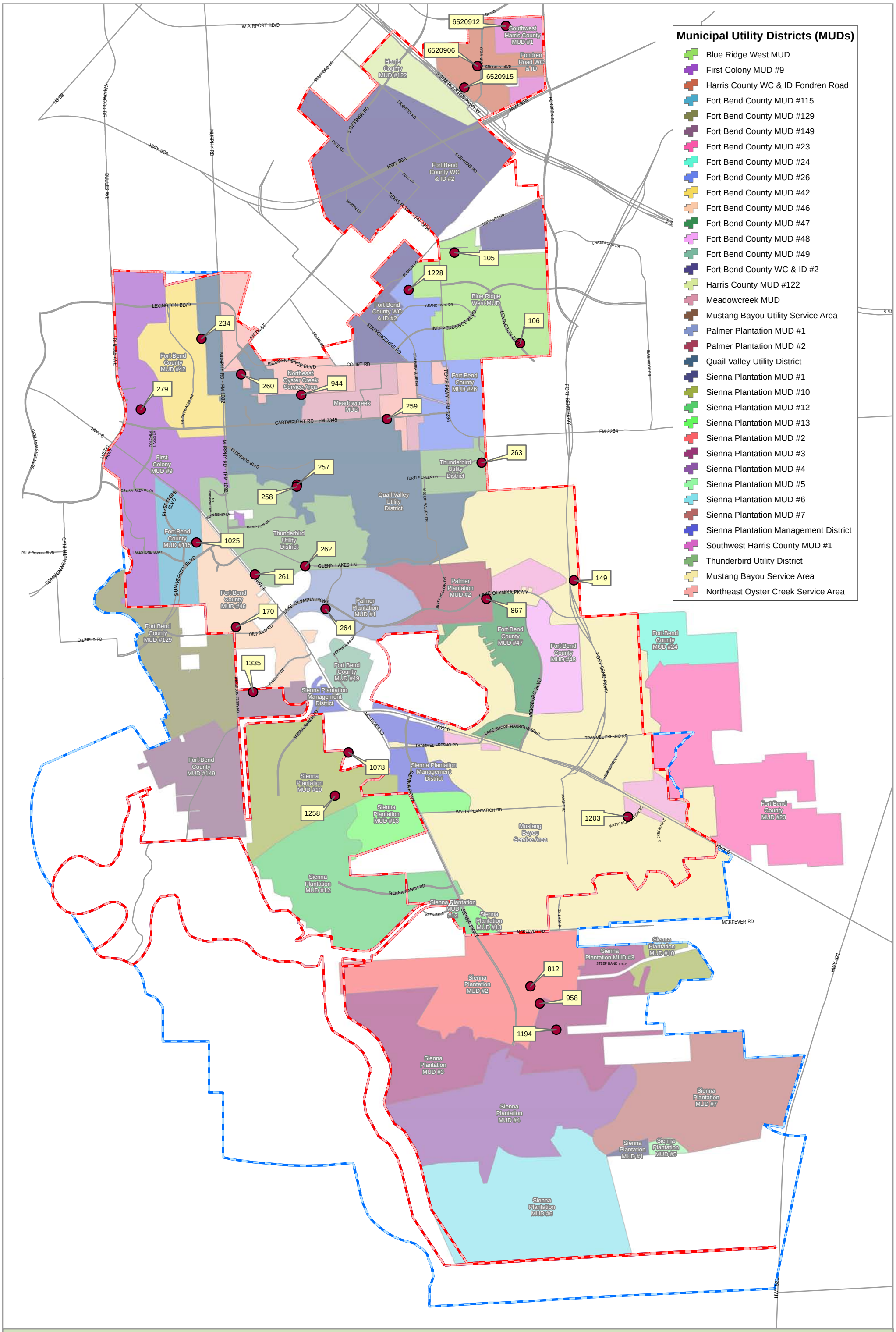
- County Lines
- City Limits
- ETJ

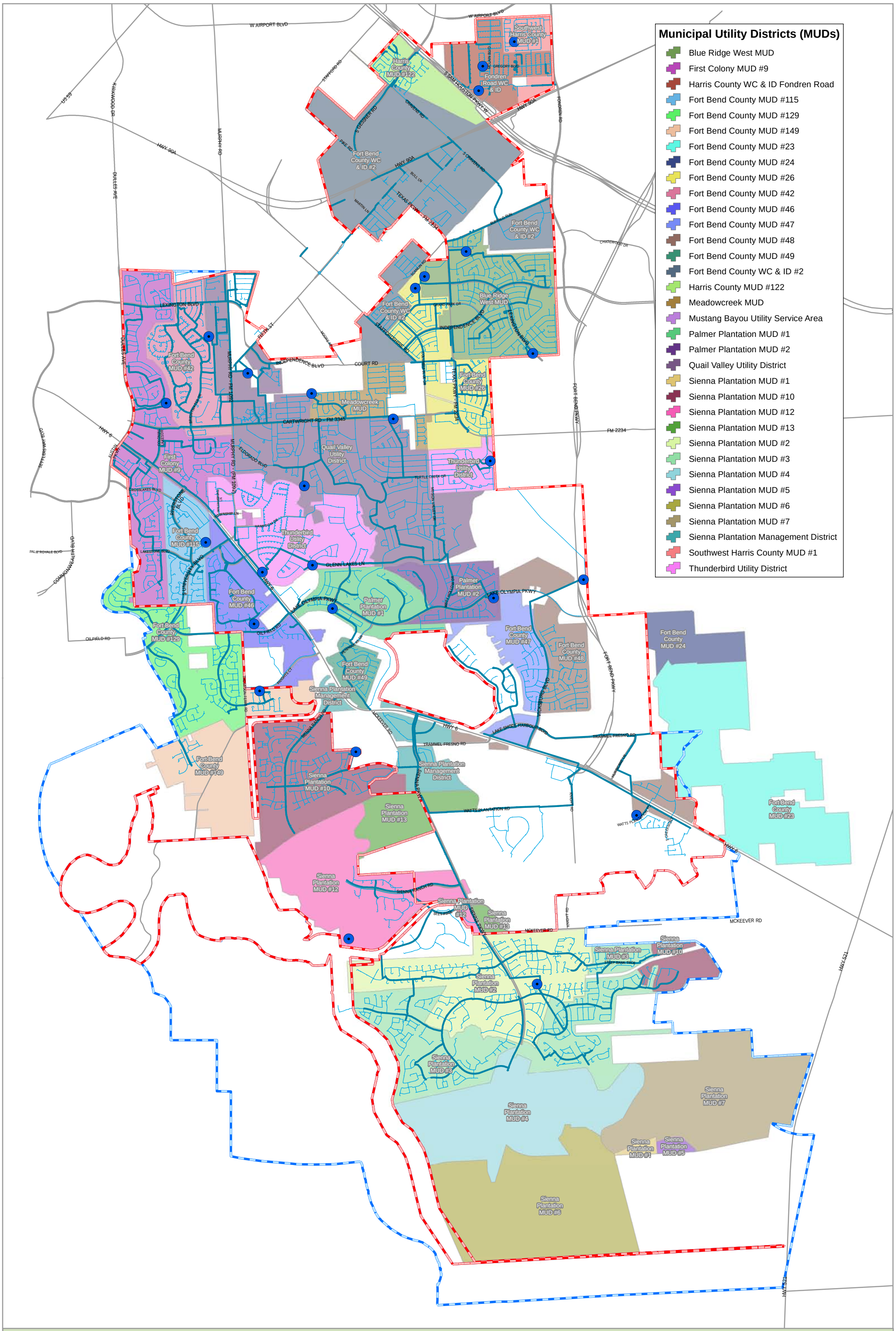
0 4,000 8,000 16,000 24,000 Feet

Geographic Coordinate System North American Datum 1983 (NAD83)

The information on this map is provided and maintained by various agencies, including county departments, municipal governments, state and federal agencies. The map is designed to serve as a secondary representation of real property found within this jurisdiction, and is compiled from the recorded deeds, plats, and other public records, which are primary sources for this public information. The data layers do not take the place of a legal survey or other primary source documentation.The City and its vendors assume no legal responsibility for the information on this map.


Municipal Utility Districts (MUDs)
Blue Ridge West MUD
First Colony MUD #9
Harris County WC & ID Fondren Road
Fort Bend County MUD #115
Fort Bend County MUD #129
Fort Bend County MUD #149
Fort Bend County MUD #23
Fort Bend County MUD #24
Fort Bend County MUD #26
Fort Bend County MUD #42
Fort Bend County MUD #46
Fort Bend County MUD #47
Fort Bend County MUD #48
Fort Bend County MUD #49
Fort Bend County WC & ID #2
Harris County MUD #122
Meadowcreek MUD
Mustang Bayou Utility Service Area
Palmer Plantation MUD #1
Palmer Plantation MUD #2
Quail Valley Utility District
Sienna Plantation MUD #1
Sienna Plantation MUD #10
Sienna Plantation MUD #12
Sienna Plantation MUD #13
Sienna Plantation MUD #2
Sienna Plantation MUD #3
Sienna Plantation MUD #4
Sienna Plantation MUD #5
Sienna Plantation MUD #6
Sienna Plantation MUD #7
Sienna Plantation Management District
Southwest Harris County MUD #1
Thunderbird Utility District
Mustang Bayou Service Area
Northeast Oyster Creek Service Area
W AIRPORT BLVD
US 59
KIRKWOOD DR
HWY 90A
DULLES AVE
MURPHY RD
S GESSNER RD
STAFFORD RD
CRAVENS RD
PIKE RD
S CRAVENS RD
BULL LN
MARTIN LN
TEXAS PKWY - FM 2234
S SAM HOUSTON PKWY W
GREGORY BLVD
FONDREN RD
BUFFALO RUN
CHASEWOOD DR
SCANLIN RD
GRAND PARK DR
INDEPENDENCE BLVD
LEXINGTON BLVD
STAFFORDSHIRE RD
COLUMBIA BLUE DR
FIFTH ST
MOORE RD
COURT RD
LEXINGTON BLVD
BRIGHTWATER DR
MURPHY RD - FM 1092
CARTWRIGHT RD - FM 3345
ELDORADO BLVD
TURTLE CREEK DR
MISSION VALLEY DR
FM 2234
FORT BEND PKWY
HWY 6
AUSTIN PKWY
SETTLERS WAY BLVD
CASAWAY LAKES DR
CROSSLAKES BLVD
RIVERSTONE BLVD
WILLAMBURG LN
TOWNSHIP LN
HAMPTON DR
PALM ROYALE BLVD
LAKESTONE BLVD
COMMONWEALTH BLVD
S UNIVERSITY BLVD
GLENN LAKES LN
OILFIELD RD
LAKE OLYMPIA PKWY
MISTY HOLLOW DR
PENNSHIRE DR
KNIGHTS CT
THOMPSON FERRY RD
SIENNA RANCH RD
MCKEEVER RD
TRAMMEL FRESNO RD
LAKE SHORE HARBOUR BLVD
VICKSBURG BLVD
HURRICANE LN
SIENNA PKWY
WATTS PLANTATION RD
KNIGHT RD
S CREEKMONT
REES POST
STEEP BANK TRCE
HWY 521
Map By:
GIS Division
October 2011
Exhibit 1-2
Planning Area Participants
Legend
City Limits Line
ETJ Line
Geographic Coordinate System North American Datum 1983 (NAD83)
0 2,000 4,000 6,000 8,000 Feet
The information on this map is provided and maintained by various agencies, including county departments, municipal governments, state and federal agencies. No guarantee is given as to the accuracy or currency of any of the data. The map is designed to serve as a secondary representation of real property found within this jurisdiction, and is compiled from the recorded deeds, plats, and other public records, which are primary sources for this public information. Users of this map are hereby notified that these primary sources should be consulted for verification of the information presented here. The data layers do not take the place of a legal survey or other primary source documentation. The county and its vendors assume no legal responsibility for the information on this map.


Municipal Utility Districts (MUDs)
Blue Ridge West MUD
First Colony MUD #9
Harris County WC & ID Fondren Road
Fort Bend County MUD #115
Fort Bend County MUD #129
Fort Bend County MUD #149
Fort Bend County MUD #23
Fort Bend County MUD #24
Fort Bend County MUD #26
Fort Bend County MUD #42
Fort Bend County MUD #46
Fort Bend County MUD #47
Fort Bend County MUD #48
Fort Bend County MUD #49
Fort Bend County WC & ID #2
Harris County MUD #122
Meadowcreek MUD
Mustang Bayou Utility Service Area
Palmer Plantation MUD #1
Palmer Plantation MUD #2
Quail Valley Utility District
Sienna Plantation MUD #1
Sienna Plantation MUD #10
Sienna Plantation MUD #12
Sienna Plantation MUD #13
Sienna Plantation MUD #2
Sienna Plantation MUD #3
Sienna Plantation MUD #4
Sienna Plantation MUD #5
Sienna Plantation MUD #6
Sienna Plantation MUD #7
Sienna Plantation Management District
Southwest Harris County MUD #1
Thunderbird Utility District
Mustang Bayou Service Area
Northeast Oyster Creek Service Area
6520912
6520906
6520915
105
1228
106
234
260
944
279
259
263
257
258
1025
262
261
170
264
149
867
1335
1078
1258
1203
812
958
1194
Southwest Harris County MUD #1
Fondren Road WC & ID
Harris County MUD #122
Fort Bend County WC & ID #2
Blue Ridge West MUD
Fort Bend County MUD #42
Northeast Oyster Creek Service Area
Meadowcreek MUD
Fort Bend County MUD #26
First Colony MUD #9
Thunderbird Utility District
Quail Valley Utility District
Fort Bend County MUD #115
Fort Bend County MUD #46
Fort Bend County MUD #129
Palmer Plantation MUD #1
Palmer Plantation MUD #2
Fort Bend County MUD #47
Fort Bend County MUD #48
Fort Bend County MUD #24
Fort Bend County MUD #49
Sienna Plantation Management District
Fort Bend County MUD #149
Sienna Plantation MUD #10
Sienna Plantation MUD #13
Mustang Bayou Service Area
Fort Bend County MUD #23
Sienna Plantation MUD #12
Sienna Plantation MUD #2
Sienna Plantation MUD #3
Sienna Plantation MUD #4
Sienna Plantation MUD #7
Sienna Plantation MUD #1
Sienna Plantation MUD #5
Sienna Plantation MUD #6
W AIRPORT BLVD
US 59
KIRKWOOD DR
HWY 90A
MURPHY RD
DULLES AVE
STAFFORD RD
S GESSNER RD
CRAVENS RD
PIKE RD
S CRAVENS RD
BULL LN
MARTIN LN
TEXAS PKWY - FM 2234
BUFFALO RUN
CHASEWOOD DR
SCANLIN RD
GRAND PARK DR
INDEPENDENCE BLVD
LEXINGTON BLVD
STAFFORDSHIRE RD
COLUMBIA BLUE DR
COURT RD
FIFTH ST
MOORE RD
LEXINGTON BLVD
BLUE RIDGE DR
FORT BEND PKWY
FM 2234
CARTWRIGHT RD - FM 3345
MURPHY RD - FM 1092
BRIGHTWATER DR
COLONIAL LAKES DR
HWY 6
AUSTIN PKWY
ELDORADO BLVD
TURTLE CREEK DR
MISSION VALLEY DR
CROSSLAKES BLVD
RIVERSTONE BLVD
WILLAMSBURG LN
TOWNSHIP LN
HAMPTON DR
LAKESTONE BLVD
PALM ROYALE BLVD
COMMONWEALTH BLVD
S UNIVERSITY BLVD
GLENN LAKES LN
MISTY HOLLOW DR
LAKE OLYMPIA PKWY
OILFIELD RD
PENINSULA DR
KNIGHT CT
THOMPSON FERRY RD
SIENNA RANCH RD
MCKEEVER RD
VICKSBURG BLVD
LAKE SHORE HARBOUR BLVD
TRAMMEL FRESNO RD
AUBURNMERE LN
WATTS PLANTATION RD
KNIGHT RD
CREEKMONT
SIENNA PKWY
STEEP BANK TRCE
BEES PAGE
HWY 521
Map By:
GIS Division
October 2011
Exhibit 1-3
Public Water Wells
Legend
Water Wells
City Limits Line
ETJ Line
Geographic Coordinate System North American Datum 1983 (NAD83)
0 2,000 4,000 6,000 8,000
Feet
The information on this map is provided and maintained by various agencies, including county departments, municipal governments, state and federal agencies. No guarantee is given as to the accuracy or currency of any of the data. The map is designed to serve as a secondary representation of real property found within this jurisdiction, and is compiled from the recorded deeds, plats, and other public records, which are primary sources for this public information. Users of this map are hereby notified that these primary sources should be consulted for verification of the information presented here. The data layers do not take the place of a legal survey or other primary source documentation. The county and its vendors assume no legal responsibility for the information on this map.



Map By:
GIS Division
October 2011

Exhibit 1-4
Water Distribution System

Legend

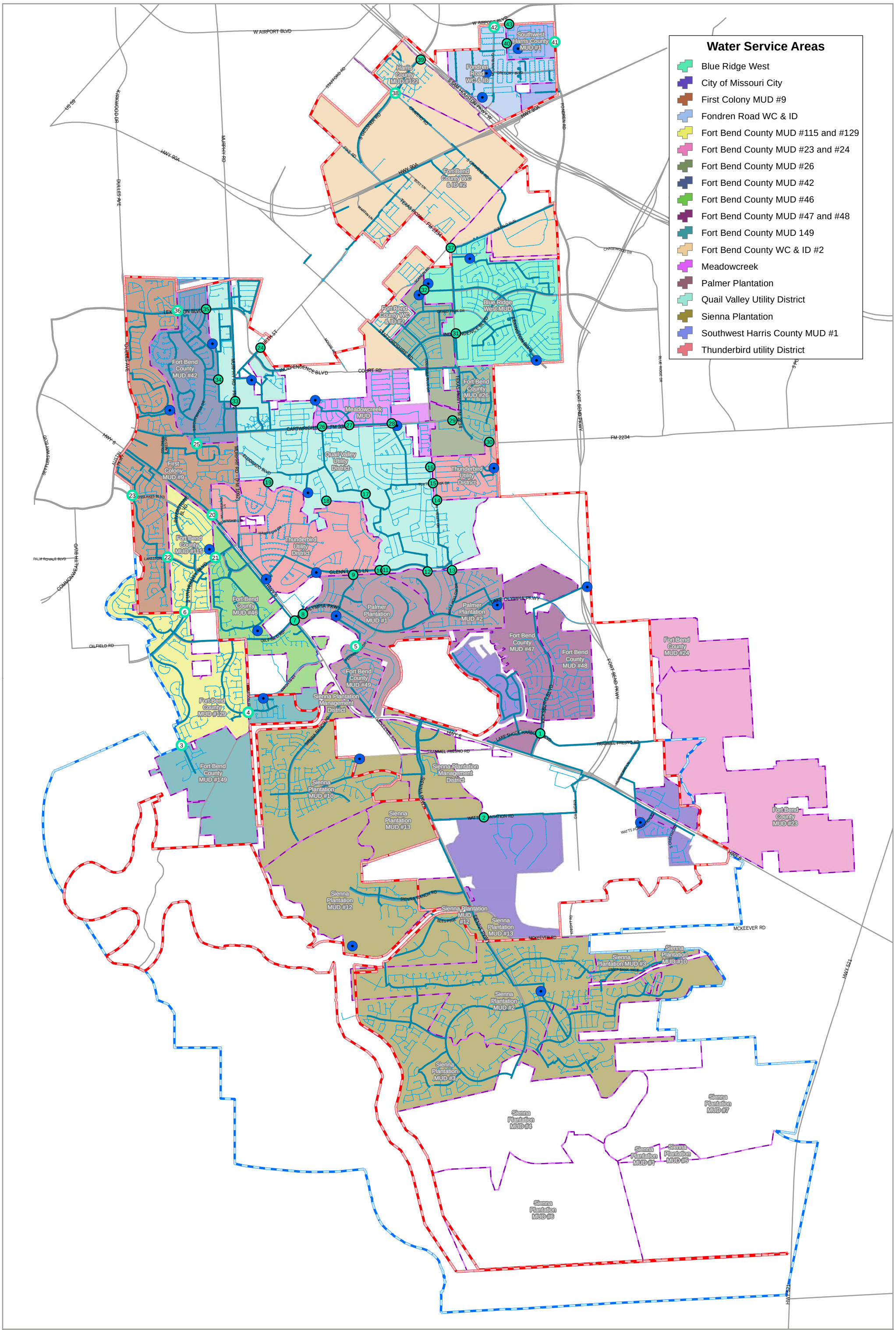
Waterlines
- Under 12 Inches
- 12 Inches or Larger

- Water Treatment Plants
- City Limits Line
- ETJ Line

Geographic Coordinate System North American Datum 1983 (NAD83)

0 2,000 4,000 6,000 8,000 Feet

The information on this map is provided and maintained by various agencies, including county departments, municipal governments, state and federal agencies. No guarantee is given as to the accuracy or currency of any of the data. The map is designed to serve as a secondary representation of real property found within this jurisdiction, and is compiled from the recorded deeds, plats, and other public records, which are primary sources for this public information. Users of this map are hereby notified that these primary sources should be consulted for verification of the information presented here. The data layers do not take the place of a legal survey or other primary source documentation. The county and its vendors assume no legal responsibility for the information on this map.


Water Service Areas
Blue Ridge West
City of Missouri City
First Colony MUD #9
Fondren Road WC & ID
Fort Bend County MUD #115 and #129
Fort Bend County MUD #23 and #24
Fort Bend County MUD #26
Fort Bend County MUD #42
Fort Bend County MUD #46
Fort Bend County MUD #47 and #48
Fort Bend County MUD 149
Fort Bend County WC & ID #2
Meadowcreek
Palmer Plantation
Quail Valley Utility District
Sienna Plantation
Southwest Harris County MUD #1
Thunderbird utility District
Harris County MUD #122
Southwest Harris County MUD #1
Fondren Road WC & ID
Fort Bend County WC & ID #2
Blue Ridge West MUD
Fort Bend County MUD #42
Fort Bend County MUD #26
Meadowcreek MUD
Quail Valley Utility District
Thunderbird Utility District
First Colony MUD #9
Fort Bend County MUD #115
Fort Bend County MUD #46
Palmer Plantation MUD #1
Palmer Plantation MUD #2
Fort Bend County MUD #47
Fort Bend County MUD #48
Fort Bend County MUD #24
Fort Bend County MUD #49
Sienna Plantation Management District
Fort Bend County MUD #129
Fort Bend County MUD #149
Sienna Plantation MUD #10
Sienna Plantation MUD #13
Sienna Plantation MUD #12
Sienna Plantation MUD #3
Sienna Plantation MUD #2
Fort Bend County MUD #23
Sienna Plantation MUD #4
Sienna Plantation MUD #7
Sienna Plantation MUD #1
Sienna Plantation MUD #5
Sienna Plantation MUD #6
W AIRPORT BLVD
HWY 90A
FM 2234
HWY 6
HWY 521
MCKEEVER RD
FORT BEND PKWY
TEXAS PKWY – FM 2234
INDEPENDENCE BLVD
COURT RD
SIENNA RANCH RD
TRAMMEL FRESNO RD
OILFIELD RD
OLYMPIA PKWY
GLENN LAKES LN
CARTWRIGHT RD – FM 359
MURPHY RD – FM 1092
DULLES AVE
FONDREN RD
S GESSNER RD
S SAM HOUSTON PKWY W
LEXINGTON BLVD
COMMONWEALTH BLVD
PALM ROYALE BLVD
LAKE OLYMPIA PKWY
LAKE SHORE HARBOR BLVD
Map By:
GIS Division
October 2011
Exhibit 1-5
Water
Interconnects
*Interconnect numbers refer to data in corresponding spreadsheet
Legend
MUD Boundaries
City Limits Line
ETJ Line
Waterlines
Under 12 Inches
12 Inches or Larger
Interconnects
Closed
Open
Water Treatment Plants
Geographic Coordinate System North American Datum 1983 (NAD83)
0 2,000 4,000 6,000 8,000 Feet
The information on this map is provided and maintained by various agencies, including county departments, municipal governments, state and federal agencies. No guarantee is given as to the accuracy or currency of any of the data. The map is designed to serve as a secondary representation of real property found within this jurisdiction, and is compiled from the recorded deeds, plats, and other public records, which are primary sources for this public information. Users of this map are hereby notified that these primary sources should be consulted for verification of the information presented here. The data layers do not take the place of a legal survey or other primary source documentation. The county and its vendors assume no legal responsibility for the information on this map.

Municipal Utility Districts (MUDs)

- Blue Ridge West MUD
- First Colony MUD #9
- Harris County WC & ID Fondren Road
- Fort Bend County MUD #115
- Fort Bend County MUD #129
- Fort Bend County MUD #149
- Fort Bend County MUD #23
- Fort Bend County MUD #24
- Fort Bend County MUD #26
- Fort Bend County MUD #42
- Fort Bend County MUD #46
- Fort Bend County MUD #47
- Fort Bend County MUD #48
- Fort Bend County MUD #49
- Fort Bend County WC & ID #2
- Harris County MUD #122
- Meadowcreek MUD
- Mustang Bayou Utility Service Area
- Palmer Plantation MUD #1
- Palmer Plantation MUD #2
- Quail Valley Utility District
- Sienna Plantation MUD #1
- Sienna Plantation MUD #10
- Sienna Plantation MUD #12
- Sienna Plantation MUD #13
- Sienna Plantation MUD #2
- Sienna Plantation MUD #3
- Sienna Plantation MUD #4
- Sienna Plantation MUD #5
- Sienna Plantation MUD #6
- Sienna Plantation MUD #7
- Sienna Plantation Management District
- Southwest Harris County MUD #1
- Thunderbird Utility District

Map By:
GIS Division
October 2011

Exhibit 1-6
Sanitary Sewer Collection System

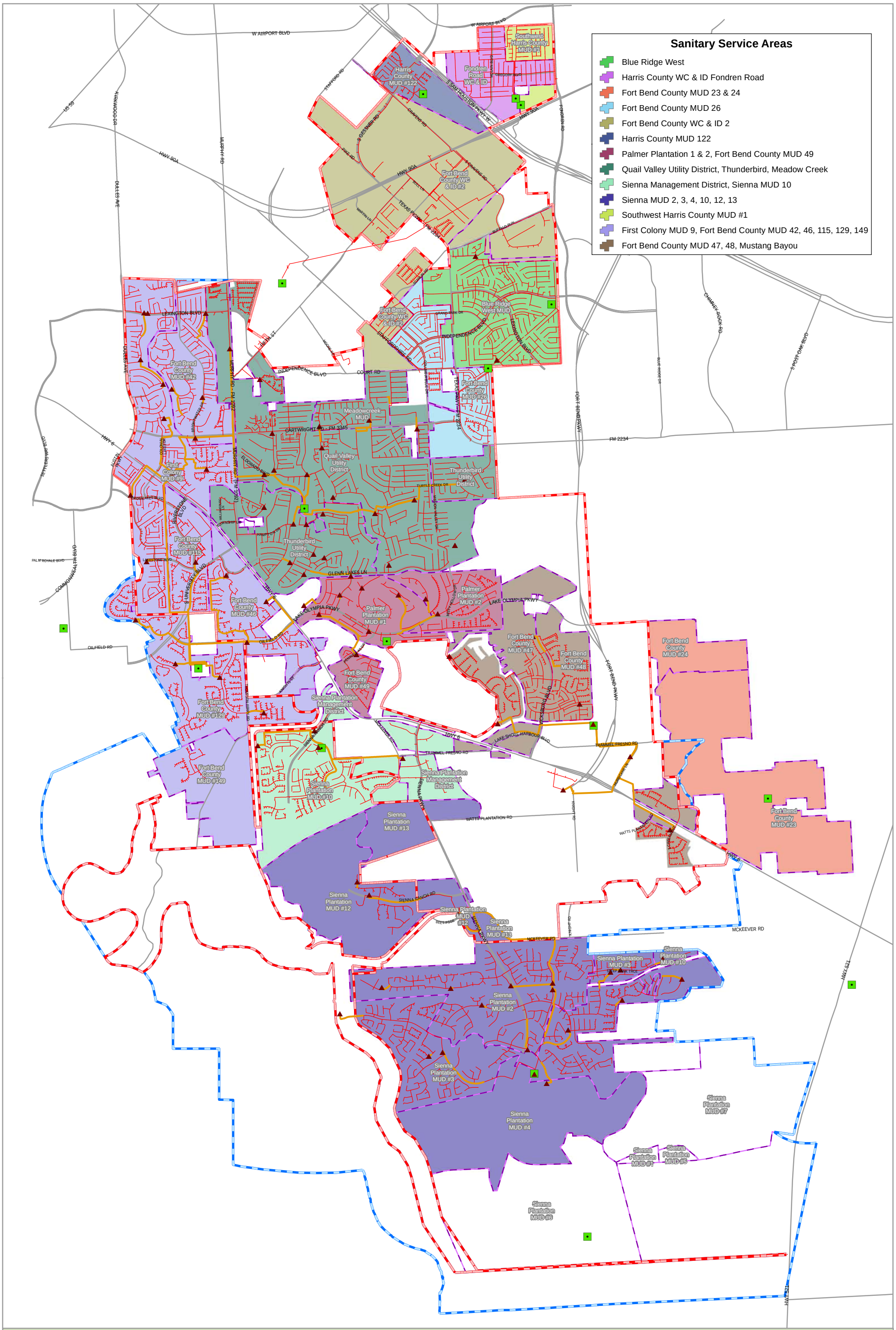
Legend

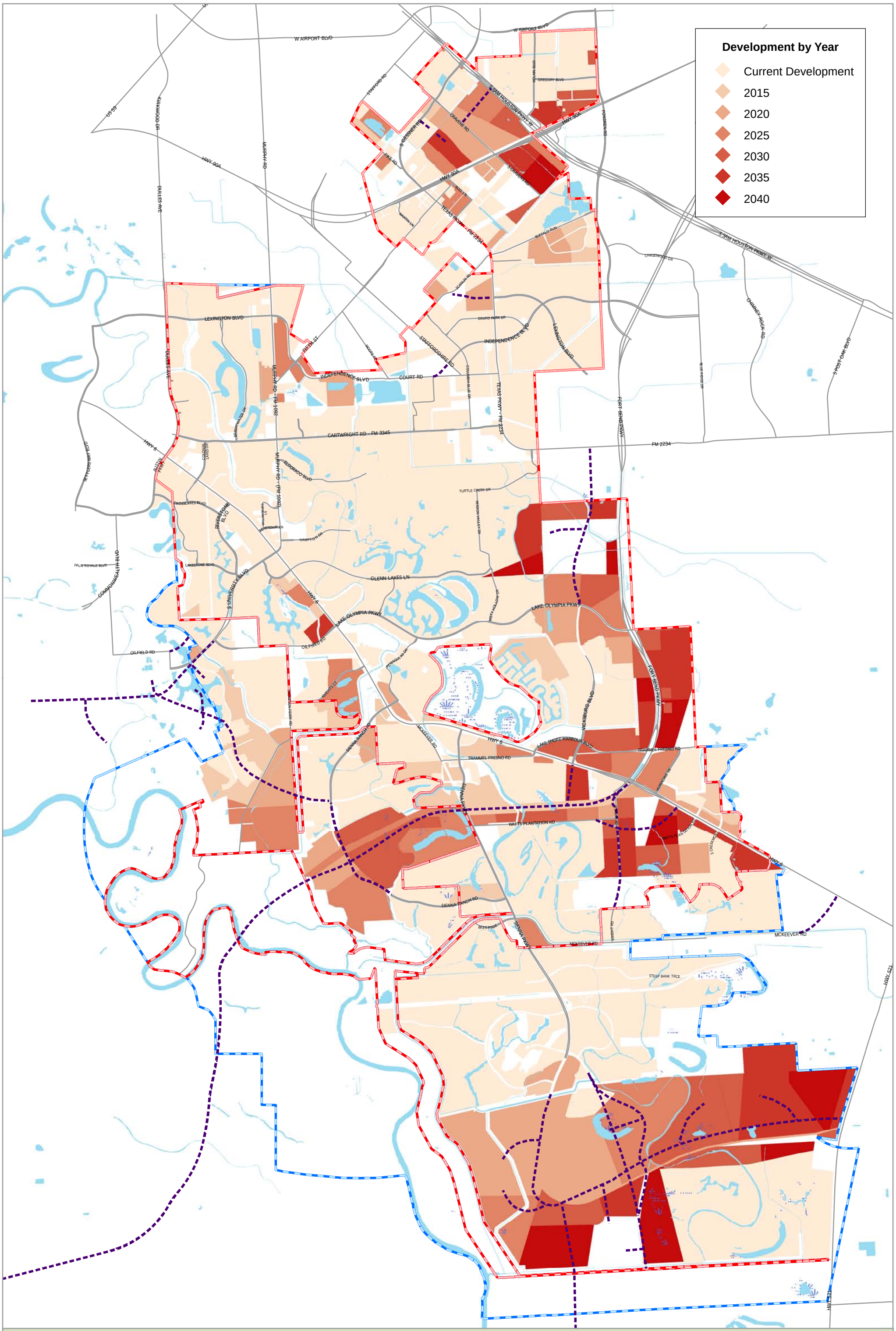
- Waste Water Treatment Plants
- Lift Stations
- Gravity Sanitary Sewer Lines
- City Limits Line
- Force Mains
- ETJ Line

Geographic Coordinate System North American Datum 1983 (NAD83)

0 2,000 4,000 6,000 8,000 Feet

The information on this map is provided and maintained by various agencies, including county departments, municipal governments, state and federal agencies. No guarantee is given as to the accuracy or currency of any of the data. The map is designed to serve as a secondary representation of real property found within this jurisdiction, and is compiled from the recorded deeds, plats, and other public records, which are primary sources for this public information. Users of this map are hereby notified that these primary sources should be consulted for verification of the information presented here. The data layers do not take the place of a legal survey or other primary source documentation. The county and its vendors assume no legal responsibility for the information on this map.


Sanitary Service Areas
Blue Ridge West
Harris County WC & ID Fondren Road
Fort Bend County MUD 23 & 24
Fort Bend County MUD 26
Fort Bend County WC & ID 2
Harris County MUD 122
Palmer Plantation 1 & 2, Fort Bend County MUD 49
Quail Valley Utility District, Thunderbird, Meadow Creek
Sienna Management District, Sienna MUD 10
Sienna MUD 2, 3, 4, 10, 12, 13
Southwest Harris County MUD #1
First Colony MUD 9, Fort Bend County MUD 42, 46, 115, 129, 149
Fort Bend County MUD 47, 48, Mustang Bayou
Harris County MUD #122
Fondren Road WC & ID
Southwest Harris County MUD #1
Fort Bend County WC & ID #2
Blue Ridge West MUD
Fort Bend County MUD #42
Meadowcreek MUD
Quail Valley Utility District
Thunderbird Utility District
First Colony MUD #9
Fort Bend County MUD #115
Fort Bend County MUD #46
Palmer Plantation MUD #1
Palmer Plantation MUD #2
Fort Bend County MUD #47
Fort Bend County MUD #48
Fort Bend County MUD #49
Fort Bend County MUD #24
Fort Bend County MUD #129
Sienna Plantation Management District
Fort Bend County MUD #149
Sienna Plantation MUD #10
Sienna Plantation MUD #13
Fort Bend County MUD #23
Sienna Plantation MUD #12
Sienna Plantation MUD #3
Sienna Plantation MUD #2
Sienna Plantation MUD #4
Sienna Plantation MUD #7
Sienna Plantation MUD #1
Sienna Plantation MUD #5
Sienna Plantation MUD #6
W AIRPORT BLVD
HWY 90A
US 59
KIRKWOOD DR
MURPHY RD
BULLES AVE
STAFFORD RD
S GESSNER RD
GRAVENS RD
PIKE RD
S SAM HOUSTON PKWY W
FONDREN RD
W GREGORY BLVD
TEXAS PKWY
FM 2234
BLUE RUN
LEXINGTON BLVD
INDEPENDENCE BLVD
COURT RD
STAFFORDSHIRE RD
GRAND PARK DR
FORT BEND PKWY
CHIMNEY ROCK RD
S POST OAK BLVD
BLUE RIDGE DR
CARTWRIGHT RD - FM 3345
HWY 6
SETTLERS WAY BLVD
AUSTIN PKWY
COLONIAL CREEK DR
BRIGHTWATER DR
MURPHY RD - FM 1092
ELDORADO BLVD
CROSS ARES BLVD
RIVERSTONE BLVD
TOWNSHIP LN
HAMPTON DR
TURTLE CREEK DR
HUNTSMAN TRCE
FM 1092
LAKESTONE BLVD
PALM ROYALE BLVD
COMMONWEALTH BLVD
UNIVERSITY BLVD
GLENN LAKES LN
LAKE OLYMPIA PKWY
MEETINGHOUSE DR
OILFIELD RD
KNIGHTS CT
HAMPTON ESTATES DR
SIENNA RANCH RD
MCKEEVER RD
SIENNA PKWY
WATTS PLANTATION RD
LAKE SHORE HARBOUR BLVD
VICKSBURG BLVD
TRAMMEL FRESNO RD
HAMPTON LAKES LN
KNIGHT RD
LOBERA DR
BEES RDGE
SWEETWATER TRCE
HWY 521
Map By:
GIS Division
October 2011
Exhibit 1-7
Sanitary
Service Areas
Legend
Lift Stations
Waste Water Treatment Plants
Gravity Sanitary Sewer Lines
Force Mains
MUD Boundaries
City Limits Line
ETJ Line
Geographic Coordinate System North American Datum 1983 (NAD83)
0 2,000 4,000 6,000 8,000 Feet
The information on this map is provided and maintained by various agencies, including county departments, municipal governments, state and federal agencies. No guarantee is given as to the accuracy or currency of any of the data. The map is designed to serve as a secondary representation of real property found within this jurisdiction, and is compiled from the recorded deeds, plats, and other public records, which are primary sources for this public information. Users of this map are hereby notified that these primary sources should be consulted for verification of the information presented here. The data layers do not take the place of a legal survey or other primary source documentation. The county and its vendors assume no legal responsibility for the information on this map.



Map By:
GIS Division
October 2011

Exhibit 1-8
Projected Growth Areas

Legend
- Hydro
- Marsh
- Proposed Major Thoroughfares
- City Limits Line
- ETJ Line

Geographic Coordinate System North American Datum 1983 (NAD83)

0 2,000 4,000 6,000 8,000 Feet

The information on this map is provided and maintained by various agencies, including county departments, municipal governments, state and federal agencies. No guarantee is given as to the accuracy or currency of any of the data. The map is designed to serve as a secondary representation of real property found within this jurisdiction, and is compiled from the recorded deeds, plats, and other public records, which are primary sources for this public information. Users of this map are hereby notified that these primary sources should be consulted for verification of the information presented here. The data layers do not take the place of a legal survey or other primary source documentation. The county and its vendors assume no legal responsibility for the information on this map.

Section 2: Water Distribution and Water Treatment Alternatives

2.1 Current City Water Regionalization Plans

The Joint GRP group has identified a plan for which as a whole, the participants will meet the groundwater reduction requirements set forth by the FBCSD. In working toward meeting the Joint GRP groundwater usage reduction goals, the City has already begun to implement a few projects to regionalize some of the utility services in the Study area. These plans include the City directly providing water services to a portion of the residents as well as a plan to combine the operation of the City's Mustang Bayou USA with two other utility districts. Additional details of these plans are discussed below.

2.1.1 RWTP

The participants of the Joint GRP group have determined that the most cost-effective means of meeting the requirements set forth by the FBCSD is a complete conversion from groundwater to surface water in a portion of the City's service area, while leaving the remaining service area on groundwater supplies. Initially, those utility districts located in the southern portion of the City and its ETJ are converting from groundwater to surface water to achieve the 30% reduction in groundwater usage required by 2013. As the 60% reduction requirement is approached in 2025, additional utility districts will be converted to surface water, generally moving northward on the system.

The initial RWTP size is 10 MGD (Phase I), which is anticipated to meet the City's required maximum demand through 2018, at which time the RWTP is intended to be expanded. Exhibit 2-1 identifies the initial converting utility districts, which will generally consist of Sienna Plantation MUDs. The first phase of the RWTP is currently under construction and is anticipated to be fully operational by the first of the year in 2012.

The City anticipates two additional conversion phases. Phase 2 is anticipated to consist of converting Sienna MUD #s 1, 4, 5, 6 and 7, Fort Bend County MUD #s 46, 47, 48 and 149, and the Mustang Bayou USA. Phase 3 is anticipated to consist of converting Fort Bend County MUD #s 129 and 115. Exhibit 2-1 identifies the converting entities as part of Phase 2 and Phase 3.[1]

[1] City of Missouri City Joint GRP

2.1.2 Mustang Bayou USA/Fort Bend County MUD #47/Fort Bend County MUD #48

Mustang Bayou USA is supplied water from the Mustang Bayou WTP owned by the City. Fort Bend County MUD #47 and Fort Bend County MUD #48 are supplied water from the Vicksburg Joint Powers WTP. Currently, Fort Bend County MUD #47 and Fort Bend County MUD #48 are interconnected and operate as one system. A plan has been identified to combine the Mustang Bayou USA and Fort Bend County MUD #47 and Fort Bend County MUD #48. By combining the two systems, the overall system capacity is greater and each water plant makes up in areas where the other is lacking. The infrastructure for combining these systems has been constructed, and once the interconnect valve between the two systems is opened, the two systems should operate as one combined system. This project was recently completed with an agreement between the City and the two utility districts.

2.2 Water Treatment System Alternatives

As the City begins looking at ways to consolidate the various utility district distribution systems into one single, or several larger distribution systems, additional improvements to the various systems are likely. This subsection discusses the impacts to the various utility district plants that will convert completely to treated surface water as a result of the new RWTP. The following subsection covers the various storage and distribution improvements needed throughout the utility district distribution systems.

2.2.1 Type of Finished Water

The majority of the utility districts within the Study area have historically utilized groundwater as the supply source. In recent years, several of the neighboring utility districts with connection to utility districts in the City have converted to surface water sources (e.g., City of Houston and Fort Bend County WC&ID #2). The City is also constructing a new RWTP that will treat surface water. From the Joint GRP plan, the City is required to meet a reduction in groundwater usage by a minimum of 30% by 2013 and 60% by 2025. To meet the 60% reduction requirement will require two expansions, the first in 2018 that will increase total treatment capacity to 21.1 MGD and a second expansion in 2025 to increase total treatment capacity to 33.3 MGD.

As a result, over the course of the next 15 years, the water supply source for some utility districts will remain unchanged and some utility districts will convert to surface water supplies. Utility districts whose supply source will remain unchanged will continue to operate in the same way while utility districts systems that will switch to treated surface water will begin operating their plants as a storage and booster pump station only.

2.2.2 Disinfection Modifications

Currently all of the utility districts within the City, with the exception of Harris County MUD #122, Southwest Harris County MUD #1 and Harris County WC & ID - Fondren Rd., are treating groundwater with the use of free chlorine for disinfection. With the

construction of the City's RWTP, the utility districts converting to treated surface water must change from free chlorine to chloramines in the distribution system. This is important to note because any utility districts with an interconnection to a utility district operating on a treated surface water source must also convert to use chloramines. Converting to chloramines is necessary because the mixture of free chlorine and chloramines in the distribution system results in a loss of measurable disinfectant residual, which can increase the risk to the health of the City's residents.

The cost to convert to chloramines for a typical utility district WTP consisting of a groundwater well, ground storage, high service pumps, hydropneumatic tank and free chlorine disinfection is approximately $250,000 for a liquid ammonium sulfate (LAS) chemical feed and control system. However, this cost is representative only for the chemical feed system and a small building to house the system, which is appropriate for utility districts not receiving surface water directly. For the utility districts anticipated to receive treated surface water directly from the new RWTP, additional flow control improvements will be necessary (including a new automated flow control valve system, flow control building and flow control and chemical feed control PLC), at an approximate cost of $400,000 per utility district facility.

For the consolidation projects identified in this report, if a utility district is proposed to be connected to a utility district that is currently supplied surface water or a utility district that will be converted to surface water in a future phase of the City's RWTP, a more detailed cost for the chloramines conversion has been included in the cost estimates. Even though these costs have been included in the overall project cost estimate, the Joint GRP group has discussed the potential for the GRP to pay for the chloramine conversion of the districts receiving surface water as part of the RWTP.

2.3 Water Distribution System Alternatives

2.3.1 Water System Interconnection Alternatives

The following proposed water interconnect locations are shown in Exhibit 2-2.

2.3.1.1 Interconnect First Colony MUD #9 with Fort Bend County MUD #115

The proposed scope for this alternative is a 12-inch water line interconnection from the south portion of First Colony MUD #9 to Fort Bend County MUD #115. This interconnect should provide increased pressure in the southern areas of First Colony MUD #9, as well as increased fire protection.

While Fort Bend County MUD #115 is not anticipated to be converted to treated surface water via the RWTP until Phase III (2025), the conversion from chlorine to chloramines will need to be incorporated into this project if the City decides to complete this project ahead of Phase III of the RWTP.

2.3.1.2 Mustang Bayou WTP System and Sienna Plantation System Interconnect No. 2

The proposed scope is a 16- and/or 12-inch water line interconnection from Vicksburg Drive to Christus Drive along SH 6. This interconnection would provide a second interconnection between the two systems and provide future service to currently undeveloped property along SH 6. This interconnection should further improve operation of both systems for more consistent pressures, water quality and fire protection. Construction should be completed adjacent to undeveloped areas, as well to avoid future conflicts as the area develops. These improvements could potentially result in needing minor upgrades to plant facilities to fully realize the benefits.

2.3.1.3 Mustang Bayou WTP System and Sienna Plantation System Interconnect No. 3

The proposed scope is a 12-inch water line along Trammel Fresno Road from SH 6 to Sienna Parkway. This interconnection would provide the third interconnection between the two water distribution systems and will allow the existing residential acreage lot development south of Trammel Fresno to be converted off their existing individual well systems. This interconnection should further improve operation of both systems for more consistent pressures, water quality and fire protection. These improvements could potentially result in needing minor upgrades to plant facilities to fully realize the benefits.

2.3.1.4 Sienna Plantation Water System Internal Interconnect

The proposed scope is a 12-inch water line along SH 6 between the commercial development at Sienna Parkway and the commercial development at Sienna Ranch Road. This interconnection should improve operation of both systems for more consistent pressures, water quality and fire protection. These improvements could potentially result in needing minor upgrades to plant facilities to fully realize the benefits.

2.3.1.5 Sienna Plantation System and Palmer Plantation System Interconnect No. 1

This proposed project includes a 12-inch water line interconnect across SH 6. This interconnection would provide the only emergency interconnection between the Sienna system and the Palmer Plantation system. The benefit would be for emergency conditions and would provide both systems with a backup water supply if a problem ever occurred.

2.3.1.6 Silver Ridge Development and Sienna Plantation Water System Interconnect No. 1

This proposed project includes extending a 12-inch water line across Sienna Parkway to the Silver Ridge development. This would provide a source of treated surface water, once Sienna Plantation MUD #1 converts to surface water, to the

Silver Ridge residents as this system is currently operated on a community well system.

Typically, the TCEQ requires that a community supplied by a community well distribution system be converted over to treated surface water when it becomes available to the community. However, as many of the service areas within the Study area will continue to remain on groundwater, it has not been determined whether converting the Silver Ridge system over to treated surface water can be accomplished efficiently and/or cost effectively. Therefore, a more detailed evaluation (preferably including modeling) of the Silver Ridge system would need to be completed to confirm whether or not the existing Sienna Plantation water system in the area could provide adequate volumes and pressure for the Silver Ridge development. In addition, a cost analysis would need to be performed to compare potential revenues with the cost of improvements within the Silver Ridge system to determine if interconnecting the system to Sienna Plantation is worthwhile provided the TCEQ ultimately does not require it.

2.3.1.7 Fort Bend County MUD #149 and Sienna Plantation MUD #1 Water System Interconnect No. 1

This proposed project includes extending a 12-inch water line across the Flat Bank Creek Diversion Channel between the Sienna Plantation and Riverstone water systems along Sienna Springs Blvd. This would provide an additional source of water to both systems. In order to connect to Sienna Plantation MUD #1, chloramine conversion would be required prior to startup of the proposed interconnection. After the surface water conversion, operation of the interconnection should be able to provide additional pressure maintenance between the two systems.

2.3.1.8 Blue Ridge West MUD

In this project an existing interconnection already exists, though it has been used in the past only for emergency purposes. Therefore, completion of this project would only require the permanent opening of the interconnection between Fort Bend County MUD #26 and Blue Ridge West, which is located at the intersection of Texas Parkway and Settegast Blvd.

2.3.1.9 Blue Ridge West MUD

In this project an existing interconnection already exists, though it has been used in the past only for emergency purposes. Therefore, completion of this project would only require the permanent opening of the 10-inch interconnection between Fort Bend County WC&ID No.2 and Blue Ridge West MUD located at the intersection of Texas Parkway at Independence Road. Prior to permanently opening this interconnection Blue Ridge West MUD would be required to convert to chloramines.

2.3.1.10 Fort Bend County MUD #s 47 and 48

Fort Bend County MUD #s 47 and 48 have finalized a water consolidation agreement with the City. This agreement involved permanently opening the 12-inch interconnection between the two water systems supplied by the Vicksburg WTP and the Mustang Bayou WTP.

2.3.1.11 Interconnect Mustang Bayou and Sienna Plantation

In this project an interconnection already exists, though it has been used in the past only for emergency purposes. Therefore, completion of this project would only require the permanent opening of the 24-inch Watts Plantation interconnect between the Mustang Bayou service area and Sienna Plantation. Additional modeling of the two systems will be required to determine improvements necessary to operate the combined system, as preliminary information from the Sienna Plantation MUD #1 engineer indicates that higher pressures in the Sienna system will only allow water to flow to the Mustang Bayou system.

2.3.1.12 Interconnect Mustang Bayou and Palmer Plantation

This project includes the construction of a new interconnect between the Mustang Bayou service area and the Palmer Plantation MUD service area at the intersection of Lake Olympia Parkway and the Mustang Bayou Diversion Channel.

2.3.1.13 Interconnect Mustang Bayou and Quail Valley UD

This project includes the construction of a new interconnect between the Mustang Bayou service area and Quail Valley UD service area by extending a water main along the proposed future Vicksburg Blvd. to the City Regional Park.

2.3.2 Water System Storage Alternatives

The City requested an evaluation of potential new EST locations in order to provide a more hydraulic-oriented elevated storage system, as opposed to continuing operation of the pressure-driven storage system. In order to compare the life cycle costs of a hydropneumatic pressure tank (HPT) versus that for an EST, the operating process of each system and the components required for each system is discussed. An EST requires only the feed pressure from the incoming water to lift water into the elevated tank. Therefore, during an emergency if the nearby WTPs have backup power, then the EST will be filled and will continue operation.

A typical HPT system consists of an outer metal shell, inner bladder and an air compressor system. When the HPT needs to be filled, nearby pumps fill the tank with water. Air compressors are used to maintain a specific tank pressure which keeps the inner bladder in compression to provide a specific discharge pressure when the HPT lets water out into the distribution system. Similar to the EST system, an HPT still requires water from a nearby source, which would require backup power at the water source. However, backup power is also needed for the HPT system to operate the air compressors necessary to maintain tank pressure.

In addition, the typical useful life is fairly different for the two tank systems. Older types of ESTs (such as legged tank, ellipsoid, etc.) were traditionally all constructed of welded steel and typically had a useful life of 20-30 years, without completing a major rehabilitation of the interior and exterior of the tank. Newer and more common tank designs include a composite tank, which normally consists of a concrete ring structure for the tower, and uses a traditional welded steel bowl for the tank. The useful life of Composite tanks is frequently 30-50 years. The concrete structure typically lasts 50 years without major rehabilitative work and the bowl normally requires major rehabilitation every 30 years.

On the other hand, HPT systems commonly last between 10-20 years, depending primarily on the quality of the inner bladder. The type of HPT tanks used in many smaller, developer-driven WTPs or booster pump stations generally have an average useful life of 15 years. Due to the low cost of HPT tanks, it is common to see a complete HPT tank replacement rather than seeing an HPT tank cut open to replace internal components and then re-welded together.

Capital and O&M costs have been developed to assist in comparing a potential HPT to an EST as shown in Table 2-1. One proposed storage location (Sienna Plantation No. 1 WTP) is used for the cost example. These costs were developed to provide a comparison between both tank types only.

In developing the costs for both a new HPT and an EST system, the sizing for each system was determined based on TCEQ Chapter 290 design criteria for water systems, including 100 gallons per connection for an EST tank, and 20 gallons per connection for an HPT tank. The number of connections served by the Sienna Plantation No. 1 WTP is approximately 12,500. Therefore, a 1,250,000 gallon (1.25 MG) EST or 250,000 gallons of HPT storage would be required.

An example calculation for a storage tank at Sienna Plantation WTP No. 1 is as follows:

- Connections served: 12,500;
- TCEQ total storage required is 200 gallons per connection with 100 gallons per connection provided by elevated storage or 20 gallons per connection provided as pressure storage;
- 12,500 connections x 100 gallons per connection (elevated storage requirement) = 1,250,000 gallons with EST capacity = 1.25 MG;
- 12,500 connections x 20 gallons per connection (pressure storage requirement) = 250,000 gallons with HPT capacity = 250,000 gallons.

While the EST could be installed in one location, there are no WTP sites large enough in the Study area to support a 250,000 gallon HPT. The existing HPTs range in size from 5,000-25,000 gallons. Therefore, a maximum tank size of 25,000 gallons was used, knowing that HPTs would need to continue to be located at multiple WTP sites to provide enough space for the tanks. The proposed HPT and EST life cycle costs are shown in Table 2-1.

Table 2-1
Cost Comparison for HPT and EST Systems

Item	Description	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
1	Construct a new 1.25 MG EST, including piping, SCADA and high service pump station (HSPS) modifications and site work	$3,250,000	$4,602,000	$12,500	$4,848,000
2	Construct 10 new 25,000 gallon HPT tanks, including piping, SCADA and HSPS modifications, site work and emergency backup power improvements	$4,500,000	$6,372,000	$98,000	$8,293,000

Notes:
1 - Assumes no offsite collection improvements are required.
2 - Assumes that no other major capital improvements would be necessary during the project life.
3 - Assumes a 30-yr improvement life, at an interest rate of 3%.
4 - The HPT estimate assumes constructing HPT tanks at roughly 5 WTP sites, with two tanks at each site.
5 - The HPT estimate assumes replacing the HPTs once during the 30-yr period.
6 - The HPT O&M cost allows for operation of the feed pumps, air compressors and backup generators at each WTP site

When reviewing ESTs as compared to HPTs with a 15-yr operating life, the savings in constructing an EST is clear. However, if the HPTs were rehabilitated instead of being replaced, the cost difference is reduced, though it still appears to be more cost effective to construct an EST (Refer to Table 2-2).

Table 2-2
Supplemental Cost Comparison for HPT and EST Systems

Item	Description	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
1	Construct a new 1.25 MG EST, including piping, SCADA and HSPS modifications and site work	$3,250,000	$4,602,000	$12,500	$4,848,000
2	Construct 10 new 25,000-gallon HPT tanks, including piping, SCADA and HSPS modifications, site work and emergency backup power improvements	$3,500,000	$4,956,000	$98,000	$6,877,000

Notes:
1 - Assumes no offsite collection improvements are required.
2 - Assumes that no other major capital improvements would be necessary during the project life.
3 - Assumes a 30-yr improvement life, at an interest rate of 3%.
4 - The HPT estimate assumes constructing HPT tanks at roughly 5 WTP sites, with two tanks at each site.
5 - The HPT estimate assumes rehabilitating the HPTs once during the 30-yr period.
6 - The HPT O&M cost allows for operation of the feed pumps, air compressors and backup generators at each WTP site

Based on the costs shown in Table 2-1 and 2-2, construction of new ESTs throughout the City should provide a reduction in total elevated/pressure storage costs.

Proposed locations for new ESTs are based on engineering experience and coordination with existing WTP locations to determine feasible areas for a new EST. While the ideal location to construct an EST would be at an existing WTP site, it is best to locate an EST where sufficient open space (fall-down area) is available in case of a failure of the EST. Even though EST failures have an extremely low probability of collapse, when considering installation of ESTs in an area that has a potential for subsidence, it is generally a good idea to distance new ESTs from nearby residences if possible.

Therefore, the WTPs listed in Table 2-3 are not recommended for consideration of adding an EST, unless other more feasible property may be available in that system area.

Table 2-3 WTPs Not Recommended for EST Addition with Determining Factor	
WTP	**Reason this WTP is NOT a recommended location for a new EST**
Fort Bend County MUD #46	Houses within potential fall-down area
Thunderbird UD System 1 WTP No. 1	Major thoroughfare within potential fall-down area
Fort Bend County MUD #115	Houses and businesses within potential fall-down area
First Colony County MUD #9	Insufficient space within WTP site
Fort Bend County MUD #42	Insufficient space within WTP site
Quail Valley UD WTP No. 3	EST already located at this site
Meadowcreek MUD WTP	Located close to existing EST
Quail Valley UD WTP No. 1	Insufficient space within WTP site
Harris County WC&ID – Fondren Road WTP No. 1	Houses and businesses within potential fall-down area
Southwest Harris County MUD #1 WTP	Houses within potential fall-down area
Blue Ridge West MUD WTP No. 1	Located close to existing EST
Fort Bend County MUD #26 WTP	Located close to existing EST
Thunderbird UD System 2 WTP No. 1	Major thoroughfare within potential fall-down area
Palmer Plantation MUD No. 1 WTP	Houses within potential fall-down area

The recommended ESTs and their locations are described in the following subsections. A map of the proposed EST locations is shown in Exhibit 2-3.

2.3.2.1 New EST at Sienna Plantation No. 1 WTP

Phase I of the RWTP will provide treated surface water to roughly 12,500 connections in the southern part of the Study area, requiring elevated storage of roughly 1.25 million gallons (MG). Therefore, this project would include the construction of a new 1.25 MG EST at the existing Sienna Plantation No. 1 WTP site. This project would also include the modification of the existing high service pump station to allow for reusing the high service pumps to lift water into the EST in the event that the plant needed to temporarily revert back to groundwater usage. It is anticipated that the discharge pressure could be maintained at the RWTP to provide sufficient pressure to fill the new EST. Costs for the EST are based on the construction of a composite-type tank.

2.3.2.2 New EST at Mustang Bayou WTP

Phase II of the RWTP will provide treated surface water to approximately 5,000 connections in the eastern part of the Study area, requiring elevated storage of roughly 0.5 MG. Therefore, this project would include the construction of a new 0.5 MG EST at the existing Mustang Bayou WTP site. This project would also

include the modification of the existing high service pump station to allow for reusing the high service pumps to lift water into the EST in the event that the plant needed to temporarily revert back to groundwater usage. It is anticipated that the discharge pressure could be maintained at the RWTP to provide sufficient pressure to fill the new EST. Costs for the EST are based on the construction of a composite-type tank.

2.3.2.3 New EST at Fort Bend County MUD #149 WTP

Phase II and Phase III of the RWTP will also provide treated surface water to approximately 17,500 connections in the western part of the Study area, requiring elevated storage of roughly 1.75 MG. Therefore, a 1.75 MG EST is proposed for the existing Fort Bend County MUD #149 WTP site. This project would also include the modification of the existing high service pump station to allow for reusing the high service pumps to lift water into the EST in the event that the plant needed to temporarily revert back to groundwater usage. It is anticipated that the discharge pressure could be maintained at the RWTP to provide sufficient pressure to fill the new EST. Costs for the EST are based on the construction of a composite-type tank.

2.3.2.4 New EST at Palmer Plantation MUD No. 2 WTP

Elevated storage can provide pressure-sustaining benefits in the eastern part of the Study area, including supplementing pressures in Palmer Plantation MUD No.2, Fort Bend County MUD #s 47 and 48 and Quail Valley UD. Therefore, this project would include the construction of a new 1.0 MG EST at the existing Palmer Plantation MUD No. 2 WTP site. This project would also include the modification of the existing high service pump station to allow for reusing the high service pumps to lift water into the EST in the event that the plant needed to temporarily revert back to groundwater usage. It is anticipated that the discharge pressure could be maintained at the RWTP to provide sufficient pressure to fill the new EST. Costs for the EST are based on the construction of a composite-type tank.

2.3.2.5 New EST at Thunderbird Utility District System 1 WTP No. 2

Elevated storage can provide pressure sustaining benefits in the central part of the Study area, including supplementing pressures in the Thunderbird UD area, Palmer Plantation MUD #2, Quail Valley UD and Fort Bend County MUD #46. Therefore, this project would include the construction of a new 1.0 MG EST at the existing Thunderbird UD System 1 WTP No. 2 site. This project would also include the modification of the existing high service pump station to allow for reusing the high service pumps to lift water into the EST in the event that the plant needed to temporarily revert back to groundwater usage. It is anticipated that the discharge pressure could be maintained at the RWTP to provide sufficient pressure to fill the new EST. Costs for the EST are based on the construction of a composite-type tank.

2.3.2.6 New EST at Harris County WC&ID – Fondren Road WTP No. 2

Elevated storage can provide pressure sustaining benefits in the north part of the Study area, including supplementing pressures in the Harris County WC&ID – Fondren Road area, the Southwest Harris County MUD #1 area and the WC&ID #2 area. Therefore, this project would include the construction of a new 0.5 MG EST at the existing Harris County WC&ID – Fondren Road WTP No. 2 site. This project would also include the modification of the existing high service pump station to allow for reusing the high service pumps to lift water into the EST in the event that the plant needed to temporarily revert back to groundwater usage. It is anticipated that the discharge pressure could be maintained at the RWTP to provide sufficient pressure to fill the new EST. Costs for the EST are based on the construction of a composite-type tank.

2.4 Comparison of O&M Costs for Small SWTPs Versus Regional SWTPs

In evaluating the WTPs, multiple plant issues were reviewed that could impact O&M costs, such as: the age and condition of the structures and equipment; type of ground storage used; type of elevated or pressure storage used; water demand as compared to treatment capacity; and type of control systems to reduce power consumption and O&M effort. From these issues, typical O&M costs are developed for new WTPs of various sizes, ages and operating efficiencies. The anticipated O&M costs for the existing 24 WTPs as compared to a single, RWTP, and as compared to several regional facilities. The following sections cover the basis for development of O&M costs and the comparisons of the various WTPs in the Study area.

2.4.1 Development of O&M Costs

The Environmental Protection Agency (EPA) developed cost curves for various types of WTPs, including accounting for type of process, whether a treatment facility was based on treating groundwater or surface water, and flow loading. At the time, factors such as energy efficiency and level of automation from control systems had very little impact on the cost curves, as control components such as variable frequency drives were being used in a very limited percentage of the operating WTPs. As a result, the original EPA cost curves for WTP O&M have been updated and revised over the years to develop more current cost projections. The O&M cost models used in this Study were developed using EPA updated cost curves as a basis, with revisions made for newer treatment technologies such as membrane filtration and improvements in efficiency-enhancing technologies such as variable frequency drives and automated control systems.

The majority of the WTPs in the Study area consist of GWTPs. Because the plants are designed quickly for rapid implementation at a WTP site and frequently are located in areas where limited groundwater flow can be produced in a small area, GWTPs are not typically well suited for RWTP demands. For example, the Sienna Plantation No. 1 WTP can produce treated groundwater at a maximum demand of roughly 3,000 gallons per minute (gpm), or 4.3 MGD, though that maximum flow rate can only be accomplished

using a combination of onsite and offsite wells. As another example, the Sienna Plantation No. 2 WTP can produce treated groundwater at a maximum demand of roughly 2,000 gpm, or 2.9 MGD, though that maximum flow rate can also only be accomplished using a combination of onsite and offsite wells. As a result, when considering demands proposed for the new RWTP, such as 10 MGD, 20 MGD and 30 MGD, it is typically not feasible to construct a single regional GWTP capable of meeting this demand, so surface water supplies must be used.

As discussed previously, the Joint GRP has set requirements for minimum levels of reduction in groundwater usage with a 60% reduction requirement by 2025. Therefore, since a portion of the GWTPs in the City will need to convert to surface water, the comparison of small versus large WTPs should be based on the cost to operate a single, regional SWTP as compared to converting some of the existing utility districts GWTPs into SWTPs to meet the Joint GRP groundwater reduction requirements. This analysis assumes adequate surface water is available for purchase or the rights thereof.

Unfortunately, the location of many of the proposed converting GWTPs are a substantial distance from a raw surface water source. Therefore, along with constructing new surface water treatment systems (typically including coagulation, flocculation, sedimentation, filtration and disinfection) at these WTPs, a raw water pump station would need to be constructed near the Brazos River or GCWA canals, and raw water would need to be pumped to each new SWTP. In addition, due to the raw water quality from the Brazos River, the most efficient form of treatment capable of meeting current and future state and federal drinking water regulations is membrane filtration.

In considering small SWTPs compared to large SWTPs, the projected annual O&M cost for a brand new, 0.1 MGD membrane filtration SWTP is roughly $98,000, while a 1.0 MGD facility would be about $560,000 and a 10.0 MGD facility would be roughly $4,156,000. As the size of the WTP increases, economies of scale impact the O&M cost, and the O&M cost per gallon continues to drop with an increasingly larger SWTP.

To compare O&M costs for one regional SWTP as compared to multiple, small SWTPs, conceptual O&M costs were developed for similar-sized membrane filtration SWTPs that would be required to provide treatment of surface water in the areas associated with each proposed phase of the City's new RWTP. The costs also include the pumping required to transfer raw water to each of the smaller facilities. Conceptual O&M costs for the new RWTP (Phase I) as compared to multiple, small SWTPs are listed in Table 2-4.

Table 2-4 O&M Costs Comparison for Phase I RWTP		
Project Description	**Flow Capacity (MGD)**	**Conceptual Annual O&M Cost**
Sienna Plantation No. 1 SWTP	4.32	$2,036,000
Sienna Plantation No. 2 SWTP	2.88	$1,436,000
RWTP	2.80	$1,357,000
Total	**10.0**	**$4,829,000**
City RWTP (Phase I)	**10.0**	**$4,235,000**

Conceptual O&M costs have also been prepared for Phase II of the City's RWTP along with proposed small SWTPs that would be required if a regional SWTP was not constructed in the southern part of the City. The costs also include the pumping required to transfer raw water to each of the smaller facilities. Conceptual O&M costs for the new RWTP (Phase I and II) as compared to multiple, small SWTPs are listed in Table 2-5.

Table 2-5 O&M Cost Comparison for Phase II RWTP		
Project Description	**Flow Capacity (MGD)**	**Conceptual Annual O&M Cost**
Sienna Plantation No. 1 SWTP	4.32	$2,036,000
Sienna Plantation No. 2 SWTP	2.88	$1,436,000
Mustang Bayou SWTP	2.75	$1,405,000
Vicksburg SWTP	9.91	$4,459,000
RWTP	1.24	$655,000
Total	**21.1**	**$9,991,000**
City RWTP (Phase II)	**21.1**	**$8,103,000**

In reviewing O&M cost comparisons of small SWTPs compared to the City's new RWTP in Phase I, the cost difference between the two options does not appear to be significant. In Phase II, a larger cost difference is observed. However, for either Phase I or II, the 30-year O&M cost difference is roughly $18,000,000; likewise, in Phase II, the 30-year O&M cost difference is approximately $56,000,000. In conclusion, since greater economies of scale can be obtained with larger facilities, it stands to reason that a RWTP approach can be accomplished at a substantially reduced life cycle cost as compared to

constructing multiple, small SWTPs that would be compliant with the GRP's groundwater reduction requirements set for 2013 and 2025.

2.4.2 RWTP Phase I

The City is currently under construction of Phase I of a new RWTP. Phase I will provide a total treatment capacity of 10.0 MGD. The Phase I facility includes construction of a new 10.0 MGD membrane filtration system along with supporting facilities. In addition, transmission lines are also being constructed to send treated surface water to the two Sienna Plantation GWTPs that will be converting to surface water. Phase I is anticipated to be online by spring 2012.

2.4.3 RWTP Phase II Expansion

Two additional expansions are proposed for the City's new RWTP. This project would include the construction of a new 11.1 MGD (21.1 MGD total) membrane filtration system and potentially a new reverse osmosis (RO) treatment system, if necessary, to meet state and federal drinking water regulations as the quality of the raw surface water from the Brazos River is anticipated to decline in quality in the future. In addition to the membrane filtration and RO system, additional support facilities will also be constructed at the RWTP. Similar to Phase I, additional transmission lines will be constructed to the utility district systems being converted to surface water in Phase II per the GRP plan. These improvements are projected to be online by 2018.

2.4.4 RWTP Phase III Expansion

This project would include the Phase III expansion of a new 12.2 MGD (33.3 MGD total) membrane filtration system and potentially a new RO treatment system, if necessary to meet state and federal drinking water regulations. In addition to the membrane filtration and RO system, additional support facilities will also be constructed at the RWTP. Similar to Phase I and II, additional transmission lines will be constructed to the utility district systems being converted to surface water in Phase III per the GRP plan. These improvements are projected to be online by 2025.

HARRIS COUNTY WC & ID
FONDREN RD. WTP #2

COMC EST

QUAIL VALLEY UD
WTP No. 3

THUNDERBIRD UD
(SYSTEM 1) WTP #2

PALMER PLANTATION
MUD #2 WTP

FORT BEND
PARKWAY

HIGHWAY 6

FORT BEND COUNTY
MUD #149 WTP

SIENNA PARKWAY

MUSTANG BAYOU WTP

SIENNA PLANTATION #1 WTP

N

2000 0 5000

SCALE IN FEET

LEGEND

- PROPOSED ELEVATED STORAGE TANK LOCATION
- EXISTING ELEVATED STORAGE TANK LOCATION

EXHIBIT 2-3
EXISTING AND PROPOSED ELEVATED STORAGE TANK LOCATIONS
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/17/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151

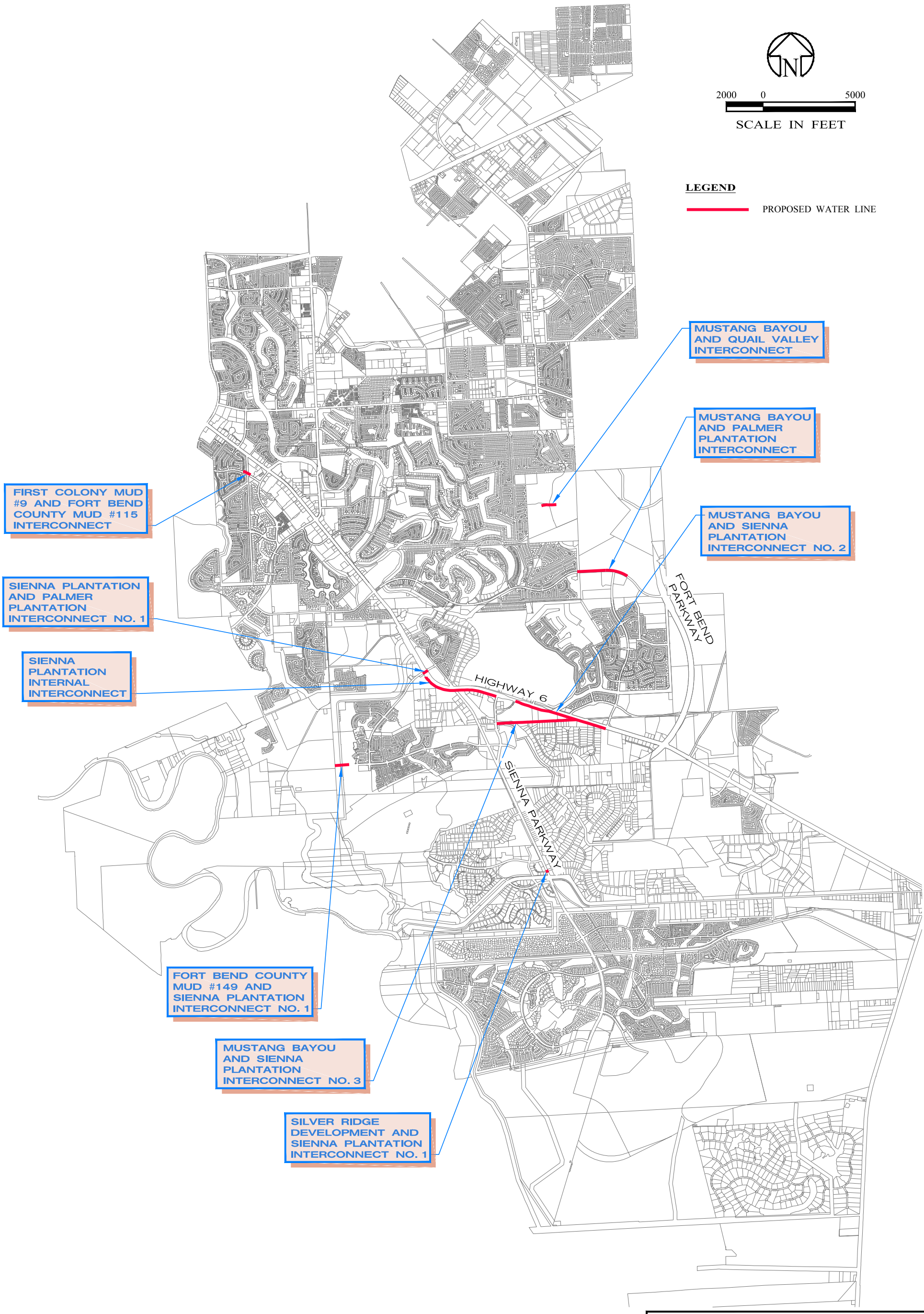
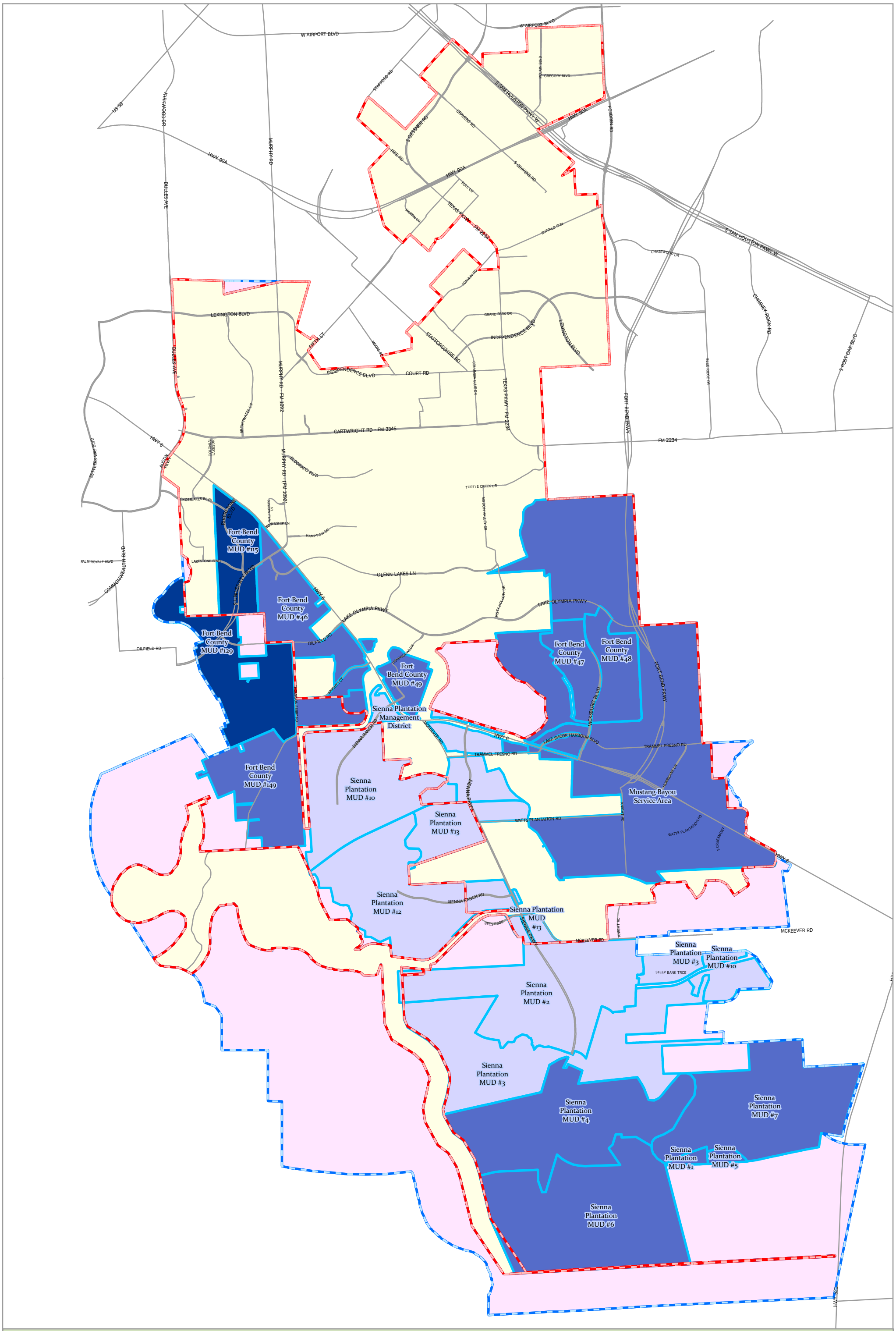


EXHIBIT 2-2
PROPOSED WATER INTERCONNECTS

2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151


W AIRPORT BLVD
US 59
KIRKWOOD DR
HWY 90A
MURPHY RD
BULLES AVE
STAFFORD RD
S GESSNER RD
GRAVENS RD
PIKE RD
S SAM HOUSTON PKWY W
GREGORY BLVD
FONDREN RD
S GRAVENS RD
BULL LN
MARTIN LN
TEXAS PKWY - FM 2234
BUFFALO RUN
CHASEWOOD DR
SCANLAN RD
LEXINGTON BLVD
GRAND PARK DR
INDEPENDENCE BLVD
FIFTH ST
JACOBS RD
STAFFORDSHIRE RD
COURT RD
COLCHESTER BLUFF DR
MURPHY RD - FM 1092
CARTWRIGHT RD - FM 3345
FM 2234
FORT BEND PKWY
BLUE RIDGE DR
CHIMNEY ROCK RD
S POST OAK BLVD
BRIARWYCK EGLE DR
COLONIAL LAKES DR
AUSTIN PKWY
HWY 6
ELDORADO BLVD
TURTLE CREEK DR
MISSION VALLEY DR
CROSSLAKES BLVD
RIVERSTONE BLVD
TOWNSHIP LN
HAMPTON DR
PALM ROYALE BLVD
LAKESTONE BLVD
COMMONWEALTH BLVD
GLENN LAKES LN
LAKE OLYMPIA PKWY
OILFIELD RD
PENINSULA DR
KNIGHTS CT
MISSION FRESNO RD
SIENNA RANCH RD
MCKEEVER RD
VICKSBURG BLVD
LAKE SHORE HARBOUR BLVD
TRAMMEL FRESNO RD
HURRICANE LN
WATTS PLANTATION RD
S GREENMONT
SIENNA PKWY
BEES PGE
STEEP BANK TRCE
HWY 521
Fort Bend County MUD #115
Fort Bend County MUD #46
Fort Bend County MUD #129
Fort Bend County MUD #149
Fort Bend County MUD #49
Fort Bend County MUD #47
Fort Bend County MUD #48
Sienna Plantation Management District
Sienna Plantation MUD #10
Sienna Plantation MUD #13
Sienna Plantation MUD #12
Sienna Plantation MUD #2
Sienna Plantation MUD #3
Sienna Plantation MUD #4
Sienna Plantation MUD #6
Sienna Plantation MUD #7
Sienna Plantation MUD #1
Sienna Plantation MUD #5
Mustang Bayou Service Area
Map By:
GIS Division
October 2011
Exhibit 2-1
Surface Water Treatment
Plant Converting Entities
Legend
Phase I
Phase II
Phase III
City Limits
ETJ
Geographic Coordinate System North American Datum 1983 (NAD83)
0 2,000 4,000 6,000 8,000
Feet
The information on this map is provided and maintained by various agencies, including county departments, municipal governments, state and federal agencies. No guarantee is given as to the accuracy or currency of any of the data. The map is designed to serve as a secondary representation of real property found within this jurisdiction, and is compiled from the recorded deeds, plats, and other public records, which are primary sources for this public information. Users of this map are hereby notified that these primary sources should be consulted for verification of the information presented here. The data layers do not take the place of a legal survey or other primary source documentation. The county and its vendors assume no legal responsibility for the information on this map.

Section 3: Wastewater Collection and Treatment Alternatives

3.1 Current City Wastewater Regionalization Efforts

The City has already begun to regionalize some of the wastewater utility services in the area. Current wastewater regionalization efforts include the Steep Bank-Flat Bank (SB-FB) Regional WWTP, Mustang Bayou Regional WWTP, and Sienna Regional WWTP. Additional details of these regionalization efforts are discussed below.

3.1.1 Steep Bank-Flat Bank Regional WWTP

The City-owned SB-FB Regional WWTP was originally constructed in 1999 with a permitted capacity of 1.5 MGD. An expansion to the plant was completed in 2010, which increased the permitted capacity to 3.0 MGD. The plant currently serves First Colony MUD #9, Fort Bend County MUD #42, Fort Bend County MUD #46, Fort Bend County MUD #115, Fort Bend County MUD #129 and Fort Bend County MUD #149. Future plans for the SB-FB Regional WWTP have historically included two additional expansions of 1.5 MGD each, giving the plant an ultimate permitted capacity of 6.0 MGD. However, discussions on additional options for this facility are included later in this section.

3.1.2 Mustang Bayou Regional WWTP

The City-owned Mustang Bayou Regional WWTP was originally constructed roughly 20 years ago. A second phase was constructed in 2006 and a third phase was completed in 2010. The current permitted capacity of the plant is 0.95 MGD. The plant serves the residents of Fort Bend County MUD #47, Fort Bend County MUD #48 and Mustang Bayou USA.

3.1.3 Sienna Regional WWTP

The southern portion of the Sienna Plantation area is currently served by the Sienna South WWTP. However, the Sienna South WWTP is operating at roughly 92%, which exceeds the TCEQ 75/90 rule. The TCEQ 75/90 rule (30 Texas Administrative Code (T AC) §305.126) requires that whenever flow at a WWTP reaches 75% of the permitted average daily capacity for three consecutive months, engineering and financial planning must be initiated for expansion and/or upgrading. If the planned population to be served, or the quantity of waste produced is not expected to exceed the design limitations of the WWTP, a waiver of this requirement may be requested. Whenever the average daily flow reaches 90% of the permitted average daily flow for three consecutive months, the construction of the expansion and/or upgrades is required to begin.

Therefore, a new WWTP will need to be built to support the remaining undeveloped area south of Sienna Plantation. A new 3.5 MGD regional WWTP has been proposed for the undeveloped portion of the Sienna area, and could also absorb flows from the Sienna South package WWTP. This project is currently in the conceptual stage.

3.2 Wastewater Collection System Alternatives

The existing wastewater system utilizes sanitary sewer lift stations where necessary. No recommended alternatives have been identified that would provide a cost beneficial alternative to the currently designed systems. However, potential alternatives to the current treatment system locations will also include improvements to specific lift stations as necessary to divert flows from one WWTP service area to another.

3.3 Wastewater Treatment System Alternatives

The goal of this section of the Study is to evaluate potential alternatives of consolidating WWTPs where feasible to increase operational efficiency and cost effectiveness throughout the Study area's wastewater system. For a city the size of Missouri City, it is normal to only have one or two wastewater treatment facilities. Substantial savings in annual O&M costs (and therefore the cost of service for the City's residents) can typically be attained by consolidating to a smaller number of WWTPs.

There are 11 existing WWTPs within the Study area, with an additional regional WWTP planned for the southernmost area of the City. Two of the WWTPs are owned by the City (SB-FB and Mustang Bayou). The remaining WWTPs are owned by utility districts. Refer to Exhibit 1-6 for a map of the existing WWTP locations.

As with many other utility district WWTPs, the majority of the WWTPs in the Study area consist of package treatment plants. Package plants are typically used for low flows and small service areas, and allow for rapid design and construction. Because package plants are designed for smaller flows than conventional treatment facilities, package plants normally have limited flexibility to handle large hydraulic peak flows through the treatment system. Also, the size of each package plant typically provides very limited buffer capacity resulting in a greater potential for pass-through of untreated wastewater during high flow events. In addition, package plants typically include very little process automation such as dissolved oxygen (DO) metering to quickly monitor DO in the treatment process and variable frequency drives to allow for turndown of pumps and blowers to reduce energy usage at lower flows.

Another disadvantage of package plants is the inherent limitation in operational flexibility when multiple package plants are used to expand treatment capacity versus additional treatment trains in conventional treatment plants. Package plants are normally not well suited for large WWTP demands, such as for flows greater than 1.0 MGD. For example, the Sienna South Regional WWTP is currently rated for an average daily flow of 1.2 MGD, though it is based on the operation of 4 simultaneously-operated 0.3 MGD package treatment plants. As a result, the plant operations staff has observed substantially higher than normal daily O&M efforts to keep the plant in operation and consistently meeting permit limits.

In addition, package treatment plants typically have much shorter operating lives than conventional or advanced treatment facilities. Most conventional treatment facilities use concrete structures, which typically have a 40-50 year operating life and equipment is designed for 30-40 years. However, in package plants the anticipated operating life is frequently intended only for 10-20 years, especially when structures are designed using painted carbon steel. Package plants are usually intended to manage short-term needs, with the goal of constructing more permanent facilities in the future as flows increase.

Each WWTP was evaluated in this Study for potential consolidation by being reviewed with respect to rated capacity versus average loading; treatment performance; remaining useful life of structures and equipment; treatment and potential expansion capabilities; potential for reuse; and observed level of annual O&M efforts. Based on the evaluation of each WWTP, alternatives have been developed for potential consolidation of WWTPs to a minimum number of operating facilities. A few consolidation alternatives were developed by the various utility district engineering firms which are also incorporated into this Study.

Since the goal of this section is to determine the needs of the entire wastewater system, several additional in-depth analyses were completed for each service area with the goal of developing additional potential consolidation alternatives. In general, there are three basic potential alternatives for each WWTP which are rehabilitation and/or replacement of the WWTP structure and equipment; diversion of the entire plant influent flow to a nearby WWTP; or, expand as a new regional WWTP at the existing site. The advantages and disadvantages of each alternative are discussed in general terms in Table 3-1.

Table 3-1
Advantages & Disadvantages of Consolidation Alternatives

WWTP Alternative	Advantages	Disadvantages
Rehabilitation/Replacement of existing WWTP	Maintain existing operational requirements; provides a treatment backup in case of any problems at an adjacent WWTP.	Overall O&M is typically lower for one combined WWTP than for separate, smaller plants.
Divert WWTP flow to regional WWTP	Increase in treatment efficiency by combining plant flows or may eliminate treatment requirements in this utility district service area; reduce total O&M cost for a combined facility than separate, smaller plants; provides opportunity to establish a newer, more efficient, regional WWTP in another part of the City.	No longer have a treatment backup in case of any problems at adjacent WWTP; would need to adjust administration requirements for billing for both service areas.
Expand to or Construct new regional WWTP at existing site	Increase in treatment efficiency by combining plant flows; reduces total O&M costs for combined, regional facility rather than operating multiple, separate smaller plants; fewer discharge points increases environmental benefits.	Difficult to obtain buy-in with multiple utility districts; would need to adjust administration requirements for billing for the multiple service areas and address fear of loss of control.

Potential alternatives for each WWTP have been developed and are discussed below.

3.3.1 Blue Ridge West MUD WWTP

The Blue Ridge West MUD WWTP was originally a package plant that was built approximately 30 years ago, although Complete-Mix Activated Sludge (CMAS) conventional treatment trains have been added to the plant to replace the original plant over the past 20 years. The WWTP is rated for 1.3 MGD and is operating at 0.75 MGD, or at 58% loading. With the current condition of the structure and equipment, the facility should be expected to continue treating wastewater while meeting permit limits for the next 5-10 years without major replacement of equipment. Since the primary structure is concrete, the structure should be expected to last for another 10-plus years. However, the equipment is approaching the end of its useful life and will likely need replacement within the next 5 years.

Diversion to the nearby Fort Bend County MUD #26 WWTP was not considered as diversion of this plant flow to the MUD #26 WWTP would exceed that plant's treatment capacity. However, diversion of this plant flow to the Quail Valley UD WWTP may be accomplished by directing flow to the Fort Bend County MUD #26 WWTP and then pumping from the MUD #26 WWTP to the Quail Valley UD WWTP. As another option, this plant flow could potentially be diverted to the FBCMUD #26 WWTP and sent further downstream to the SB-FB WWTP. Benefits and disadvantages for each alternative are discussed in Table 3-2. Note that only site-specific advantages and disadvantages are included in this table and subsequent tables for additional alternatives.

Table 3-2
Consolidation Alternatives for Blue Ridge West MUD WWTP

WWTP Alternative	Advantages	Disadvantages
Rehabilitation/Replacement of existing WWTP	WWTP is operating at 58% capacity, which is a high operating efficiency.	Requires additional staff to operate this plant and nearby MUD #26 WWTP; existing WWTP as designed and operated will likely have difficulty in consistently meeting effluent limitations for ammonia.
Expand Existing WWTP to develop a new regional WWTP	Establishes new, regional WWTP in north part of City.	Higher cost than diverting to a downstream WWTP; still leaves multiple WWTPs in operation within the City.
Divert WWTP flow to Quail Valley UD WWTP	Eliminate treatment requirements in this utility district service area.	This alternative may not be cost-effective unless the MUD #26 WWTP flow is diverted to this WWTP also; the Quail Valley UD WWTP may not be able to consistently treat this additional flow.
Divert WWTP flow to SB-FB WWTP	**Eliminate treatment requirements in this utility district service area**	**Initial capital cost for transfer pipeline to this facility; this alternative may not be cost-effective unless the nearby WWTPs are considered in this alterative as well.**

Notes:
WWTP alternative in bold text denotes recommendation discussed further in Section 4.

The recommended alternative for the Blue Ridge West MUD WWTP is to divert this flow to an offsite WWTP, ultimately to the SB-FB WWTP.

3.3.2 Fort Bend County MUD #26 WWTP

The Fort Bend County MUD #26 WWTP is approximately 30 years old, though it has recently undergone a minor rehabilitation (conversion of contact-stabilization to CMAS process). The WWTP is rated for 0.5 MGD, though it is operating only at 0.3 MGD, or at 60% loading. With the current condition of the structure and equipment, the facility should be expected to continue treating wastewater while meeting permit limits for the next 5-10 years without major replacement of equipment.

Since the primary structure is concrete, the structure should be expected to last for another 10-plus years. However, the equipment is approaching the end of its useful life and will likely need replacement within the next 5 years. Benefits and disadvantages for each alternative are discussed in Table 3-3.

Table 3-3
Consolidation Alternatives for Fort Bend County MUD #26 WWTP

WWTP Alternative	Advantages	Disadvantages
Rehabilitation/Replacement of existing WWTP	WWTP is operating at 60% capacity, which is a high operating efficiency.	Requires additional treatment staff to operate this plant and nearby Blue Ridge WWTP. WWTP discharges into a regulated watershed and will likely require additional treatment upgrades to meet effluent limitations.
Divert WWTP Flow to Blue Ridge WWTP	Eliminate treatment requirements in this utility district service area.	Initial capital cost for transfer pipeline to this facility; this alternative may not be cost-effective unless the nearby WWTPs are considered in this alterative as well
Divert WWTP flow to Quail Valley UD WWTP	Eliminate treatment requirements in this utility district service area.	Initial capital cost for transfer pipeline to this facility; this alternative may not be cost-effective unless the nearby WWTPs are considered in this alterative as well
Divert WWTP flow to SB-FB WWTP	**Eliminate treatment requirements in this utility district service area.**	**Initial capital cost for transfer pipeline to this facility; this alternative may not be cost-effective unless the nearby WWTPs are considered in this alterative as well.**

Notes:
WWTP alternative in bold text denotes recommendation discussed further in Section 4.

The recommended alternative for the Fort Bend County MUD #26 WWTP is to divert this flow to an offsite WWTP, ultimately to the SB-FB WWTP.

3.3.3 Harris County MUD #122 WWTP

The Harris County MUD #122 WWTP is approximately 20 years old and has not been rehabilitated in quite some time. The WWTP is rated for 0.25 MGD, though it is operating only at 0.1 MGD, or at 40% loading. With the current condition of the structure and equipment and the process design (contact-stabilization secondary biological

process), the facility should be expected to continue treating wastewater for the next 5-10 years.

However, it is unlikely that the WWTP will be able to consistently meet its new permit, which now includes an enforced ammonia limit. The contact-stabilization type of treatment process used at this site is intended only for BOD removal and was never intended to remove ammonia. As a result, the contact (aeration) portion of the process has a short hydraulic retention time (HRT), normally between 1-2 hours. The minimum HRT for ammonia removal is usually over 6 hours which only allows for limited ammonia removal.

As an example, the Fort Bend County MUD #26 WWTP had repeated difficulty in meeting its ammonia limit with its existing contact-stabilization process until it was retrofitted into a more conventional CMAS process. Therefore, until the treatment process can be upgraded at the Harris County MUD #122 WWTP, it is unlikely that the plant will be able to consistently meet its new permit limits which will go into effect in the Summer of 2012.

Diversion to the nearby Southwest Harris County MUD #1 WWTP was not considered as diversion of this plant flow to the MUD #1 WWTP would put that plant at 75% loading which would cause it to fall under the TCEQ 75/90 rule. Benefits and disadvantages for each alternative are discussed in Table 3-4.

Table 3-4
Consolidation Alternatives for Harris County MUD #122 WWTP

WWTP Alternative	Advantages	Disadvantages
Rehabilitation/Replacement of existing WWTP	Continue operation at this plant as it currently exists.	WWTP is operating at 40% capacity, which is a low operating efficiency; existing WWTP as designed and operated will likely have difficulty in consistently meeting effluent limitations for ammonia.
Divert WWTP flow to Fondren Road WWTP	Regional WWTP in the north part of the City.	Higher cost than diverting to a downstream WWTP; still leaves multiple WWTPs in operation within the City.
Divert WWTP flow to WC&ID #2	Eliminate treatment requirements in this utility district service area.	Potentially higher cost than diverting to a downstream WWTP; still leaves multiple WWTPs in operation within the City; loss of bed and banks reuse credit by diverting to WC&ID #2.
Divert WWTP flow to SB-FB WWTP	**Eliminate treatment requirements in this utility district service area.**	**Initial capital cost for transfer pipeline to this facility; this alternative may not be cost-effective unless the nearby WWTPs are considered in this alterative as well.**

Notes:
WWTP alternative in bold text denotes recommendation discussed further in Section 4.

The recommended short-term alternative (0-5 years) for the Harris County MUD #122 WWTP is to complete a minor upgrade and/or rehabilitation to the WWTP to convert the contact-stabilization plant to a conventional CMAS treatment process to better meet the plant's new permit limits. The recommended long-term alternative for the HCMUD #122 WWTP is to divert this flow to an offsite WWTP, ultimately to the SB-FB WWTP.

3.3.4 Harris County WC&ID – Fondren Road WWTP

The Harris County WC&ID – Fondren Road WWTP is approximately 30 years old, though it has recently undergone a minor rehabilitation (cleaning and limited structural/equipment repairs). The WWTP is rated for 0.6 MGD, but it is operating only at 0.2 MGD, or at 33% loading. With the current condition of the structure and equipment, the facility should be expected to continue treating wastewater while meeting permit limits for the next 5-10 years without major replacement of equipment. Since the primary structure is concrete, the structure should be expected to last for another 10-plus years. However, the equipment is approaching the end of its useful life and will likely need replacement within the next 5 years.

Diversion to the nearby Southwest Harris County MUD #1 WWTP was not considered since diversion of this plant flow to the MUD #1 WWTP would put that plant at 75% loading, which would cause it to fall under the TCEQ 75/90 rule. In addition, the MUD #1 WWTP site is already built out, so expansion of that facility is not likely to be feasible. Benefits and disadvantages for each alternative are discussed in Table 3-5.

Table 3-5
Consolidation Alternatives for Harris County WC&ID – Fondren Road WWTP

WWTP Alternative	Advantages	Disadvantages
Rehabilitation/Replacement of existing WWTP	Continue operation at this plant as it currently exists.	WWTP is operating at 33% capacity, which is a low operating efficiency; requires additional staff to operate this plant and the nearby MUD #1 WWTP. WWTP appears to be having increasing mechanical, electrical, and control system issues which further increases O&M costs.
Construct new regional WWTP at this site	Establishes new, regional WWTP in north part of City.	Higher cost than diverting to a downstream WWTP; still leaves multiple WWTPs in operation within the City.
Divert WWTP flow to SB-FB WWTP	**Eliminate treatment requirements in this utility district service area.**	**Initial capital cost for transfer pipeline to this facility; this alternative may not be cost-effective unless the nearby WWTPs are considered in this alterative as well.**

Notes:
WWTP alternative in bold text denotes recommendation discussed further in Section 4.

The recommended alternative for the Harris County MUD #122 WWTP is to divert this flow to an offsite WWTP, ultimately to the SB-FB WWTP.

3.3.5 Mustang Bayou Regional WWTP

The Mustang Bayou WWTP is approximately 20 years old. The plant consists of 3 package plant trains, with Train No. 1 being roughly 20 years old, Train No. 2 being roughly 5 years old, and Train No. 3 being about 1 year old. The age and condition of the two newer trains will require only minor work over the next 5-10 years but the oldest train is approaching the end of its useful life. The WWTP is rated for 1.0 MGD, and it is operating at 0.4 MGD, or at 40% loading.

With the current condition of the structure and equipment, the facility can also be expected to continue treating wastewater while meeting permit limits for the next 5-10 years without major replacement of equipment. However, the structure and equipment for the oldest train is approaching the end of its useful life and will likely need a major rehabilitation and/or replacement of the majority of the structures and equipment within the next 5 years.

Therefore, three alternatives may be feasible for this facility, including rehabilitation and/or replacement of the WWTP structure and equipment over the next 5-10 years, modification of the plant to develop a new regional WWTP at this site or diversion to a downstream WWTP, such as the SB-FB WWTP. Benefits and disadvantages for each alternative are discussed in Table 3-6.

Table 3-6
Consolidation Alternatives for Mustang Bayou Regional WWTP

WWTP Alternative	Advantages	Disadvantages
Rehabilitation/Replacement of existing WWTP	Continue operation at this plant as it currently exists.	WWTP is operating at 40% of capacity which is a low operating efficiency; the existing treatment trains are all package plants which have a limited useful life.
Develop this WWTP into a large, regional WWTP	Provides opportunity to establish a more efficient, regional WWTP in eastern part of the City	Higher cost than diverting to a downstream WWTP; still leaves multiple WWTPs in operation within the City.
Divert WWTP flow to SB-FB WWTP	**Eliminate treatment requirements in this utility district service area**	**Initial capital cost for transfer pipeline to this facility**

Notes:
WWTP alternative in bold text denotes recommendation discussed further in Section 4.

The recommended alternative for the Mustang Bayou WWTP is to also divert this flow to an offsite WWTP, ultimately to the SB-FB WWTP.

3.3.6 Palmer Plantation WWTP

The Palmer Plantation WWTP is approximately 25 years old, and has not undergone a rehabilitation of the plant. The WWTP is rated for 0.6 MGD, and it is operating at 0.3 MGD, or at 50% loading. With the current condition of the structure and equipment, the facility can also be expected to continue treating wastewater while meeting permit limits for the next 5-10 years without major replacement of equipment. Since the primary structure is concrete, the structure should be expected to last for another 10-15 years.

However, the equipment is approaching the end of its useful life and will likely need replacement within the next 5-10 years. Benefits and disadvantages for both alternatives are discussed in Table 3-7.

Table 3-7
Consolidation Alternatives for Palmer Plantation WWTP

WWTP Alternative	Advantages	Disadvantages
Rehabilitation/Replacement of existing WWTP	Continue operation at this plant as it currently exists.	WWTP discharges into a regulated watershed and will likely require additional treatment upgrades to meet effluent limitations.
Divert WWTP flow to SB-FB WWTP	**Eliminates treatment requirements in this utility district.**	**May be lower cost to divert to nearby Quail Valley UD WWTP.**

Notes:
WWTP alternative in bold text denotes recommendation discussed further in Section 4.

The recommended alternative for the Palmer Plantation WWTP is to divert this flow to an offsite WWTP, ultimately to the SB-FB WWTP.

3.3.7 Quail Valley UD WWTP

The Quail Valley UD WWTP (shared with Thunderbird UD) is approximately 35 years old, though it continually undergoes rehabilitation on an annual basis. The age and condition of the plant require a full plant overhaul, though to date, the work completed has been in bits and pieces throughout the plant site. The WWTP is rated for 4.0 MGD, but it is operating only at 1.5 MGD, or at 38% loading. However, while the plant is rated for 4.0 MGD, it is not certain whether this full treatment capacity still exists. For example, the 4.0 MGD rating was based on the original plant design which only required removal of BOD and did not have an enforced ammonia limit as it currently does. Therefore, it is likely that the effective treatment capacity may be more in the range of 2.0-3.0 MGD.

With the current condition of the structures and equipment, the facility should be expected to continue treating wastewater while meeting permit limits for the next 5-10 years without major replacement of equipment. Since the primary structure is concrete, the structure should be expected to last for another 5-plus years. However, the structures and equipment are approaching the end of their respective useful lives and will likely need a major rehabilitation and/or replacement of the majority of the structures and equipment within the next 5 years.

In addition, the treatment process used at the WWTP is a pure oxygen process, which is extremely energy-intensive, especially for the actual flow being treated at the plant. The pure oxygen system produces liquid oxygen, which is injected into the treatment reactors (sealed aeration basins) to maintain a higher biomass concentration to provide treatment of wastewater in a smaller basin with a shorter HRT. Excess liquid oxygen is stored in pressurized tanks onsite, and becomes a safety issue as the tanks age. Considering the age

and condition of the equipment, it may be prudent to consider overhauling the treatment plant's secondary process and return to a more conventional form of aerated treatment.

The City would prefer to maintain treatment at this facility mainly because it provides a substantial supply of § 210 reclaimed water for the nearby golf course, so any potential offsite diversions would need to maintain the reclaimed water for irrigation at the golf course. Benefits and disadvantages for each alternative are discussed in Table 3-8.

Table 3-8
Consolidation Alternatives for Quail Valley UD – Thunderbird UD WWTP

WWTP Alternative	Advantages	Disadvantages
Rehabilitation/Replacement of existing WWTP	Continue operation at this plant as it currently exists.	WWTP is operating at 38% capacity, which is a low operating efficiency; requires additional treatment staff to operate this plant and nearby WWTPs. WWTP discharges into a regulated watershed and will likely require additional treatment upgrades to meet effluent limitations.
Develop this WWTP into Regional WWTP	Regional WWTP in the central part of the City.	The facility may not be able to consistently treat additional flow from other utility district areas.
Divert WWTP flow to SB-FB WWTP	**Eliminate treatment requirements in this utility district service area.**	**Initial capital cost for transfer pipeline to this facility.**

Notes:
WWTP alternative in bold text denotes recommendation discussed further in Section 4.

The recommended alternative for the Quail Valley UD WWTP is to divert this flow to an offsite WWTP, ultimately to the SB-FB WWTP. This alternative would also include the construction of a 0.5 MGD reclaimed water pump station and transmission system at the SB-FB WWTP site to provide a continued supply of reclaimed water back to the Quail Valley Country Club.

3.3.8 Sienna Plantation North WWTP

The Sienna Plantation wastewater collection system is divided into two service areas separated by Flat Bank Creek. The regions north of Flat Bank Creek currently are treated with a package plant - Sienna North WWTP. The WWTP is approximately 10 years old and it is rated for 0.9 MGD. It is operating only at 0.3 MGD, or at 33% loading. With the current condition of the structure and equipment, the facility should be expected to continue treating wastewater while meeting permit limits for the next 10-15 years without major replacement of equipment.

Two alternatives may be feasible for this facility, including rehabilitation and/or replacement of the WWTP structure and equipment over the next 10-15 years or diversion of wastewater flow to the SB-FB WWTP. Potential diversion of the plant flow to the nearby Palmer Plantation WWTP was not considered as the Palmer Plantation WWTP is also being evaluated for diversion to the SB-FB WWTP. Benefits and disadvantages for both alternatives are discussed in Table 3-9.

Table 3-9 Consolidation Alternatives for Sienna Plantation North WWTP		
WWTP Alternative	**Advantages**	**Disadvantages**
Rehabilitation/Replacement of existing WWTP	Continue operation at this plant as it currently exists.	WWTP is operating at 33% of capacity which is a low operating efficiency; requires additional staff to operate this plant and nearby WWTPs.
Divert WWTP flow to SB-FB WWTP	**Eliminate treatment requirements in this utility district service area.**	**Initial capital cost for transfer pipeline to this facility.**
Notes: WWTP alternative in bold text denotes recommendation discussed further in Section 4.		

The recommended alternative for the Sienna North WWTP is to divert this flow to an offsite WWTP, ultimately to the SB-FB WWTP.

3.3.9 Sienna Plantation South WWTP

The Sienna Plantation wastewater collection system south of Flat Bank Creek currently is conveyed to a 1.2 MGD package WWTP (Sienna South WWTP). The Sienna South WWTP is approximately 20 years old and is in a fairly dilapidated condition. The WWTP is rated for 1.2 MGD, and it is operating at roughly 1.1 MGD, or at 92% loading. With the current condition of the structure and equipment, the facility should be expected to continue treating wastewater while meeting permit limits for the next 5-10 years without major replacement of equipment.

Two key issues that are related to flow loading need to be addressed with this facility. The WWTP is currently in noncompliance with the TCEQ 75/90 rule. However, since the service area for this WWTP is completely built out, this means that additional treatment capacity is not needed for growth. However, the current flow loading also allows for very little buffer for treatment upsets at the plant, so the plant is currently operating right at the edge of its capabilities and excursions from the permit limits could be expected on occasion. Diversion of flows from this WWTP to another WWTP should occur as soon as feasible.

Two alternatives may be feasible for this facility, including rehabilitation and/or replacement of the WWTP structure and equipment over the next 5-10 years or diversion of wastewater flows to an offsite WWTP. Potential diversion of the plant flow to the nearby Sienna North WWTP was not considered as the current flow loading at the Sienna South WWTP would overload the treatment capacity of the Sienna North WWTP. Benefits and disadvantages for each alternative are discussed in Table 3-10.

Table 3-10 Consolidation Alternatives for Sienna Plantation South WWTP		
WWTP Alternative	**Advantages**	**Disadvantages**
Rehabilitation/Replacement of existing WWTP	Continue operation at this plant as it currently exists.	WWTP is operating at 92% of capacity, which is too high to maintain efficiency; requires additional staff to operate this plant and nearby WWTPs.
Divert WWTP flow to SB-FB WWTP	**Eliminate treatment requirements in this utility district service area.**	**Initial capital cost for transfer pipeline to this facility.**
Notes: WWTP alternative in bold text denotes recommendation discussed further in Section 4.		

The recommended alternative for the Sienna South WWTP is to divert this flow to an offsite WWTP, ultimately to the SB-FB WWTP.

3.3.10 Southwest Harris County MUD #1 WWTP

The Southwest Harris County MUD #1 WWTP is approximately 20 years old though it has recently undergone a minor rehabilitation (cleaning and minor structural/equipment repairs). The WWTP is rated for 0.4 MGD, but it is operating at 0.1 MGD, or at 25% loading. With the current condition of the structure and equipment, the facility can be expected to continue treating wastewater while meeting permit limits for the next 5-10 years without major replacement of equipment. Since the primary structure is concrete, the structure should be expected to last for another 20-plus years. However, the equipment is approaching the end of its useful life and will likely need replacement within the next 10 years.

Therefore, four alternatives may be feasible for this facility, including rehabilitation and/or replacement of the WWTP structure and equipment over the next 5-10 years, diversion of the entire plant influent flow to the nearby Harris County WC&ID – Fondren Road WWTP, diversion of wastewater flow to the nearby WC&ID #2 utility district, or diversion to an expanded SB-FB WWTP. Benefits and disadvantages for each alternative are discussed in Table 3-11.

Table 3-11 Consolidation Alternatives for Southwest Harris County MUD #1 WWTP		
WWTP Alternative	**Advantages**	**Disadvantages**
Rehabilitation/Replacement of existing WWTP	Backup in case of any problems at the Harris County - Fondren Road WWTP.	WWTP is operating at 25% capacity, which is a low operating efficiency; requires additional treatment staff to operate this plant and the nearby Harris County - Fondren Road WWTP.
Divert WWTP flow to Fondren Road WWTP	Increase in treatment efficiency by combining plant flows in a Regional WWTP in the north part of the City.	No backup in case of any problems at the Harris County - Fondren Road WWTP.
Divert WWTP flow to WC&ID #2	Eliminate treatment requirements in this utility district service area.	No backup in case of any problems at the WC&ID #2 WWTP.
Divert WWTP flow to SB-FB WWTP	**Eliminate treatment requirements in this utility district service area.**	**Initial capital cost for transfer pipeline to this facility; this alternative may not be cost-effective unless the nearby WWTPs are considered in this alterative as well.**
Notes: WWTP alternative in bold text denotes recommendation discussed further in Section 4.		

The recommended alternative for the Southwest Harris County MUD #1 WWTP is to divert this flow to an offsite WWTP, ultimately to the SB-FB WWTP.

3.3.11 SB-FB Regional WWTP

The SB-FB WWTP is approximately 20 years old though it was recently expanded in 2010. The plant is in very good condition and is ready to begin accepting limited flows from other facilities. The WWTP is rated for 3.0 MGD, and it is operating only at 1.5 MGD, or at 50% loading. While the plant is rated for 3.0 MGD, the ultimate build-out capacity for the WWTP could be as high as 6.0 MGD if the existing extended aeration secondary process continues to be used. However, if a more efficient treatment process is used, the ultimate capacity for this plant site could easily be expanded to more than 20.0 MGD. Discussion on WWTP process alternatives for this facility is included later in Section 3.5.

With the current condition of the structure and equipment, the facility can be expected to continue treating wastewater while meeting permit limits for the next 25-30 years without major replacement of equipment. However, depending on the flows diverted to this facility, an additional expansion will likely be needed within the next 5-10 years.

Due to the age of the new improvements, only one alternative has been evaluated for this facility which is the expansion of this plant into a new super-regional WWTP at this site. Diversion to nearby WWTPs was not considered since additional flow to nearby WWTPs would exceed those plants' treatment capacities. In addition, the City would prefer to maximize treatment at this facility as it provides the most efficient diversion of effluent for use with a potential bed and banks permit. Advantages and disadvantage for the one alternative are discussed in Table 3-12.

Table 3-12 Consolidation Alternatives for SB-FBWWTP		
WWTP Alternative	**Advantages**	**Disadvantages**
Develop this WWTP into a large, regional WWTP	**Provides opportunity to establish a more efficient, regional WWTP in western part of the City.**	**Difficult to obtain buy-in with multiple utility districts; would need to adjust administration requirements for billing for the multiple service areas and address fear of loss of control.**

The recommended alternative for the SB-FB WWTP is to continue expansions at the existing plant to develop a large, single regional WWTP at this plant site. While the ultimate capacity of the SB-FB WWTP would be limited to 6.0 MGD using the existing extended aeration process design, it would be more cost-effective to design future expansions around a much more efficient treatment process such as a sequencing batch reactor (SBR) to increase ultimate build-out capacity to more than 20.0 MGD. For example, a 16.0 MGD, four-basin SBR system could be constructed in roughly the same footprint as the required footprint for the proposed, two future extended aeration basins. Discussion of process alternatives for this facility is included later in Section 3.5. Costs for this alternative have been developed and are included in Section 4.

3.4 Wastewater Operation and Maintenance Alternatives

In evaluating the WWTPs, multiple plant issues were reviewed that could impact O&M costs, such as the age and condition of the structures and equipment, type of treatment process, flow loading as compared to treatment capacity, type of control systems to reduce power consumption, and O&M effort and methods of solids handling. Anticipated O&M costs for the existing 11 WWTPs as compared to a single, regional WWTP, or as compared to several regional facilities are estimated. The following sections cover the basis for development of O&M costs and the comparisons of the various WWTPs in the Study area.

3.4.1 Comparison of O&M Costs for Small WWTPs versus Regional WWTPs

The goal of this subsection is to review the method of developing O&M costs for new and older WWTPs in this Study, and determining the cost impact of issues such as under- or overloading, type of treatment process, energy use efficiency, solids handling efficiency and level of automation. The intent of developing various O&M costs in this Study is to provide the basis for evaluation of each of the existing WWTPs with regard to whether it is more efficient and cost-effective to maintain multiple WWTPs or to consolidate the WWTPs.

In the past, EPA developed cost curves for various types of WWTPs which accounted for type of process, whether a facility was a conventional treatment system or a package plant system, and flow loading and method of solids handling. At the time, factors such as energy efficiency and level of automation from control systems had very little impact on the cost curves, as control components such as variable frequency drives were being used in few WWTPs at the time. As a result, the original EPA cost curves for WWTP

O&M have been updated and revised over the years to develop more current costs. The O&M cost models used in this Study were based on EPA cost curves with revisions made for newer treatment technologies and improvements in efficiency-enhancing technologies such as variable frequency drives and automated control systems.

WWTPs are typically operated most efficiently at 60-80% of their rated capacities to maximize operation of pumps, blowers and other equipment. Some treatment plants incorporate additional equipment such as variable frequency drives to essentially "turn down" power requirements for equipment to reduce energy usage throughout the plant when operating at lower than optimal flow rates. Most package plants are not designed with this goal in mind, and only operate efficiently when the plant operates close to the permitted flow rate.

In addition to flow underloading, many of the WWTPs also utilize aerobic digestion for onsite sludge storage until such time as a third-party solids handling company can haul the liquid sludge offsite and either use it for beneficial land application or send the liquid sludge to a landfill for ultimate disposal. Aerobic digestion allows for reduction of solids in the sludge by aerobically treating the sludge at a higher rate (5-10 mg/L of dissolved oxygen) than in the normal CMAS process (2 mg/L of dissolved oxygen). Unfortunately, some of the WWTPs in this Study pay for offsite sludge hauling at a cost per gallon, which means that the aerobic digestion provides very little benefit in reduction of hauling cost as opposed to the high energy cost. Impacts of solids handling will also be addressed in the development of O&M costs for the various WWTPs.

Projected annual O&M cost for a brand new, conventional 0.1 MGD facility (operating at 60-80% capacity) is roughly $75,000, while a 1.0 MGD facility (operating at 60-80% capacity) would be roughly $400,000, and a 10.0 MGD facility (operating at 60-80% capacity) would be roughly $1,550,000. Therefore, as the size of the WWTP increases, economies of scale impact the O&M cost (and capital cost), and the O&M cost per 1,000 gallons treated continues to drop with an increasingly larger WWTP. However, as a WWTP deteriorates, the annual cost of operation increases at a lesser or greater rate, depending on the type of treatment process, type of plant (conventional vs. package), level of automation and energy use, and method of solids handling and ultimate disposal.

To review the impacts on the annual O&M cost for a WWTP, several additional cost factors were considered for this analysis. Multipliers for the cost factors were determined based on observations of cost impacts seen at various WWTPs through discussion with operators and engineering experience.

- Cost addition multiplier depending on type of WWTP. Package plant ultimately costs more to operate and maintain than conventional systems; therefore, the conventional plant is the baseline with a 1.0 multiplier and a package plant uses a 1.25 multiplier;

- Cost reduction multiplier to allow for underloading of WWTPs as a cost savings;

- Cost addition multiplier for equipment such as pump and blower systems that are not designed to operate at reduced energy requirements when underloaded. A site-specific multiplier was selected based on the equipment at each facility;

- Cost addition multiplier for age and condition of structure and equipment (e.g. the older a system is, the greater the O&M effort to keep the system operational). The multiplier was calculated using 1 + 0.1 per 5 years of age;

- Cost addition multiplier for onsite aerobic digestion of solids;

- Cost addition multiplier for hauling liquid sludge offsite, as opposed to dewatering onsite and hauling offsite as a dry solids cake; and

- Cost addition multiplier for limited or no automation of plant processes (less automation means greater operator onsite support of plant processes is required).

An example calculation for the SWHC MUD #1 WWTP is shown below.

- Plant Rating: 0.4 MGD;

- O&M Cost for New 0.4 MGD Conventional WWTP: $180,000 per year (this would be the anticipated annual operational cost for a brand new 0.4 MGD conventional WWTP, operated at 60-80% capacity);

- Type of WWTP – Package Plant: 1.25 x $180,000 = $225,000;

- Plant Loading: 0.1 MGD – 0.1/0.4 = 0.25 x $225,000 = $56,250;

- Loss of energy savings on equipment: 1.2 x $56,250 = $67,500;

- Plant Age: 20 years - 1.4 x $67,500 = $94,500;

- Onsite aerobic digestion of solids: 1.25 x $94,500 = $118,125;

- Hauling liquid sludge offsite: 1.25 x $118,125 = $147,656; and

- Lack of automation of plant processes: 1.2 x $147,656 = $178,000.

While this WWTP is currently operating at only 25% of its rated capacity, cost factors regarding how the system is designed, operated and maintained can have a substantial impact in the O&M cost for each separate facility. Adjusted O&M costs (taking into account the cost factors listed above) have been developed for each WWTP to increase

the base O&M cost (developed using updated cost models) which would be anticipated for a new facility operating at full capacity.

As the age of each WWTP increases, the adjusted annual O&M cost will continue to increase unless substantial rehabilitation improvements are completed. Associated O&M costs for each existing facility are listed in Table 3-13.

Table 3-13
Projected O&M Costs at Current Flow Rates

Name	Base O&M Cost (per year)	Multiplier for Type of Plant	Multiplier for Flow Loading	Multiplier for Loss of Energy Savings	Multiplier for Age and Condition	Multiplier for Solids Digestion	Multiplier for 3rd Party Handling of Solids	Multiplier for Level of Automation and SCADA Support	Adjusted O&M Cost (per year)
Blue Ridge West MUD WWTP	$435,000	1.25	0.58	1.1	1.4	1.25	1	1.1	$665,000
Fort Bend County MUD #26 WWTP	$220,000	1.25	0.6	1.2	1.6	1.25	1.25	1.2	$594,000
Harris County MUD #122 WWTP	$130,000	1.25	0.4	1.2	1.4	1.25	1.25	1.2	$205,000
Harris County WC&ID - Fondren Road WWTP	$253,000	1.25	0.33	1.2	1.6	1.25	1.25	1.2	$380,000
Mustang Bayou Regional WWTP	$400,000	1.25	0.4	1.2	1.1	1.25	1.25	1.2	$495,000
Palmer Plantation WWTP	$253,000	1	0.5	1.2	1.6	1.25	1.25	1.2	$456,000
Quail Valley UD WWTP	$780,000	1	0.375	1.75	1.7	1	1	1.2	$1,045,000
Sienna North WWTP	$360,000	1.25	0.33	1.2	1.2	1.25	1.25	1.2	$405,000
Sienna South WWTP	$422,000	1.25	0.92	1	1.4	1.25	1.25	1.2	$1,270,000
Southwest Harris County MUD #1 WWTP	$180,000	1.25	0.25	1.2	1.4	1.25	1.25	1.2	$178,000
SB-FB Bank Regional WWTP	$652,000	1	0.5	1.1	1.1	1	1	1	$395,000

3.4.2 Project O&M Costs for Regional WWTPs

As discussed previously, O&M cost projections have been developed for informational purposes only. Since it may or may not be feasible to consolidate the entire City wastewater service area into a single treatment plant, O&M cost projections have been developed for one consolidated, single treatment plant and for several, smaller regional WWTPs in the Study area for comparison.

3.4.2.1 Projected O&M Costs for a Super-Regional WWTP

The existing WWTPs in the City's Study area provide an approximate total treatment capacity of 13.75 MGD. While the current flow loading is roughly only 6.55 MGD, or 48%, the flow loading matches fairly close to the current percent of development within the City limits and ETJ. At build-out, the projected wastewater production will be roughly 16.4 MGD (per wastewater projections from Section 1). Therefore, it would be reasonable to develop costs for a single regional treatment facility based on an assumed capacity of 16.4 MGD to allow for continued future growth. The anticipated annual O&M cost for a brand new, super-regional 16.4 MGD WWTP would be approximately $2,217,000 per year, operating at 60-80% capacity. However, similar to the O&M cost evaluation of the SB-FB WWTP, the super-regional WWTP would not be operated at full flow loading at this time, and so the adjusted O&M cost would be roughly $1,029,000 per year. Also note that this cost does not include the additional O&M costs for the regional lift stations required to transfer wastewater from the various service areas in the City to this one treatment location, which at full build-out would be approximately $100,000 to $300,000 per year, depending on ultimate pump and pipeline sizing. These costs were developed to compare against total O&M costs for multiple, smaller regional WWTPs discussed as follows.

3.4.2.2 Projected O&M Costs for a Several Regional WWTPs

If the City were to instead develop several sites throughout the Study area as smaller regional WWTPs, the cost for new lift stations should be somewhat reduced though it is expected that the total O&M cost for the multiple regional WWTPs would be higher than for a single regional facility. Refer to Table 3-14 for projected O&M costs for multiple regional WWTPs, utilizing both the Fondren Road and Quail Valley UD WWTP sites as regional plant sites. The costs in Table 3-14 assume that the new Sienna South Regional WWTP is not yet in operation (cost to operate existing Sienna South WWTP is much higher than for a new conventional regional WWTP) and that a more permanent, conventional treatment system has not yet been constructed at the Mustang Bayou site (O&M cost would be much lower for a conventional system).

Table 3-14
Projected O&M Costs for Multiple Regional WWTPs - Scenario 1

Name	Base O&M Cost (per year)	Multiplier for Type of Plant	Multiplier for Flow Loading	Multiplier for Loss of Energy Savings	Multiplier for Age and Condition	Multiplier for Solids Digestion	Multiplier for 3rd Party Handling of Solids	Multiplier for Level of Automation and SCADA Support	Adjusted O&M Cost (per year)
New Regional Plant at the Fondren Road WWTP Site	$460,000	1	0.27	1.1	1.1	1	1	1	$149,000
New Regional Plant at the Quail Valley UD WWTP Site	$780,000	1	0.69	1.1	1.1	1	1	1	$649,000
New Regional Plant at the SB-FB WWTP Site	$845,000	1	0.47	1.1	1.1	1	1	1	$478,000
Existing Mustang Bayou WWTP Site	$400,000	1.25	0.4	1.2	1.1	1.25	1.25	1.2	$495,000
Sienna South WWTP	$422,000	1.25	0.92	1	1.4	1.25	1.25	1.2	$1,270,000
Total									**$3,041,000**

Since the total projected O&M for multiple regional WWTPs appears to be three times higher than the cost to operate one single regional WWTP, it would be more cost-effective to construct a single regional WWTP rather than to maintain several smaller regional WWTPs. However, final recommendation of a WWTP consolidation scenario should be based on the capital cost, annual O&M cost and ultimately, the 30-year life cycle costs, which incorporates both capital and O&M costs. These costs have been developed and are discussed in Section 4.

3.5 Process Alternatives for Regional WWTP Scenarios

As discussed previously, there are currently four different secondary treatment processes in use throughout the various WWTPs in the Study area. The existing treatment processes used are extended aeration, CMAS, contact-stabilization and pure oxygen. Of these four processes, the contact-stabilization process is not designed for removing ammonia, which is now a common permit limit; therefore, it should certainly not be considered for further implementation in any regional WWTP scenario, as any scenario will require ammonia removal as part of its treatment requirements.

3.5.1 Process Alternatives

Potential treatment processes that should be considered for implementation in future regional WWTP improvements are as follows:

- Extended Aeration (EA);
- Conventional Mixed Aerated Sludge (CMAS);

- Pure Oxygen (PO);
- Sequencing Batch Reactor (SBR);
- Modified Ludzack-Ettinger (MLE);
- Biological Nutrient Removal (BNR); and
- Membrane Bio-Reactor (MBR).

The advantages and disadvantages of the various process alternatives are listed in Table 3-15.

Table 3-15
Advantages and Disadvantages of WWTP Process Alternatives

Process	Designed for Ammonia Removal	Designed for Total Nitrogen Removal	Designed for Phosphorus Removal	Requires Clarifiers for Solids Separation	Process Commonly Used for WWTPs Larger than 1.0 MGD	Typical Maximum Organic Loading (lb per 1,000 cf)	Buildout Capacity at SB-FB WWTP Site Based on this Process	Typical Process Capital Cost per Gallon
EA	Yes	No	No	Yes	No	15	6.0 MGD	$3.00
CMAS	Yes	No	No	Yes	Yes	35	12.0 MGD	$4.00
PO	No	No	No	Yes	No	45	10.0 MGD	$6.00
SBR	Yes	Yes	No	No	Yes	35	20.0+ MGD	$2.00
MLE	Yes	Yes	No	Yes	Yes	35	12.0 MGD	$5.00
BNR	Yes	Yes	Yes	Yes	Yes	35	16.0 MGD	$6.00
MBR	Yes	Yes	Yes	No	Yes	50+	20.0+ MGD	$10.00

While processes such as extended aeration and pure oxygen can be constructed for WWTPs with capacities greater than 1.0 MGD, they typically are limited to 1.0 MGD in size due to inherent difficulties in construction or in cost of equipment. With extended aeration as an example, the organic loading allowed by the TCEQ for design is so low that the structure required is usually three times larger than other process alternatives. However, in selecting a recommended process for the improvements in any of the regional WWTP scenarios, it is generally necessary to strike a balance among cost of construction, footprint of the process and complexity of the process. The prioritized goals were first cost of construction and then expandability potential at a given site. In looking at potential improvements in any of the regional WWTP scenarios, the process recommended for implementation is an SBR process.

3.5.2 SBR Process

SBR is an activated sludge process designed to operate in a true batch mode with aeration and sludge settling both occurring in the same basin. The major differences between SBR and CMAS are that the SBR basin carries out the functions of equalization, aeration and sedimentation in a time sequence rather than in the conventional space sequence of CMAS. In addition, an SBR system can be designed with the ability to treat a wide range of influent volumes, whereas CMAS is based on a fixed influent flowrate. SBRs produce

sludge with good settling properties providing the influent wastewater is admitted into the aeration in a controlled manner.

Controls range from a simplified float and timer based system (older systems) with a programmable logic controller (PLC) to a PC-based supervisory control and data acquisition (SCADA) system (newer systems) with color graphics using either flow proportional aeration or DO-controlled aeration to reduce aeration as necessary, to reduce energy consumption, and to enhance the removal of BOD and nutrients. An appropriately designed SBR process is a unique combination of equipment and software. Working with automated control reduces the number of operators, skill and attention requirements.

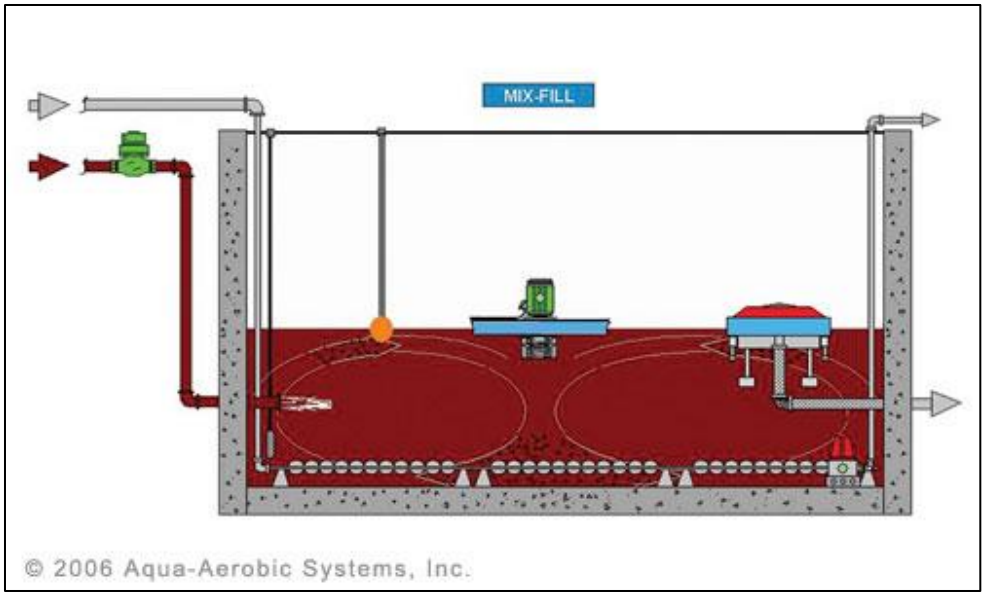
The operating principles of an SBR process are characterized in five discrete cycles:

1. Mix Fill
2. React Fill
3. React
4. Settle
5. Decant / Waste Solids

Following the fifth step in the process, the SBR is ready to start back at Step 1 and begin receiving new influent wastewater flow.

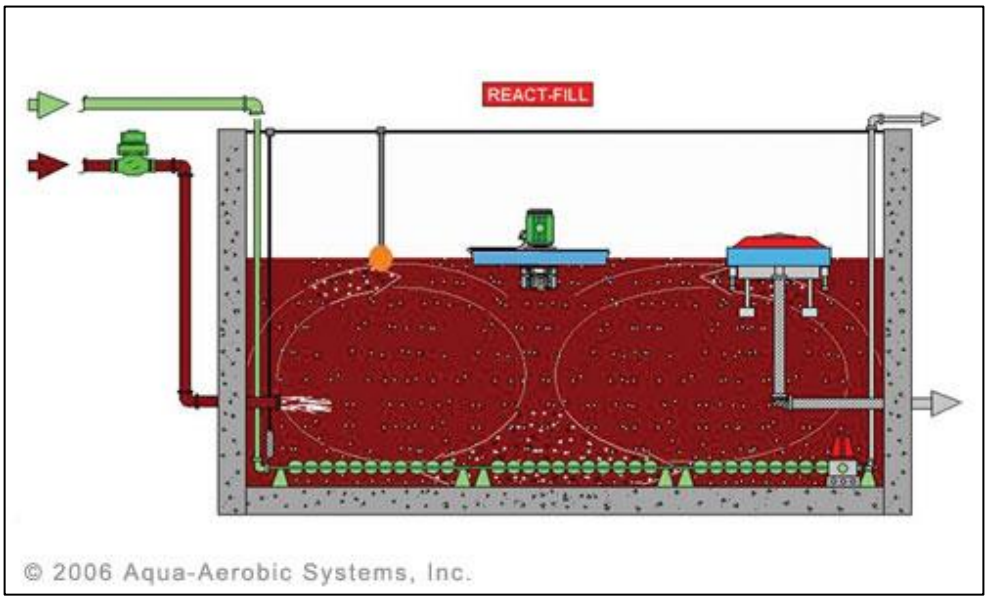
3.5.2.1 Mix Fill

The influent wastewater is distributed throughout the settled sludge through the influent distribution manifold to provide good contact between the microorganisms and the influent wastewater. The influent can be either pumped in or allowed to flow in by gravity. Most of this step occurs without aeration to create an environment that favors the growth of microorganisms with good settling characteristics. Aeration begins at the end of this period. An example graphic of this cycle is provided. The graphics for each step are based on Aqua Aerobic brand system, though all SBR manufacturers design around the same five basic process periods. Note that in the mix fill diagram, the influent line (brown) is active, showing influent filling. The grey line is the inactive air line to the air diffusers. The vertical line extending into the basin is the float level. The center float is the mixer/aerator and the equipment on the left is the decanter.



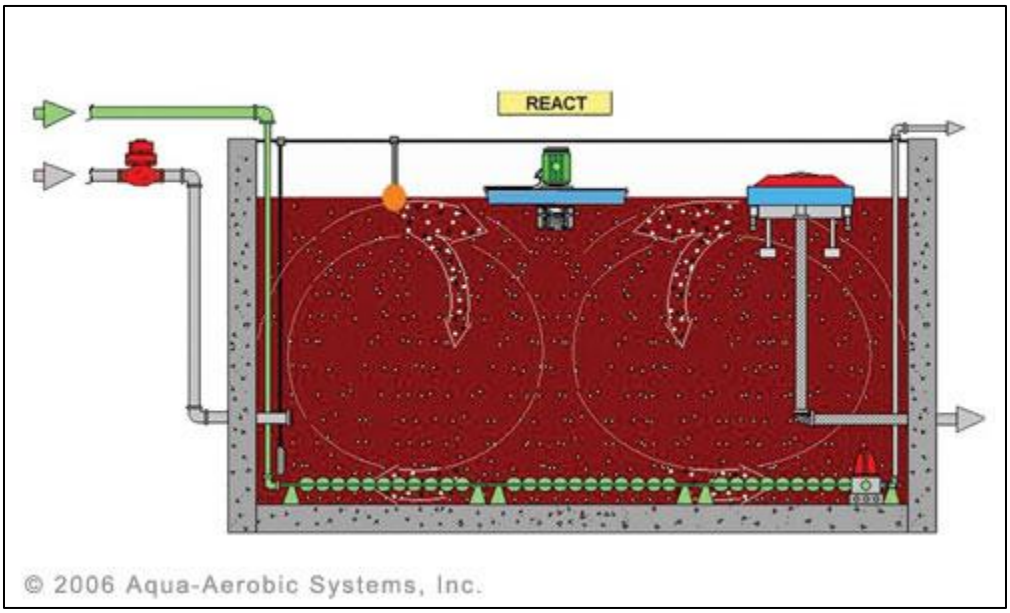
3.5.2.2 React Fill

The influent wastewater continues to be distributed throughout the settled sludge through the influent distribution manifold to provide good contact between the microorganisms and the influent wastewater. Most of this step occurs with aeration to create an environment that balances energy usage while reducing BOD and ammonia. Aeration begins at the start of this cycle and operates intermittently based on operator input. An example graphic of this cycle is shown as follows. Note that in the react fill diagram, the influent line (brown) is still active, showing influent filling, and the air line (green) is also active, reflecting aeration through the diffusers.



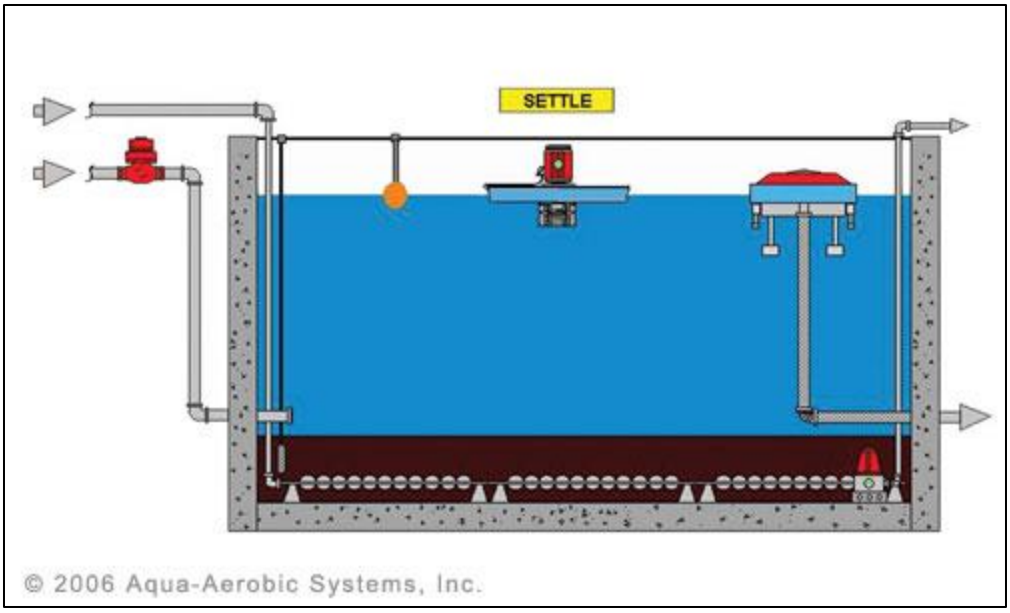
3.5.2.3 React

During this cycle, aeration continues until complete removal of BOD and ammonia is achieved. After the BOD is consumed, the microorganisms enter into a famine stage. During this stage some microorganisms will die because of the lack of food (BOD) and will help to reduce the volume of the settling sludge. The length of the aeration period determines the degree of BOD consumption and ammonia removal. An example graphic of this cycle follows. Note that in the react diagram, only the air line (green) is active, reflecting only aeration in this cycle.



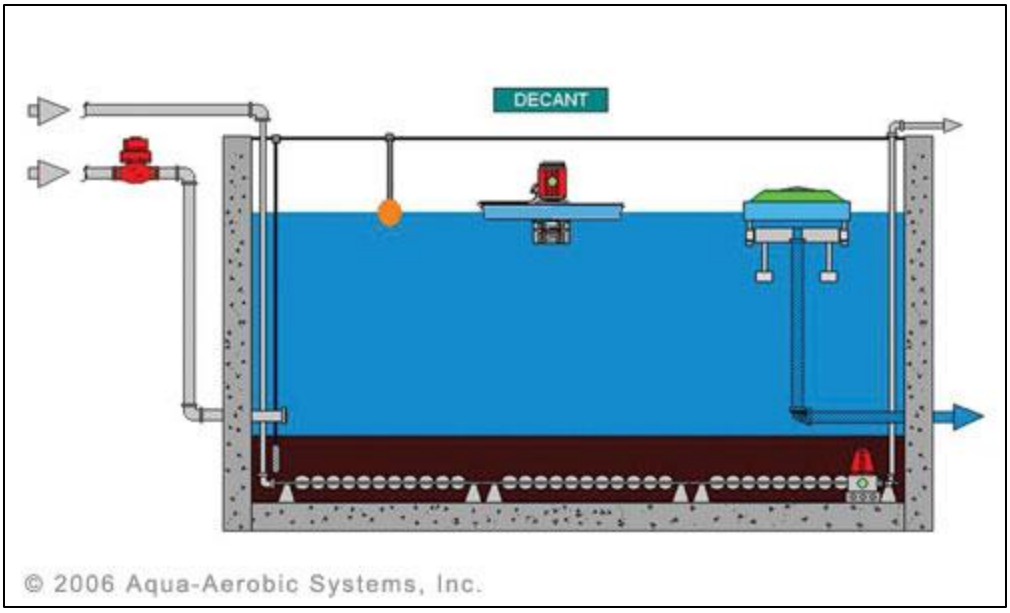
3.5.2.4 Settle

Aeration is stopped at the settle stage and solids separation takes place, leaving clear, treated effluent above the sludge blanket (basin now operates as a clarifier). During this clarifying period, no liquids should enter or leave the tank to avoid turbulence and solids carryover in the effluent. An example graphic of this cycle is included. Note that in the settle diagram, no lines are active, indicating that the system is completely stopped, to allow for settling of sludge.



3.5.2.5 Decant / Waste Solids

The decant / waste solids period is characterized by the withdrawal of treated effluent from approximately two feet below the surface of the mixed liquor by the floating decanter while preventing solids carryover in the effluent. This removal must be done without disturbing the settled sludge to prevent solids carryover in the effluent. Sludge is then wasted to a nearby sludge storage tank or digester. The frequency of sludge wasting ranges between once each cycle to once every two to three months depending upon system design. An example graphic of this period is shown as follows. Note that in the decant diagram, the decant line (blue) is active, indicating that the system is decanting the top liquid layer as effluent, which goes to either filtration or final disinfection before discharge. Wasting of sludge also occurs in this cycle.



3.6 Use of Reclaimed Water

Within the Study area there has been very little use of reclaimed water. Reclaimed water use has typically been limited to the City's use of effluent from the Quail Valley UD WWTP for irrigation of the golf course. The average daily usage is approximately 300,000-400,000 gallons per day (gpd). Therefore, of the average effluent produced each day (6.55 MGD), roughly 94% of the current effluent produced (6.25 MGD) is discharged to waterways ultimately draining to the Brazos River. As the City begins converting part of the Study area to usage of surface water per the Joint GRP requirements, efficient management of all potential water supply sources is critical to the City. Regardless of whether all the existing WWTPs are selected for consolidation by the City, potential reclaimed water use in each area should be researched thoroughly to determine areas of drinking water demand reduction via use of reclaimed water for non-potable uses, such as irrigation.

3.6.1 Regional Bed and Banks Permit

Generally about 60% of all water diverted from Texas' rivers and streams or groundwater pumped for municipal purposes enters the state's watercourses as discharges of treated effluent from WWTPs. Once considered a threat to surface water supplies, due in part to actual or perceived water quality concerns, the value of this treated effluent is now clearly recognized. This is evidenced by a much heightened interest in reuse projects to meet current and future increased municipal demands. Further, the concept of reuse is included in nearly every Senate Bill 1 regional plan. Treated wastewater effluent discharged into Texas' rivers also helps meet downstream water needs, including those of the environment and agriculture.[1]

[1]Texas Water Rights and Wastewater Reuse, Prepared by the Reuse Committee of the TWCA

In water rights permitting, reuse is the use of surface water which has already been beneficially used once under a water right, or the use of groundwater which has been used per 30 (TAC § 297.1(44). There are two types of reuse: indirect reuse and direct reuse. Indirect reuse is the reuse of water, usually effluent, which is placed back into the river or stream (referred to as "return flow"). This generally occurs when a WWTP discharges effluent into a stream and either the discharger or another person or entity diverts the effluent further downstream to use again. A bed and banks authorization under the Texas Water Code § 11.042 is required for the use of the watercourse to transport the water for reuse. In contrast, direct reuse occurs when effluent from a WWTP is piped directly to a place where it is used.

Municipalities have increasingly looked to their effluent as an additional water resource and the City is no exception. Currently, under the auspices of the Joint GRP Group with the City as the Sponsor, a regional bed & banks permit is being pursued. The Project will consist primarily of the following tasks:

- Preparation of the Bed and Banks Permit Application(s), which includes data collection, financial development and map preparation;
- Submit initial application to the TCEQ;
- Respond to the TCEQ Requests for Information;
- Prepare and Submit Accounting Plan;
- Coordinate with and support the City in response/negotiations with any permit protestants;
- Work with Staff and outside legal counsel in support of the application process; and
- Work with the TCEQ throughout the process to ensure approval to the best extent possible.

A summary of the WWTPs and their associated effluent discharges included in this project are shown in Table 3-16.

Table 3-16 Potential Bed and Banks Flows				
Plant	**Source Water**	**Permit No.**	**Authorized Discharge**	**2010**
			(MGD	**Annual Average Discharge**
			Acre-ft / year)	**(MGD**
				Acre-ft / year)
SB-FBRegional WWTP	GW / SW	WQ0013873001	6	1.322
			6,721	1,481
Mustang Bayou	GW	WQ0013873002	0.95	0.395
			1,064	442
Palmer Plantation MUD No. 1	GW	WQ0012937001	0.6	0.316
			672	353
Quail Valley UD	GW	WQ0011046001	4	1.309
			4,481	1,467
Sienna Plantation MUD No. 1	GW / SW	WQ0014100001	0.902	0.324
			1,010	363
Totals			**12.452**	**3.666**
			13,948	**4,106**

As the sponsor, the City intends to apply for the total permitted discharge of 13,948 ac-ft per year. However, if the City decides to pursue consolidating more WWTPs into the SB-FB WWTP, the City could gain a greater benefit of more flow to apply for in the proposed Bed and Banks permit. For example, if all the existing WWTPs were consolidated into the SB-FB WWTP, the City could apply for the potential total plant flow less reuse demands at Quail Valley UD, of 16.0 MGD, or 17,924 acre-ft per year. In addition, at current City wastewater flows, with approval of the Bed and Banks permit, the City should be able to utilize (less Quail Valley UD reuse flow) up to 6.18 MGD, or 6,923 acre-ft per year.

Currently the City's consultant is assembling the data and calculating the carriage losses. It is anticipated that an application will be submitted in early November 2011.

Section 4: Costs for Recommended Consolidation Projects

4.1 Costs for Recommended Water Projects

This subsection describes the costs associated with the recommended alternatives identified in Section 2 of the Study for water improvements. The financial impacts to the various utility districts from improvements to the distribution systems, storage systems, and the future phases of the RWTP are described below.

4.1.1 Costs for Recommended Interconnection Projects

4.1.1.1 Interconnect First Colony MUD #9 with Fort Bend County MUD #115

Costs for the proposed 12-inch water line interconnect between First Colony MUD #9 and Fort Bend County MUD #115 are summarized in Table 4-1. The estimated costs include the conversion from chlorine to chloramines which will be needed ahead of Phase III of the RWTP.

Table 4-1
First Colony MUD #9 & Fort Bend County MUD #115 Interconnect Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	12-inch wet connect	EA	2	$2,500.00	$5,000.00
2	12-inch C-900 PVC water line by trenchless	LF	100	$200.00	$20,000.00
3	12-inch C-900 PVC water line by open cut	LF	20	$150.00	$3,000.00
4	Chloramine conversion, including new flow control and chemical feed building, chemical feed and control system	LS	1	$400,000.00	$400,000.00
Subtotal					$428,000.00
Contingencies (20%)					$86,000.00
Engineering & Testing (18%)					$93,000.00
Total Estimated Capital Cost					**$607,000.00**

Notes:
1 - This estimate does not include costs for acquisition of easements from property owners.
2 - This estimate does not include costs for dewatering of the water line or the bore pits.

4.1.1.2 Mustang Bayou Water Treatment Plant System and Sienna Plantation System Interconnect No. 2

Costs for the proposed interconnect between Mustang Bayou and Sienna Plantation are summarized in Table 4-2.

Table 4-2
Mustang Bayou & Sienna Plantation Interconnect No. 2 Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	16-inch water line	LF	2,150	$33.00	$70,950.00
2	12-inch water line	LF	4,362	$28.00	$122,136.00
3	Bore of 18-inch steel casing (includes casing pipe only)	LF	775	$350.00	$271,250.00
4	Trench safety & testing of water line	LF	7,287	$2.00	$14,574.00
5	Utility spoils (includes disposal adjacent to water line construction)	CY	1,200	$2.50	$3,000.00
6	Water meter for interconnect	EA	1	$25,000.00	$25,000.00
7	Butterfly or gate valves	EA	7	$2,500.00	$17,500.00
8	Flushing valves	EA	18	$2,200.00	$39,600.00
Subtotal					$564,000.00
Contingencies (20%)					$113,000.00
Engineering & Testing (18%)					$122,000.00
Total Estimated Capital Cost					**$799,000.00**

Notes:
1 - This estimate does not include costs for acquisition of easements from property owners.
2 - This estimate assumes there is adequate room for the water line to fit within the existing ROW.
3 - This estimate assumes there are no conflicts with the existing dry utilities within the SH6 ROW.
4 - This estimate assumes the scope of construction will be approved by TxDOT.
5 - This estimate does not include costs for dewatering of the water line or the bore pits.
6 - This estimate assumes there are no conflicts with existing potential jurisdictional wetlands. Permitting costs are not included.

4.1.1.3 Mustang Bayou Water Treatment Plant System and Sienna Plantation System Interconnect No. 3

Costs for the proposed 12-inch water line establishing the third interconnect between the two water distribution systems are summarized in Table 4-3.

Table 4-3
Mustang Bayou & Sienna Plantation Interconnect No. 3 Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	12-inch water line	LF	3,403	$28.00	$95,284.00
2	Bore of 18-inch steel casing across SH6 (includes casing pipe only)	LF	230	$350.00	$80,500.00
3	12-inch steel water line across Oyster Creek to be bored	LF	550	$325.00	$178,750.00
4	Dewatering of bore pit for Oyster Creek Bore	EA	2	$20,000.00	$40,000.00
5	Trench safety and testing of water line	LF	3,953	$2.00	$7,906.00
6	Utility spoils (includes disposal adjacent to water line construction)	CY	1,000	$2.50	$2,500.00
7	Water meter for interconnect	EA	1	$25,000.00	$25,000.00
8	Butterfly or gate valves	EA	7	$2,500.00	$17,500.00
9	Flushing valves	EA	16	$2,200.00	$35,200.00
Subtotal					$483,000.00
Contingencies (20%)					$96,600.00
Engineering & Testing (18%)					$104,500.00
Total Estimated Capital Cost					**$683,500.00**

Notes:
1 - This estimate does not include any costs for acquisition of easements from property owners.
2 - This estimate assumes there is adequate room for the water line to fit within the existing ROW.
3 - This estimate assumes there are no conflicts with the existing dry utilities within the SH6 ROW.
4 - This estimate assumes there are no conflicts with the existing dry utilities within the Trammel Fresno ROW.
5 - This estimate assumes there are no conflicts with existing potential jurisdictional wetlands. Permitting costs are not included.
6 - This estimate does not include any costs for dewatering of the water line only the bore pits at Oyster Creek.

4.1.1.4 Sienna Plantation Water System Internal Interconnect

Costs for the proposed 12-inch water line internal interconnect for Sienna Plantation are summarized in Table 4-4.

Table 4-4
Sienna Plantation Internal Interconnect Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	12-inch water line	LF	950	$28.00	$26,600.00
2	12-inch steel water line across Oyster Creek (by bore)	LF	550	$325.00	$178,750.00
3	Dewatering of bore pit for Oyster Creek bore	EA	2	$20,000.00	$40,000.00
4	18-inch bore across SPLID levee (includes casing and no carrier pipe)	LF	131	$375.00	$49,125.00
5	Trench safety & testing of water line	LF	1,500	$2.00	$3,000.00
6	Utility spoils (includes disposal adjacent to water line construction)	CY	1,000	$2.50	$2,500.00
7	Concrete collar for crossing levee	EA	2	$5,000.00	$10,000.00
8	Butterfly or gate valves	EA	2	$2,500.00	
9	Flushing valves	EA	6	$2,200.00	$13,200.00
Subtotal					$323,000.00
Contingencies (20%)					$65,000.00
Engineering & Testing (18%)					$70,000.00
Total Estimated Capital Cost					**$458,000.00**

Notes:
1 - This estimate does not include costs for acquisition of easements from property owners.
2 - This estimate assumes there is adequate room for the water line to fit within the existing ROW.
3 - This estimate assumes there are no conflicts with the existing dry utilities within the SH6 ROW.
4 - This estimate assumes there are no conflicts with existing potential jurisdictional wetlands. Permitting costs are not included.
5 - This estimate does not include any costs for dewatering of the water line only the bore pits at Oyster Creek.

4.1.1.5 Sienna Plantation System and Palmer Plantation System Interconnect No. 1

Costs for the proposed 12-inch water line interconnect between Sienna Plantation and Palmer Plantation are summarized in Table 4-5.

Table 4-5
Sienna Plantation & Palmer Plantation Interconnect No. 1 Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	12-inch water line	LF	300	$28.00	$8,400.00
2	Bore of 18-inch steel casing across SH6 (includes casing pipe only)	LF	300	$350.00	$105,000.00
3	Trench safety & testing of water line	LF	300	$2.00	$600.00
4	Utility spoils (includes disposal adjacent to water line construction	CY	50	$2.50	$125.00
5	Concrete collar for crossing levee	EA	2	$5,000.00	$10,000.00
6	Butterfly or gate valves	EA	2	$2,500.00	$5,000.00
7	Water meter for interconnect	EA	1	$25,000.00	$25,000.00
8	Chloramine conversion of Palmer Plantation	LS	2	$250,000.00	$500,000.00
Subtotal					$655,000.00
Contingencies (20%)					$131,000.00
Engineering & Testing (18%)					$141,500.00
Total Estimated Capital Cost					**$927,500.00**

Notes:
1 - This estimate assumes there is adequate room for the water line to fit within the existing ROW.
2 - This estimate assumes there are no conflicts with the existing dry utilities within the SH6 ROW.
3 - This estimate assumes there are no conflicts with any existing potential jurisdictional wetlands. Permitting costs are not included.
4 - This estimate does not include costs for dewatering of the water line or the bore pits.

4.1.1.6 Silver Ridge Development and Sienna Plantation Water System Interconnect No. 1

Costs for this proposed project which only include extending a 12-inch water line across Sienna Parkway are summarized in Table 4-6. Further cost analysis will be required to compare potential revenues with the cost of distribution improvements within the Silver Ridge system to determine if interconnecting the system to Sienna Plantation is worthwhile provided the TCEQ ultimately does not require it.

Table 4-6
Silver Ridge Development & Sienna Plantation Interconnect No. 1 Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	12-inch water line	LF	150	$40.00	$6,000.00
2	18-inch steel water line casing across SH6	LF	150	$350.00	$52,500.00
3	16-inch x 12-inch tapping sleeve and valve	EA	1	$3,000.00	$3,000.00
4	Dewatering of bore pit	EA	2	$8,000.00	$16,000.00
5	Trench safety & testing of water line	LF	150	$2.00	$300.00
6	Butterfly or gate valves	EA	2	$2,500.00	$5,000.00
7	Water meter for interconnect	EA	1	$25,000.00	$25,000.00
8	Utility spoils (includes disposal adjacent to water line construction)	CY	50	$2.50	$125.00
Subtotal					$108,000.00
Contingencies (20%)					$22,000.00
Engineering & Testing (18%)					$24,000.00
Total Estimated Capital Cost					**$154,000.00**

Notes:
1 - This estimate assumes there is adequate room for the water line to fit within the existing ROW.
2 - This estimate assumes there are no conflicts with the existing dry utilities within the Sienna Parkway ROW.
3 - This estimate does not include running of line pipe within the Silver Ridge development.
4 - This estimate does not include costs for increased plant capacity which may be required to service the development.

4.1.1.7 Fort Bend County MUD #149 and Sienna Plantation MUD #1 Water System Interconnect No. 1

Costs for the proposed 12-inch water line between the Sienna Plantation and Fort Bend County MUD #149 (Riverstone) water systems are summarized in Table 4-7.

Table 4-7
Fort Bend County MUD #149 & Sienna Plantation MUD #1 Interconnect No. 1
Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	12-inch wet connect	EA	2	$2,500.00	$5,000.00
2	12-inch steel water line by pipe bridge	LF	500	$300.00	$150,000.00
3	12-inch C-900 PVC water line by open cut	LF	20	$125.00	$2,500.00
4	Chloramine conversion of Riverstone WP	EA	1	$250,000.00	$250,000.00
Subtotal					$408,000.00
Contingencies (20%)					$82,000.00
Engineering & Testing (18%)					$89,000.00
Total Estimated Capital Cost					**$579,000.00**

Notes:
1 - This estimate does not include costs for acquisition of easements from property owners.
2 - This estimate assumes there are no conflicts with any existing potential jurisdictional wetlands. Permitting costs are not included.

4.1.1.8 Mustang Bayou and Palmer Plantation Interconnect

Costs for the proposed interconnect between the Mustang Bayou service area and the Palmer Plantation MUD service area are summarized in Table 4-8.

Table 4-8
Mustang Bayou & Palmer Plantation Interconnect Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	16-inch water line by open cut	LF	1,250	$65.00	$81,250.00
2	16-inch water line by trenchless	LF	100	$200.00	$20,000.00
3	16-inch gate valve & box	EA	4	$6,000.00	$24,000.00
4	12-inch water line by open cut	LF	1,200	$50.00	$60,000.00
5	12-inch water line by trenchless	LF	140	$100.00	$14,000.00
6	12-inch gate valve & box	EA	4	$2,000.00	$8,000.00
7	Connection to existing water line	EA	2	$1,500.00	$3,000.00
Subtotal					$210,000.00
Contingencies (20%)					$42,000.00
Engineering & Testing (18%)					$46,000.00
Total Estimated Capital Cost					**$298,000.00**

Notes:
1 - This estimate does not include costs for acquisition of easements from property owners.
2 - This estimate assumes there are no conflicts with any existing potential jurisdictional wetlands. Permitting costs are not included.

4.1.1.9 Mustang Bayou and Quail Valley Interconnect

Costs for the proposed new interconnect between the Mustang Bayou service area and Quail Valley UD service area are summarized in Table 4-9.

Table 4-9
Mustang Bayou & Quail Valley Interconnect Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	12-inch water line by open cut	LF	2,000	$50.00	$100,000.00
2	12-inch steel water line across Oyster Creek (by bore)	LF	150	$325.00	$48,750.00
3	Dewatering of bore pit for Oyster Creek bore	EA	2	$20,000.00	$40,000.00
4	12-inch gate valve & box	EA	6	$2,000.00	$12,000.00
5	Connection to existing water line	EA	2	$1,500.00	$3,000.00
Subtotal					$204,000.00
Contingencies (20%)					$41,000.00
Engineering & Testing (18%)					$44,000.00
Total Estimated Capital Cost					**$289,000.00**

Notes:
1 - This estimate does not include costs for acquisition of easements from property owners.
2 - This estimate assumes there are no conflicts with any existing potential jurisdictional wetlands. Permitting costs are not included.
3 - This estimate does not include any costs for dewatering of the water line only the bore pits at Mustang Bayou.

4.1.2 Costs for Recommended Storage Projects

An evaluation of potential new EST locations was completed in order to provide a more hydraulic-oriented elevated storage system as opposed to continuing operation of the pressure-driven storage system. The costs associated with the recommended ESTs are described below.

4.1.2.1 New EST at Sienna Plantation WTP #1

Costs for a new 1.25 MG EST at the existing Sienna Plantation No. 1 WTP site are based on the proposed construction of a composite-type tank and are summarized in Table 4-10.

Table 4-10
Sienna Plantation WTP #1 EST Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	New 1.25 MG composite elevated storage tank	GAL	1,250,000	$2.50	$3,125,000.00
2	Piping modifications and sitework	LS	1	$50,000.00	$50,000.00
3	High service pumping modifications	LS	1	$50,000.00	$50,000.00
4	SCADA system for new EST	LS	1	$25,000.00	$25,000.00
Subtotal					$3,250,000.00
Contingencies (20%)					$650,000.00
Engineering & Testing (18%)					$702,000.00
Total Estimated Capital Cost					**$4,602,000.00**

Notes:
1 - This estimate does not include costs for acquisition of easements from property owners.

4.1.2.2 New EST at Mustang Bayou WTP

Costs for a new 0.5 MG EST at the existing Mustang Bayou WTP site are based on the proposed construction of a composite-type tank and are summarized in Table 4-11.

Table 4-11
Mustang Bayou WTP EST Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	New 0.5 MG composite elevated storage tank	GAL	500,000	$2.50	$1,250,000.00
2	Piping modifications and sitework	LS	1	$50,000.00	$50,000.00
3	High service pumping modifications	LS	1	$50,000.00	$50,000.00
4	SCADA system for new EST	LS	1	$25,000.00	$25,000.00
Subtotal					$1,375,000.00
Contingencies (20%)					$275,000.00
Engineering & Testing (18%)					$297,000.00
Total Estimated Capital Cost					**$1,947,000.00**

Notes:
1 - This estimate does not include costs for acquisition of easements from property owners.

4.1.2.3 New EST at Fort Bend County MUD #149 WTP

Costs for a new 1.75 MG EST at the existing Fort Bend County MUD #149 WTP site are based on the proposed construction of a composite-type tank and are summarized in Table 4-12.

Table 4-12
Fort Bend County MUD #149 WTP EST Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	New 1.75 MG composite elevated storage tank	GAL	1,750,000	$2.50	$4,375,000.00
2	Piping modifications and sitework	LS	1	$50,000.00	$50,000.00
3	High service pumping modifications	LS	1	$50,000.00	$50,000.00
4	SCADA system for new EST	LS	1	$25,000.00	$25,000.00
Subtotal					$4,500,000.00
Contingencies (20%)					$900,000.00
Engineering & Testing (18%)					$972,000.00
Total Estimated Capital Cost					**$6,372,000.00**

Notes:
1 - This estimate does not include any costs for acquisition of easements from property owners.

4.1.2.4 New EST at Palmer Plantation MUD No. 2 WTP

Costs for a new 1.0 MG EST at the existing Palmer Plantation MUD No. 2 WTP site are based on the proposed construction of a composite-type tank and are summarized in Table 4-13.

Table 4-13
Palmer Plantation MUD No. 2 WTP EST Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	New 1.0 MG composite elevated storage tank	GAL	1,000,000	$2.50	$2,500,000.00
2	Piping modifications and sitework	LS	1	$50,000.00	$50,000.00
3	High service pumping modifications	LS	1	$50,000.00	$50,000.00
4	SCADA system for new EST	LS	1	$25,000.00	$25,000.00
Subtotal					$2,625,000.00
Contingencies (20%)					$525,000.00
Engineering & Testing (18%)					$567,000.00
Total Estimated Capital Cost					**$3,717,000.00**

Notes:
1 - This estimate does not include costs for acquisition of easements from property owners.

4.1.2.5 New EST at Thunderbird UD System 1 WTP No. 2

Costs for a new 1.0 MG EST at the existing Thunderbird Utility District System 1 WTP No. 2 site are based on the proposed construction of a composite-type tank and are summarized in Table 4-14.

Table 4-14
Thunderbird UD System 1 WTP No. 2 EST Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	New 1.0 MG composite elevated storage tank	GAL	1,000,000	$2.50	$2,500,000.00
2	Piping modifications and sitework	LS	1	$50,000.00	$50,000.00
3	High service pumping modifications	LS	1	$50,000.00	$50,000.00
4	SCADA system for new EST	LS	1	$25,000.00	$25,000.00
Subtotal					$2,625,000.00
Contingencies (20%)					$525,000.00
Engineering & Testing (18%)					$567,000.00
Total Estimated Capital Cost					**$3,717,000.00**

Notes:
1 - This estimate does not include costs for acquisition of easements from property owners.

4.1.2.6 New EST at Harris County WC&ID – Fondren Road WTP No. 2

Costs for of a new 0.5 MG EST at the existing HCWC&ID – Fondren Road WTP No. 2 site are based on the proposed construction of a composite-type tank and are summarized in Table 4-15.

Table 4-15
Harris County WC&ID - Fondren Road WTP No. 2 EST Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	New 0.5 MG composite elevated storage tank	GAL	500,000	$2.50	$1,250,000.00
2	Piping modifications and sitework	LS	1	$50,000.00	$50,000.00
3	High service pumping modifications	LS	1	$50,000.00	$50,000.00
4	SCADA system for new EST	LS	1	$25,000.00	$25,000.00
Subtotal					$1,375,000.00
Contingencies (20%)					$275,000.00
Engineering & Testing (18%)					$297,000.00
Total Estimated Capital Cost					**$1,947,000.00**

Notes:
1 - This estimate does not include costs for acquisition of easements from property owners.

4.1.3 Costs for Recommended Regional Water Treatment Plant

4.1.3.1 RWTP Phase II

The project would include an 11.1 MGD expansion to increase the total RWTP capacity to 21.1 MGD to accommodate the increased water demand and growth in the Study area. Costs include the construction of a new membrane filtration system and a new RO system.

Table 4-16
RWTP Phase II Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	RWTP Phase II	LS	1	$25,000,000.00	$25,000,000.00
Subtotal					$25,000,000.00
Contingencies (20%)					$5,000,000.00
Engineering & Testing (18%)					$5,400,000.00
Total Estimated Capital Cost					**$35,400,000.00**

4.1.3.2 RWTP Phase III

This project includes the Phase III expansion of the City's new RWTP. The project would include an additional 12.2 MGD expansion to bring the total RWTP capacity to 33.3 MGD to accommodate the increased water demand and growth in the Study area. Costs include the construction of a new membrane filtration system and a new RO system.

Table 4-17
RWTP Phase III Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	RWTP Phase II	LS	1	$30,000,000.00	$30,000,000.00
Subtotal					$30,000,000.00
Contingencies (20%)					$6,000,000.00
Engineering & Testing (18%)					$6,480,000.00
Total Estimated Capital Cost					**$42,480,000.00**

4.1.4 Costs for Recommended Transmission Line Projects

4.1.4.1 RWTP Phase II Transmission Lines

The project would include approximately 11.5 miles of transmission line to deliver treated surface water from the City's RWTP to the Mustang Bayou WTP, the Vicksburg WTP, the future Sienna WTP No.3, and the Fort Bend County MUD #149 WTP. Cost estimates are based on a PVC transmission line.

Table 4-18
RWTP Phase II Transmission Lines Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	Transmission line to Mustang Bayou WTP	LF	18,850	$160.00	$3,016,000.00
2	Transmission line to Vicksburg WTP	LF	15,720	$160.00	$2,515,200.00
3	Transmission line to future Sienna WTP No. 3	LF	13,525	$160.00	$2,164,000.00
4	Transmission line to Fort Bend County MUD #149 WTP	LF	13,075	$160.00	$2,092,000.00
Subtotal					$9,787,200.00
Contingencies (20%)					$1,957,440.00
Engineering & Testing (18%)					$2,114,000.00
Total Estimated Capital Cost					**$13,850,000.00**

Notes:
1 - This estimate does not include costs for acquisition of easements from property owners.
2 - This estimate does not include costs for permitting with City, State, or private entities.
3 - This estimate does not include permitting for jurisdictional wetlands.
4 - Preliminary lengths were estimated without the benefit of a field survey. Additional conflicts may arise during final design.

4.1.4.2 RWTP Phase III Transmission Lines

The project would include approximately 2.25 miles of transmission line to deliver treated surface water from the City's RWTP to the Fort Bend County MUD #115 WTP. Cost estimates are based on a PVC transmission line.

Table 4-19
RWTP Phase III Transmission Lines Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	Transmission line to Fort Bend County MUD #115 WTP	LF	11,875	$160.00	$1,900,000.00
Subtotal					$1,900,000.00
Contingencies (20%)					$380,000.00
Engineering & Testing (18%)					$410,400.00
Total Estimated Capital Cost					**$2,690,000.00**

Notes:
1 - This estimate does not include costs for acquisition of easements from property owners.
2 - This estimate does not include costs for permitting with City, State, or private entities.
3 - This estimate does not include permitting for jurisdictional wetlands.
4 - Preliminary lengths were estimated without the benefit of a field survey. Additional conflicts may arise during final design.

4.1.5 Water Improvements Summary

Table 4-20
Summary of Cost Estimates for Water Improvements

Project Description	Projected Total Capital Cost for New Interconnects	Projected Total Capital Cost for New ESTs	Projected Total Capital Cost for New WTPs	Projected Total Capital Cost for New Transmission Lines
Interconnect First Colony MUD #9 with Fort Bend County MUD #115	$607,000	-	-	-
Mustang Bayou WTP System and Sienna Plantation System Interconnect No. 2	$799,000	-	-	-
Mustang Bayou Water Treatment Plant System and Sienna Plantation System Interconnect No. 3	$683,500	-	-	-
Sienna Plantation Water System Internal Interconnect	$458,000	-	-	-
Sienna Plantation System and Palmer Plantation System Interconnect No. 1	$927,500	-	-	-
Silver Ridge Development and Sienna Plantation Water System Interconnect No. 1	$154,000	-	-	-
Fort Bend County MUD #149 and Sienna Plantation MUD #1 Water System Interconnect No. 1	$579,000	-	-	-
Mustang Bayou and Palmer Plantation Interconnect	$298,000	-	-	-
Mustang Bayou and Quail Valley Interconnect	$289,000	-	-	-
New EST at Sienna Plantation No. 1 WTP	-	$4,602,000	-	-
New EST at Mustang Bayou WTP	-	$1,947,000	-	-
New EST at Fort Bend County MUD #149 WTP	-	$6,372,000	-	-
New EST at Palmer Plantation MUD No. 2 WTP	-	$3,717,000	-	-
New EST at Thunderbird Utility District System 1 WTP No. 2	-	$3,717,000	-	-
New EST at Harris County WC&ID – Fondren Road WTP No. 2	-	$1,947,000	-	-
RWTP Phase II	-	-	$35,400,000	$13,850,000
RWTP Phase III	-	-	$42,480,000	$2,690,000
Total Cost Per Category	**$4,795,000**	**$22,302,000**	**$77,880,000**	**$16,540,000**
Total Projected Cost	**$121,517,000**			

4.2 Costs for Potential Wastewater Projects

Conceptual capital and O&M costs have been developed for each WWTP alternative discussed in Section 3. Costs have been developed to determine improvements needed for the Study area, which reflect a total required treatment capacity of 16.4 MGD. The total capital costs include the Opinion of Probable Construction Cost (OPCC) plus additional engineering and construction overhead estimates. In some WWTP alternatives, several of the costs are similar, such as the cost for consolidation. When considering consolidation of WWTP flow to another offsite facility, the exact same flow, pump station (PS) size and pipeline length and alignment may be used for separate alternatives; therefore, the costs would be the same.

Costs for similar project concepts (same PS and pipeline sizing) will be shown as the same projected cost, regardless of the WWTP being reviewed. Please note that cost factors such as cost for easements and land acquisition, fluctuations in fuel, chemical and power costs, increases in inflation rates and future condition of structures (if consolidations are completed in the future) have not been incorporated into the costs developed in this section.

4.2.1 Wastewater Consolidation Project Alternatives for Each WWTP

Several scenarios were developed to determine anticipated capital and O&M costs for various WWTP consolidation scenarios. The first scenario was developed to determine the 30-year life cycle cost to maintain all the existing WWTPs in operation through 2040, along with construction of a new regional WWTP in the Sienna area. The second, third and fourth scenarios were developed to evaluate various methods of consolidation with the ultimate goal of reducing the total number of active WWTPs to roughly half the current number of operating WWTPs at this time. During the development of Scenarios 1 through 4, it was determined that as the total number of active WWTPs was reduced, economies of scale for capital and O&M cost resulted in a lower life cycle cost. As a result, a fifth scenario was developed with the concept of utilizing one WWTP site to create a super-regional WWTP that would treat the entire wastewater flows for the Study area even at build-out.

Life cycle costs were developed for each WWTP with respect to the alternatives discussed in Section 3 and with regard to the five scenarios discussed above. The goal was to identify which WWTPs were best suited for expansion, rehabilitation, or consolidation into another offsite WWTP facility, and how best the recommended alternative for each WWTP fit in with an overall consolidation scenario. In some cases, the recommended alternative for a given WWTP is fairly obvious due to the difference in cost. In some cases, the lowest life cycle cost is not actually the best project, as a higher project cost may ultimately fit in best with the recommended overall consolidation scenario. Life cycle costs per scenario for each WWTP are shown on the following pages.

4.2.1.1 Blue Ridge West MUD WWTP

Project alternatives have been developed for the Blue Ridge West MUD WWTP, including rehabilitation, expansion, or diversion to an offsite facility. Based on the review of the various project scenarios for this facility and the costs in Table 4-21, it is apparent that the most cost effective alternative is to consolidate flows into an offsite facility, regardless of the ultimate makeup of final treatment capacity for the Study area. In order to gain maximum benefit from reuse potential, it is recommended that the flows from the three north WWTPs also be collected and transferred to other City WWTPs via the new PS and pipeline proposed for this site. Due to the condition and current flow loading at this facility, it is recommended that this project be completed within the next 5-10 years if possible.

Adjusted O&M costs (taking into account the cost factors listed in Section 3) were developed for each WWTP, to modify the anticipated annual O&M cost for each WWTP to account for the improvements proposed in each scenario. Examples on how the adjusted O&M costs (per scenario) were developed for the Blue Ridge West MUD WWTP are shown below. The methodology used to develop adjusted O&M costs are the same for each WWTP.

An example calculation for the Blue Ridge West MUD WWTP is shown below, regarding rehabilitating and/or expanding all WWTPs (corresponding to Scenario 1 discussed later in this section).

- Plant rating – 1.3 MGD;
- O&M cost for new 1.3 MGD conventional WWTP - $435,000 per year (this would be the anticipated cost for a brand new 1.3 MGD conventional WWTP, operated at 60-80% capacity);
- Type of WWTP – Package Plant – 1.25 x $435,000 = $543,750 (some package processes still remain at the site);
- Plant loading – 0.75 MGD – 0.75/1.3 = 0.58 x $543,750 = $313,702;
- Loss of energy savings on equipment – 1.1 x $313,702 = $345,072 (cost factor decreases to allow for variable frequency drive improvements);
- Plant age – 5 years or less – 1.1 x $345,072 = $379,579 (following plant improvements);
- Onsite aerobic digestion of solids – 1 x $379,579 = $379,579 (convert digestion to aerated sludge storage to minimize blower and energy use);

- Hauling liquid sludge offsite – 1 x $379,579 = $379,579 (add onsite sludge dewatering to significantly reduce sludge hauling costs); and,

- Lack of automation of plant processes – 1.1 x $379,579 = $418,000 (addition of some SCADA improvements, final total rounded up to the nearest 1,000).

Also, an example calculation for the Blue Ridge West MUD WWTP was prepared which corresponds to Scenario 2 and 4 discussed later in this section.

- Plant rating – 1.8 MGD;

- O&M cost for new 1.8 MGD conventional WWTP - $499,000 per year (this would be the anticipated cost for a brand new 1.8 MGD conventional WWTP, operated at 60-80% capacity);

- Type of WWTP – Package Plant – 1.25 x $499,000 = $623,750 (some package processes still remain at the site);

- Plant loading – 1.25 MGD – 1.25/1.8 = 0.69 x $623,750 = $433,160;

- Loss of energy savings on equipment – 1.1 x $433,160 = $476,476 (cost factor decreases to allow for variable frequency drive improvements);

- Plant age – 5 years or less – 1.1 x $476,476 = $524,123 (following plant improvements);

- Onsite aerobic digestion of solids – 1 x $524,123 = $524,123 (convert digestion to aerated sludge storage to minimize blower and energy use);

- Hauling liquid sludge offsite – 1 x $524,123 = $524,123 (add onsite sludge dewatering to significantly reduce sludge hauling costs); and

- Lack of automation of plant processes – 1.1 x $524,123 = $577,000 (addition of some SCADA improvements, final total rounded up to the nearest $1,000).

The projected O&M costs for Scenario 3 (using Quail Valley UD as a regional WWTP) and Scenario 5 (using SB-FB WWTP as a regional WWTP) are based solely on the projected energy costs associated with transferring plant flows to the regional plant associated with each scenario. In addition, while Scenario 3 reflects only pumping the Blue Ridge West MUD WWTP flow, Scenario 5 includes also pumping flows from Southwest Harris County MUD #1 WWTP, Harris County WC&ID – Fondren Road WWTP and Harris County MUD #122 WWTP flows.

Table 4-21 Costs for Blue Ridge West MUD WWTP Alternatives					
Scenario	**Impact to WWTP**	**OPCC**	**Total Capital Cost**	**Annual O&M Cost**	**30-YrLife Cycle Cost**
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$8,775,000	$12,426,000	$418,000	$20,619,000
Consolidate WWTPs based on MUD engineering firm recommendations	Expand WWTP	$9,000,000	$12,744,000	$577,000	$24,054,000
Consolidate WWTPs using QVUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$493,000	$699,000	$10,700	$909,000
Consolidate WWTPs using BRWMUD WWTP as a regional facility	Expand WWTP	$16,500,000	$23,364,000	$577,000	$34,674,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$797,000**	**$1,129,000**	**$32,000**	**$1,757,000**

4.2.1.2 Fort Bend County MUD #26 WWTP

Project alternatives have been developed for the Fort Bend County MUD #26 WWTP, including rehabilitation or diversion to an offsite facility. Based on the review of the various project scenarios and associated costs as shown in Table 4-22, it is apparent that the most cost effective alternative is to consolidate flows into an offsite facility. While the cost to divert flow to the Blue Ridge West MUD WWTP is the lowest projected life cycle cost, the cost savings for other offsite WWTP diversions would offset the increased cost shown in bold below. Due to the recent rehabilitation work completed at this facility, it is recommended that this project be completed within the next 10-15 years if possible.

Table 4-22
Costs for Fort Bend County MUD #26 WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$3,375,000	$4,779,000	$220,000	$9,092,000
Consolidate WWTPs based on MUD engineering firm recommendations	Consolidate WWTP into an offsite facility	$439,000	$622,000	$4,100	$703,000
Consolidate WWTPs using QVUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$1,862,500	$2,638,000	$18,500	$3,001,000
Consolidate WWTPs using BRWMUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$385,000	$546,000	$4,100	$627,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$2,362,500**	**$3,346,000**	**$37,000**	**$4,072,000**

4.2.1.3 Harris County – Fondren Road WWTP

Project alternatives have been developed for the HC-FR WWTP, including rehabilitation, expansion, or diversion to an offsite facility. Based on the review of the various project scenarios for this facility and the costs shown in Table 4-23, it is apparent that the most cost effective alternative is to consolidate flows into an offsite facility, regardless of the ultimate makeup of final treatment capacity for the Study area. In order to gain maximum benefit from reuse potential, it is recommended that the flows from Southwest Harris County MUD #1 WWTP and Harris County MUD #122 WWTP also be collected and transferred to other City WWTPs via the new PS and pipeline proposed for this site. Due to the recent rehabilitation work completed at this facility, it is recommended that this project be completed within the next 10-15 years if possible.

Table 4-23
Costs for Harris County – Fondren Road WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$4,050,000	$5,735,000	$141,000	$8,499,000
Consolidate WWTPs based on MUD engineering firm recommendations	Rehab WWTP	$4,050,000	$5,735,000	$141,000	$8,499,000
Consolidate WWTPs using QVUD WWTP as a regional facility	Expand WWTP	$7,500,000	$10,620,000	$149,000	$13,541,000
Consolidate WWTPs using BRWMUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$1,062,500	$1,505,000	$9,900	$1,700,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$1,062,500**	**$1,505,000**	**$9,900**	**$1,700,000**

4.2.1.4 Harris County MUD #122 WWTP

Project alternatives have been developed for the Harris County MUD #122 WWTP, including rehabilitation or diversion to an offsite facility. Based on the review of the various project scenarios for this facility and the costs shown in Table 4-24, it is apparent that the most cost effective alternative is to consolidate flows into an offsite facility, regardless of the ultimate makeup of final treatment capacity for the Study area. Due to the upcoming potential permit compliance issues (discussed in Section 3) with the Harris County MUD #122 WWTP and the age and condition of the other facilities proposed for consolidation, it is recommended that this project be completed within the next 5 years if possible.

Table 4-24
Cost Estimates for Harris County MUD #122 WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$1,687,500	$2,390,000	$87,000	$4,096,000
Consolidate WWTPs based on MUD engineering firm recommendations	Consolidate WWTP into an offsite facility	$1,480,000	$2,096,000	$89,100	$3,843,000
Consolidate WWTPs using QVUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$443,750	$629,000	$2,100	$671,000
Consolidate WWTPs using BRWMUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$443,750	$629,000	$2,100	$671,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$443,750**	**$629,000**	**$2,100**	**$671,000**

4.2.1.5 Mustang Bayou WWTP

Project alternatives have been developed for the Mustang Bayou WWTP, including rehabilitation, expansion, or diversion to an offsite facility. Based on the review of the various project scenarios for this facility and the associated project costs shown in Table 4-25, it is apparent that the most cost effective alternative is to consolidate flows into an offsite facility, regardless of the ultimate makeup of final treatment capacity for the Study area. Due to the condition and current flow loading at this facility, it is recommended that this project be completed within the next 15-20 years if possible.

Table 4-25
Costs for Mustang Bayou WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Expand WWTP	$8,212,500	$11,629,000	$267,000	$16,863,000
Consolidate WWTPs based on MUD engineering firm recommendations	Expand WWTP	$8,212,500	$11,629,000	$267,000	$16,863,000
Consolidate WWTPs using Quail Valley UD WWTP as a regional facility	Expand WWTP	$8,212,500	$11,629,000	$267,000	$16,863,000
Consolidate WWTPs using Blue Ridge West MUD WWTP as a regional facility	Expand WWTP	$8,212,500	$11,629,000	$267,000	$16,863,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$868,750**	**$1,231,000**	**$19,000**	**$1,604,000**

4.2.1.6 Palmer Plantation WWTP

The project alternatives developed for the Palmer WWTP, include rehabilitation or diversion to an offsite facility. Based on the review of the various project scenarios for this facility and the project costs as shown in Table 4-26, it is apparent that the most cost effective alternative is to consolidate flows into an offsite facility. While the cost to divert flow to the SB-FB WWTP with only Palmer Plantation WWTP flow is the lowest projected life cycle cost, the cost savings for other offsite WWTP diversions would offset the increased cost shown in bold below due to transferring from other WWTPs. Due to the condition and current flow loading at this facility, it is recommended that this project be completed within the next 5-10 years if possible.

Table 4-26
Costs for Palmer Plantation WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$4,050,000	$5,735,000	$169,000	$9,048,000
Consolidate WWTPs based on MUD engineering firm recommendations	Consolidate WWTP into an offsite facility	$454,000	$643,000	$5,000	$742,000
Consolidate WWTPs using Quail Valley UD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$454,000	$643,000	$5,000	$742,000
Consolidate WWTPs using Blue Ridge West MUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$454,000	$643,000	$5,000	$742,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$1,108,000**	**$1,569,000**	**$64,000**	**$2,824,000**

4.2.1.7 Quail Valley UD WWTP

Project alternatives have been developed for the Quail Valley UD WWTP, including rehabilitation, expansion, or diversion to an offsite facility. Based on the review of the various project scenarios for this facility and the associated project costs shown in Table 4-27, it is apparent that the most cost effective alternative is to consolidate flows into an offsite facility, regardless of the ultimate makeup of final treatment capacity for the Study area. However, because non-potable reuse of Quail Valley UD effluent is still a primary goal for the City, the Quail Valley UD WWTP consolidation scenario also includes the construction and operation of a 0.5 MGD reuse PS and pipeline from the SB-FB WWTP back to the Quail Valley UD WWTP for non-potable reclaimed water use. Due to the condition and current flow loading at this facility, it is recommended that this project be completed within the next 5-10 years if possible.

Table 4-27
Costs for Quail Valley UD WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$9,000,000	$12,744,000	$620,000	$24,897,000
Consolidate WWTPs based on MUD engineering firm recommendations	Rehab WWTP	$9,000,000	$12,744,000	$620,000	$24,897,000
Consolidate WWTPs using QVUD WWTP as a regional facility	Expand WWTP	$16,500,000	$23,364,000	$649,000	$36,085,000
Consolidate WWTPs using BRWMUD WWTP as a regional facility	Rehab WWTP	$9,000,000	$12,744,000	$620,000	$24,897,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$1,100,000**	**$1,558,000**	**$23,100**	**$2,011,000**

4.2.1.8 Sienna Regional WWTP

Project alternatives have been developed for the Sienna Regional WWTP, including construction of a new regional WWTP or diversion to an offsite facility. Based on the review of the various project scenarios for this facility and associated project costs as shown in Table 4-28, it is apparent that the most cost effective alternative is to consolidate flows into an offsite facility, regardless of the ultimate makeup of final treatment capacity for the Study area. While the southern area of the City could easily be served by a south regional WWTP, the total capital cost and annual O&M cost would be less for consolidating flows from the southern area into a single WWTP facility further north (SB-FB WWTP). Since the area has not yet been developed, it is recommended that this project be completed within the next 15-20 years if possible.

Table 4-28
Costs for Sienna Regional WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Construct new regional WWTP	$9,200,000	$13,028,000	$297,000	$18,850,000
Consolidate WWTPs based on MUD engineering firm recommendations	Construct new regional WWTP	$14,000,000	$19,824,000	$297,000	$25,646,000
Consolidate WWTPs using QVUD WWTP as a regional facility	Construct new regional WWTP	$14,000,000	$19,824,000	$297,000	$25,646,000
Consolidate WWTPs using BRWMUD WWTP as a regional facility	Construct new regional WWTP	$14,000,000	$19,824,000	$297,000	$25,646,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WW service area into an offsite facility**	**$1,687,500**	**$2,390,000**	**$19,000**	**$2,763,000**

4.2.1.9 Sienna North WWTP

Project alternatives have been developed for the Sienna North WWTP, including rehabilitation or diversion to an offsite facility. Based on the review of the various project scenarios for this facility and the associated project costs as shown in Table 4-29, it is apparent that the most cost-effective alternative is to consolidate flows into an offsite facility, regardless of the ultimate makeup of final treatment capacity for the Study area. While the cost to divert flow to the SB-FB WWTP with only Sienna North WWTP flow is the lowest projected life cycle cost, the cost savings for other offsite WWTP diversions would offset the increased cost shown in bold below due to transferring shows from other WWTPs also. Due to the age and condition of this WWTP and the current flow loading, it is recommended that this project be completed within the next 5-10 years if possible, to prepare for handling and transferring additional offsite wastewater flows.

Table 4-29
Costs for Sienna North WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$6,075,000	$8,603,000	$200,000	$12,524,000
Consolidate WWTPs based on MUD engineering firm recommendations	Rehab WWTP	$6,075,000	$8,603,000	$200,000	$12,524,000
Consolidate WWTPs using QVUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$922,500	$1,307,000	$7,400	$1,453,000
Consolidate WWTPs using BRWMUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$922,500	$1,307,000	$7,400	$1,453,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$2,825,000**	**$4,001,000**	**$50,000**	**$4,982,000**

4.2.1.10 Southwest Harris County MUD #1 WWTP

Project alternatives have been developed for the Southwest Harris County MUD #1 WWTP, including rehabilitation or diversion to an offsite facility.The projected life cycle costs for each consolidation scenario are included in Table 4-30. Based on the review of the various project scenarios for this facility, it is apparent that the most cost-effective alternative is to consolidate flows into an offsite facility, regardless of the ultimate makeup of final treatment capacity for the Study area. Due to the recent rehabilitation work completed at this facility, it is recommended that this project be completed within the next 10-15 years if possible.

Table 4-30
Cost Estimates for Southwest Harris County MUD #1 WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$2,700,000	$3,824,000	$75,000	$5,295,000
Consolidate WWTPs based on MUD engineering firm recommendations	Rehab WWTP	$2,700,000	$3,824,000	$75,000	$5,295,000
Consolidate WWTPs using Quail Valley UD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$175,000	$248,000	$3,300	$313,000
Consolidate WWTPs using Blue Ridge West MUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$175,000	$248,000	$3,300	$313,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$175,000**	**$248,000**	**$3,300**	**$313,000**

4.2.1.11 SB-FB WWTP

Project alternatives have been developed for the SB-FB WWTP, including expansion for local growth or expansion to incorporate flows from offsite WWTPs. The projected 30-year life cycle costs are shown in Table 4-32. Based on the review of the various project scenarios for this facility, it is apparent that the most cost effective alternative is to convert this WWTP into a regional treatment facility, and attempt to incorporate as much flow from other WWTPs as possible. While the cost to handle only local wastewater treatment at the SB-FB WWTP is the lowest projected life cycle cost, the cost savings for other offsite WWTP diversions would offset the increased cost shown in bold below. Modular treatment processes are recommended for adoption at the SB-FB WWTP in order to maximize available space at the WWTP site and to allow for additional phased expansions to meet WWTP consolidation goals.

Due to the age and condition of this WWTP and the current flow loading, it is recommended that this project be completed within the next 5-10 years if possible, to prepare for handling and transferring additional offsite wastewater flows. However, the expansion of this facility (if using a modular treatment process) could be completed over multiple phases as needed to incorporate the wastewater flows from the offsite WWTPs and service areas.

Table 4-32
Costs for SB-FB WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Expand WWTP	$15,000,000	$21,240,000	$395,000	$28,983,000
Consolidate WWTPs based on MUD engineering firm recommendations	Expand WWTP	$17,500,000	$24,780,000	$377,000	$32,170,000
Consolidate WWTPs using QVUD WWTP as a regional facility	Expand WWTP	$18,000,000	$25,488,000	$478,000	$34,858,000
Consolidate WWTPs using BRWMUD WWTP as a regional facility	Expand WWTP	$18,000,000	$25,488,000	$478,000	$34,858,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Expand WWTP into the City's only WWTP**	**$42,000,000**	**$59,472,000**	**$1,029,000**	**$79,641,000**

4.2.2 Wastewater Consolidation Project Scenarios

Following the development of life cycle costs for each of the existing and proposed WWTP facilities, combinations of the costs discussed in Tables 4-21 through 4-32 were completed for the five consolidation scenarios discussed on the following pages.

4.2.2.1 Projected Total Life Cycle Cost to Maintain All WWTPs in Operation

This option considers maintaining all existing WWTPs in operation, along with constructing a new south regional WWTP in the Sienna area. Since the majority of the existing WWTPs are package plants, extensive rehabilitation effort would be needed to maintain many of these plants in continued operation for the next 30 years. Obviously there are several plants that could be somewhat easily consolidated into nearby facilities, so this cost was developed to determine a baseline of lifecycle cost for the planning area.

Table 4-33
Capital and O&M Costs for WWTP Scenario 1

Item	Description	OPCC	Total Capital Cost	Annual O&M Cost	30-YrLife Cycle Cost
1	Rehab and upgrade Harris County MUD #1 WWTP, including solids improvements	$2,700,000	$3,824,000	$75,000	$5,295,000
2	Rehab and upgrade Fondren Road WWTP, including solids improvements	$4,050,000	$5,735,000	$141,000	$8,499,000
3	Rehab and upgrade Harris County MUD #122 WWTP, including solids improvements	$1,687,500	$2,390,000	$87,000	$4,096,000
4	Rehab and upgrade Blue Ridge West WWTP, including solids improvements	$8,775,000	$12,426,000	$418,000	$20,619,000
5	Rehab and upgrade Fort Bend County MUD #26 WWTP, including structure rehab and equipment replacement	$3,375,000	$4,779,000	$220,000	$9,092,000
6	Rehab and upgrade Quail Valley UD WWTP, including structure rehab and equipment replacement	$9,000,000	$12,744,000	$620,000	$24,897,000
7	Rehab and upgrade Palmer Plantation WWTP, including structure rehab and equipment replacement	$4,050,000	$5,735,000	$169,000	$9,048,000
8	Expand and upgrade SB-FB WWTP, including structure rehab and equipment replacement	$15,000,000	$21,240,000	$395,000	$28,983,000
9	Expand and upgrade Mustang Bayou WWTP, including structure rehab and equipment replacement	$8,212,500	$11,629,000	$267,000	$16,863,000
10	Rehab and upgrade Sienna North WWTP, including structure rehab and equipment replacement	$6,075,000	$8,603,000	$200,000	$12,524,000
11	Rehab and upgrade Sienna South WWTP, including structure rehab and equipment replacement	$8,100,000	$11,470,000	$586,000	$22,956,000
12	Construct new regional WWTP in Sienna area	$9,200,000	$13,028,000	$297,000	$18,850,000
TOTAL		**$80,225,000**	**$113,603,000**	**$3,475,000**	**$181,722,000**

Notes:
1 - This estimate assumes no offsite collection improvements are required.
2 - This estimate assumes that no other major capital improvements would be necessary during the project life.
3 - This estimate assumes a 30-yr improvement life, at an interest rate of 3%.

4.2.2.2 Projected Total Life Cycle Cost to Consolidate Utility District Engineer Recommended WWTPs

This option considers consolidating several of the existing WWTPs in operation, along with constructing a new south regional WWTP in the Sienna area. Since the majority of the existing WWTPs to remain in this scenario are package plants, extensive rehabilitation effort would still be needed. In developing capital costs, consolidated plant costs include new PS and force mains to the regional facilities, and WWTPs intended to remain in this scenario include a budget for rehabilitating and/or upgrading each facility to maintain continued treatment for the next 30 years.

O&M costs for this scenario include projected O&M costs for the regional facilities (accounting for newly added flow) and O&M costs for the consolidated facilities (costs for the new transfer PSs). These O&M costs however do not include the existing collection system O&M. Also, these life cycle costs do not account for any change in inflation in interest or in power cost.

Table 4-34
Capital and O&M Costs for WWTP Scenario 2

Item	Description	OPCC	Total Capital Cost	Annual O&M Cost	30-YrLife Cycle Cost
1	Rehab and upgrade Harris County MUD #1 WWTP, including solids improvements	$2,700,000	$3,824,000	$75,000	$5,295,000
2	Rehab and upgrade Fondren Road WWTP, including solids improvements	$4,050,000	$5,735,000	$141,000	$8,499,000
3	Construct a transfer PS at Harris County MUD #122 WWTP to transfer plant flow to WC&ID #2, includes PS, pipeline and expansion of WC&ID #2 WWTP	$1,480,000	$2,096,000	$89,100	$3,843,000
4	Expand Blue Ridge WWTP to handle Fort Bend County MUD #26 flow, including solids improvements	$9,000,000	$12,744,000	$577,000	$24,054,000
5	Construct a transfer PS at Fort Bend County MUD #26 WWTP to transfer plant flow to Blue Ridge West WWTP, including PSand pipeline	$439,000	$622,000	$4,100	$703,000
6	Rehab and upgrade Quail Valley UD WWTP, including structure rehab and equipment replacement	$9,000,000	$12,744,000	$620,000	$24,897,000
7	Construct a transfer PS at Palmer Plantation WWTP to transfer plant flow to SB-FB WWTP, including PS and pipeline	$454,000	$643,000	$5,000	$742,000
8	Expand and upgrade SB-FB WWTP, including structure rehab and equipment replacement	$17,500,000	$24,780,000	$377,000	$32,170,000
9	Expand and upgrade Mustang Bayou WWTP, including structure rehab and equipment replacement	$8,212,500	$11,629,000	$267,000	$16,863,000
10	Rehab and upgrade Sienna North WWTP, including structure rehab and equipment replacement	$6,075,000	$8,603,000	$200,000	$12,524,000
11	Construct new transfer PS at Sienna South WWTP to transfer Sienna South plant flow to the new regional WWTP in Sienna, including PS and pipeline	$1,375,000	$1,947,000	$9,900	$2,142,000
12	Construct new regional WWTP in Sienna area	$14,000,000	$19,824,000	$297,000	$25,646,000
TOTAL		**$74,285,500**	**$105,191,000**	**$2,662,100**	**$157,378,000**

Notes:
1 - This estimate assumes no offsite collection improvements are required.
2 - This estimate assumes that no other major capital improvements would be necessary during the project life.
3 - This estimate assumes a 30-yr improvement life, at an interest rate of 3%.

4.2.2.3 Projected Total Life Cycle Cost to Consolidate WWTPs Using Quail Valley UD WWTP as a Regional WWTP

This option considers consolidating the existing WWTPs down to a maximum of five plants, including constructing a new south regional WWTP in the Sienna area. In this scenario, the three northernmost WWTPs would be consolidated into a new regional facility, the central service area would be consolidated between the Quail Valley UD WWTP and the SB-FB WWTP, the eastern area would be covered by the Mustang Bayou WWTP and the southern area would be supported by the new south regional WWTP in the Sienna area. In developing capital costs, consolidated plant costs include new PSs and force mains to the regional facilities, and WWTPs intended to remain in this scenario include a budget for rehabilitating and/or upgrading each facility to maintain continued treatment for the next 30 years.

O&M costs for this scenario include projected O&M costs for the regional facilities (accounting for newly added flow) and O&M costs for the consolidated facilities (costs for the new transfer PSs). These O&M costs however do not include the existing collection system O&M. Also, these life cycle costs do not account for any change in inflation in interest or in power cost.

Table 4-35
Capital and O&M Costs for WWTP Scenario 3

Item	Description	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
1	Construct new transfer PS to transfer Southwest Harris County MUD #1 plant flow to the nearby Fondren Road WWTP, including PS and pipeline	$175,000	$248,000	$3,300	$313,000
2	Construction of a new regional WWTP at the Fondren Road plant site, including solids improvements	$7,500,000	$10,620,000	$149,000	$13,541,000
3	Construct new transfer PS to transfer Harris County MUD #122 plant flow to the Fondren Road WWTP, including PS and pipeline	$443,750	$629,000	$2,100	$671,000
4	Construct new transfer PS to transfer Blue Ridge West WWTP flow to the new Fort Bend County MUD #26 PS, including PS and pipeline	$493,000	$699,000	$10,700	$909,000
5	Construct new transfer PS to transfer both plant flows to the Quail Valley UD WWTP, including PS and pipeline	$1,862,500	$2,638,000	$18,500	$3,001,000
6	Expand and upgrade Quail Valley UD WWTP for additional flow	$16,500,000	$23,364,000	$649,000	$36,085,000
7	Construct a transfer PS at Palmer Plantation WWTP to transfer plant flow to SB-FB WWTP, including PS and pipeline	$454,000	$643,000	$5,000	$742,000
8	Expand and upgrade SB-FB WWTP for growth and to handle Palmer Plantation and Sienna North flow, including structure rehab and equipment replacement	$18,000,000	$25,488,000	$478,000	$34,858,000
9	Expand and upgrade Mustang Bayou WWTP, including solids improvements	$8,212,500	$11,629,000	$267,000	$16,863,000
10	Construct new transfer PS at Sienna North WWTP to transfer Sienna North plant flow to the SB-FB WWTP, including PS and pipeline	$922,500	$1,307,000	$7,400	$1,453,000
11	Construct new transfer PS at Sienna South WWTP to transfer Sienna South plant flow to the new regional WWTP in Sienna, including PS and pipeline	$1,375,000	$1,947,000	$9,900	$2,142,000
12	Construct new regional WWTP in Sienna area	$14,000,000	$19,824,000	$297,000	$25,646,000
TOTAL		**$69,938,250**	**$99,036,000**	**$1,896,900**	**$136,224,000**

Notes:
1 - This estimate assumes no offsite collection improvements are required.
2 - This estimate assumes that no other major capital improvements would be necessary during the project life.
3 - This estimate assumes a 30-yr improvement life, at an interest rate of 3%.

4.2.2.4 Projected Total Life Cycle Cost to Consolidate WWTPs Using Blue Ridge West WWTP as a Regional WWTP

This option also considers consolidating the existing WWTPs down to a maximum of five plants, including constructing a new south regional WWTP in the Sienna area. In this scenario, the three northernmost WWTPs would be consolidated into an expanded Blue Ridge West WWTP, the central service area would be consolidated between the Quail Valley UD WWTP, the Blue Ridge West WWTP and the SB-FB WWTP, the eastern area would still be covered by the Mustang Bayou WWTP and the southern area would still be supported by the new south regional WWTP in the Sienna area. In developing capital costs, consolidated plant costs include new PSs and force mains to the regional facilities, and WWTPs intended to remain in this scenario include a budget for rehabilitating and/or upgrading each facility to maintain continued treatment for the next 30 years. O&M costs for this scenario include projected O&M costs for the regional facilities (accounting for newly added flow) and O&M costs for the consolidated facilities (costs for the new transfer PSs). These O&M costs however do not include the existing collection system O&M. Also, these life cycle costs do not account for any change in inflation in interest or in power cost.

Table 4-36
Capital and O&M Costs for WWTP Scenario 4

Item	Description	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
1	Construct new transfer PS to transfer Southwest Harris County MUD #1 plant flow to the nearby Fondren Road WWTP, including PS and pipeline	$175,000	$248,000	$3,300	$313,000
2	Construction of a new PS at the Fondren Road plant site to transfer all north flows to the Blue Ridge West WWTP, including PS and pipeline	$1,062,500	$1,505,000	$9,900	$1,700,000
3	Construct new transfer PS to transfer Harris County MUD #122 plant flow to the Fondren Road WWTP, including PS and pipeline	$443,750	$629,000	$2,100	$671,000
4	Expand Blue Ridge West WWTP for additional flow, including solids improvements	$16,500,000	$23,364,000	$577,000	$34,674,000
5	Construct a transfer PS at Fort Bend County MUD #26 WWTP to transfer plant flow to Blue Ridge West WWTP, including PS and pipeline	$385,000	$546,000	$4,100	$627,000
6	Rehab and upgrade Quail Valley UD WWTP, including structure rehab and equipment replacement	$9,000,000	$12,744,000	$620,000	$24,897,000
7	Construct a transfer PS at Palmer Plantation WWTP to transfer plant flow to SB-FB WWTP, including PS and pipeline	$454,000	$643,000	$5,000	$742,000
8	Expand and upgrade SB-FB WWTP for growth and to handle Palmer Plantation and Sienna North flow, including structure rehab and equipment replacement	$18,000,000	$25,488,000	$478,000	$34,858,000
9	Expand and upgrade Mustang Bayou WWTP, including solids improvements	$8,212,500	$11,629,000	$267,000	$16,863,000
10	Construct new transfer PS at Sienna North WWTP to transfer Sienna North plant flow to the SB-FB WWTP, including PS and pipeline	$922,500	$1,307,000	$7,400	$1,453,000
11	Construct new transfer PS at Sienna South WWTP to transfer Sienna South plant flow to the new regional WWTP in Sienna, including PS and pipeline	$1,375,000	$1,947,000	$9,900	$2,142,000
12	Construct new regional WWTP in Sienna area	$14,000,000	$19,824,000	$297,000	$25,646,000
TOTAL		**$70,530,250**	**$99,874,000**	**$2,280,700**	**$144,586,000**

Notes:
1 - This estimate assumes no offsite collection improvements are required.
2 - This estimate assumes that no other major capital improvements would be necessary during the project life.
3 - This estimate assumes a 30-yr improvement life, at an interest rate of 3%.

4.2.2.5 Projected Total Life Cycle Cost to Consolidate WWTPs into a New Super Regional Facility at the Steep Bank – Flat Bank WWTP

This option considers consolidating all of the existing WWTPs into a super-regional treatment facility, including incorporating flows from the new Sienna area. In developing capital costs, consolidated plant costs include new PSs and force mains to the regional facilities, and WWTPs intended to remain in this scenario include a budget for expanding and upgrading to maintain continued treatment for the next 30 years.

O&M costs for this scenario include projected O&M costs for the regional facilities (accounting for newly added flow) and O&M costs for the consolidated facilities (costs for the new transfer PSs and pipelines). These O&M costs however do not include the existing collection system O&M. Also, these life cycle costs do not account for any change in inflation in interest or in power cost.

Table 4-37
Capital and O&M Costs for WWTP Scenario 5

Item	Description	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
1	Construct new transfer PS to transfer Southwest Harris County MUD #1 plant flow to the nearby Fondren Road WWTP, includes PS and pipeline	$175,000	$248,000	$3,300	$313,000
2	Construct new transfer PS to transfer HCMUD #122 plant flow to the Fondren Road WWTP, includes PS and pipeline	$443,750	$629,000	$2,100	$671,000
3	Construction of a new PS at the Fondren Road plant site to transfer all north flows to the Blue Ridge WWTP, includes PS and pipeline	$1,062,500	$1,505,000	$9,900	$1,700,000
4	Construct a new transfer PS at the Blue Ridge West WWTP to transfer north plant flows to the new Fort Bend County MUD #26 WWTP PS, includes PS and pipeline	$797,000	$1,129,000	$32,000	$1,757,000
5	Construct new transfer PS at Fort Bend County MUD #26 WWTP to transfer all northeast plant flows to the new Palmer Plantation WWTP PS, includes PS and pipeline	$2,362,500	$3,346,000	$37,000	$4,072,000
6	Construct new transfer PS at Quail Valley UD WWTP to transfer plant flow to the SB-FB WWTP, includes PS and pipeline for raw wastewater and reuse PS and 6" pipeline to return 0.5 MGD effluent back to Quail Valley UD lake	$1,100,000	$1,558,000	$23,100	$2,011,000
7	Construct new transfer PS at Mustang Bayou WWTP to transfer plant flow to the new Palmer Plantation WWTP PS, includes PS and 10" pipeline	$868,750	$1,231,000	$19,000	$1,604,000
8	Construct a transfer PS at Palmer Plantation WWTP to transfer plant flow to SB-FB WWTP, includes PS and 18" pipeline	$1,108,000	$1,569,000	$64,000	$2,824,000
9	Construct new transfer PS in Sienna Development to transfer Sienna flow to new Sienna South WWTP PS, includes PS and 12" pipeline	$1,687,500	$2,390,000	$19,000	$2,763,000
10	Construct new transfer PS at Sienna South WWTP to transfer Sienna South flows to the new Sienna North WWTP PS, includes PS and 16" pipeline	$3,962,500	$5,611,000	$43,000	$6,454,000
11	Construct new transfer PS at Sienna North WWTP to transfer all south flows to the SB-FB WWTP, includes PS and 18" pipeline	$2,825,000	$4,001,000	$50,000	$4,982,000
12	Expand and upgrade SB-FB WWTP for growth and to handle remaining plant flows, including structure rehab and equipment replacement	$42,000,000	$59,472,000	$1,029,000	$79,641,000
TOTAL		**$58,392,500**	**$82,689,000**	**$1,331,400**	**$108,792,000**

Notes:
1 - This estimate assumes no offsite collection improvements are required.
2 - This estimate assumes that no other major capital improvements would be necessary during the project life.
3 - This estimate assumes a 30-yr improvement life, at an interest rate of 3%.

4.2.3 Wastewater Improvements Summary

The summary of the five main scenarios reviewed are provided in Table 4-38. Based on the review of the various project scenarios for the existing and proposed WWTPs, it appears that the most cost effective scenario is to convert the SB-FB WWTP into a super-regional treatment facility, and attempt to incorporate as much flow from the other WWTPs as possible. During the final draft report review, the utility districts requested an additional WWTP scenario, which is included in Appendix F.

Table 4-38
Summary of Capital and O&M Costs for WWTP Scenarios

Scenario Description	WWTPs Online in This Scenario	Projected Total Capital Cost	Projected Annual O&M Cost	Projected 30-Year Life Cycle Cost
Rehab/Expand all existing WWTPs as needed and construct new South Regional WWTP to continue use for 30 years (11 existing WWTPs plus 1 new WWTP)	Southwest Harris County MUD #1, Harris County MUD #122, Harris County MUD-Fondren Road, Blue Ridge West MUD, Fort Bend County MUD #26, Palmer Plantation, Quail Valley UD, SB-FB, Mustang Bayou, Sienna North, Sienna South, New Sienna Regional	$113,603,000	$3,475,000	$181,722,000
Consolidate WWTPs based on MUD engineering firm recommendations (7 existing WWTPs plus 1 new WWTP)	Southwest Harris County MUD #1, Harris County MUD-Fondren Road, Blue Ridge West MUD, Quail Valley UD, SB-FB, Mustang Bayou, Sienna North, New Sienna Regional	$105,191,000	$2,662,100	$157,378,000
Consolidate WWTPs to reduce total number of WWTPs using Quail Valley UD as a regional facility (4 existing WWTPs plus 1 new WWTP)	Harris County MUD-Fondren Road, Quail Valley UD, SB-FB, Mustang Bayou, New Sienna Regional	$99,036,000	$1,896,900	$136,224,000
Consolidate WWTPs to reduce total number of WWTPs using Blue Ridge West MUD as a regional facility (4 existing WWTPs plus 1 new WWTP)	Blue Ridge West MUD, Quail Valley UD, SB-FB, Mustang Bayou, New Sienna Regional	$99,874,000	$2,280,700	$144,586,000
Consolidate WWTPs to reduce total number of WWTPs using SB-FB as the only regional WWTP facility (1 existing WWTP)	**SB-FB**	**$82,689,000**	**$1,331,400**	**$108,792,000**

Multiple advantages and several potential disadvantages relate to utilization of the SB-FB facility as a super-regional WWTP, including, but not limited to:

- **Advantages**
    - Lowest life cycle cost of the various scenarios;
    - Largest existing treatment site in the Study area, provides adequate space for expanding upwards of 16.4 MGD if using more efficient treatment processes;
    - Reduced cost for monitoring and reporting for monthly discharge monitoring reports (DMR) and annual sludge reporting;
    - Reduced environmental impact by limiting discharge to one receiving stream instead of multiple streams (TCEQ and TWDB prefer consolidating WWTP discharges whenever feasible);
    - Potential for capturing all the City's current and future effluent produced to increase total bed and banks water rights;
    - Cost to utilize additional reclaimed water for bed and banks permit via a single treatment facility may be less than cost to purchase additional water rights elsewhere for future SWTP expansions;
    - If bed and banks water rights are not pursued, can provide a greater single source opportunity for marketing reclaimed water supply;
    - Potentially lower wastewater rates due to economies of scale for treatment cost and lower O&M via a single treatment facility; and,
    - The existing administration for each utility district could still be maintained even though treatment would occur at only one location.

- **Disadvantages**
    - There may be existing debt service that would need to be incorporated into the costing scenarios discussed earlier in Section 4, that could impact the direction taken in the consolidation scenarios;
    - Consolidation to a super-regional WWTP would require extensive coordination with the utility districts to operate and maintain multiple rate structures; and,

- There could be a perceived loss of ownership and control of the local WWTPs by the utility districts.

Since the SB-FB WWTP is currently in the best condition of all the existing WWTP facilities, the work needed at this facility would be based on expansions to incorporate offsite WWTP flows, which could be constructed over multiple phases as needed to incorporate the wastewater flows from the offsite WWTPs at a rate of several WWTP consolidations every five years. The total projected capital cost (in 2011 dollars) for this recommended scenario is $82,689,000, including contingency and engineering (Refer to Table 4-37).

Implementation of this scenario is not expected to be completed all at once. In fact, implementation of the recommended consolidation scenario to consolidate all the existing and proposed WWTP service areas into a single super-regional WWTP would be best completed in phases over a period of time. By implementing this scenario in a phased approach, the City could accomplish consolidation at a controlled pace that balances well with project funding demands from the water system and with the benefit of observing the impact to overall wastewater system performance and net change in O&M costs. An implementation plan has been developed and is included both in Section 7 and here in additional detail.

- **Current – 11 WWTPs in Operation**

- **2010-2015 – 9 WWTPs in Operation**

  - Consolidate HCMUD #122 flow into Harris County WC&ID-Fondren Rd WWTP (addition of 0.1 MGD current flow), PS to be sized for build-out conditions;

  - Consolidate Palmer Plantation flow into SB-FB WWTP (addition of 0.3 MGD current flow), PS to be sized for future consolidation flows; and

  - Consolidate Sienna North flow into SB-FB WWTP (addition of 0.3 MGD current flow), PS to be sized for future consolidation flows.

- **2015-2020 – 7 WWTPs in Operation**

  - Construct a 4.0 MGD expansion at SB-FB WWTP to incorporate additional consolidation flow;

- Consolidate Fort Bend County MUD #26 flow into Palmer Plantation WWTP PS, going ultimately to SB-FB WWTP (addition of 0.3 MGD current flow), PS to be sized for future consolidation flows; and,

- Consolidate Sienna South flow into Sienna North WWTP PS, going ultimately to SB-FB WWTP (addition of 1.1 MGD current flow), PS to be sized for future consolidation flows.

- **2020-2025 – 4 WWTPs in Operation**

  - Construct a 4.0 MGD expansion at SB-FB WWTP to incorporate additional consolidation flow;

  - Consolidate Blue Ridge West flow into Fort Bend County MUD #26 WWTP PS, going ultimately to SB-FB WWTP (addition of 0.75 MGD current flow), PS to be sized for future consolidation flows;

  - Consolidate future Sienna development flow into Sienna South WWTP PS, going ultimately to SB-FB WWTP (addition of 0.0 MGD current flow), PS to be sized for buildout conditions;

  - Consolidate Quail Valley UD flow into SB-FB WWTP (addition of 1.5 MGD current flow), PS to be sized for build-out conditions; and,

  - Construct 0.5 MGD reuse pumping system at SB-FB to send reclaimed water back to Quail Valley UD for use at the golf course.

- **2025-2030 – 2 WWTPs in Operation**

  - Construct a 4.0 MGD expansion at SB-FB WWTP to incorporate additional consolidation flow;

  - Consolidate Harris County WC&ID-Fondren Rd flow into Blue Ridge West WWTP PS, going ultimately to SB-FB WWTP (addition of 0.2 MGD current flow), PS to be sized for future consolidation flows; and,

  - Consolidate Harris County MUD #122 flow into Harris County WC&ID-Fondren Rd WWTP PS, going ultimately to SB-FB WWTP (addition of 0.1 MGD current flow), PS to be sized for build-out conditions.

- **2030-2035 – 1 WWTP in Operation**

    - Construct a 4.0 MGD expansion at SB-FB WWTP to incorporate additional consolidation flow; and,

    - Consolidate Mustang Bayou flow into Palmer Plantation WWTP PS, going ultimately to SB-FB WWTP (addition of 0.4 MGD current flow), PS to be sized for build-out conditions.

In addition, the timing of WWTP improvements also must coincide with growth in each area to maintain compliance with the TCEQ's 75/90 Rule. Therefore, it is important to plan improvements at the proposed super-regional WWTP (SB-FB WWTP) with careful coordination with planned transfers of consolidated plant flows from other service areas. The proposed wastewater improvements are shown in Exhibit 4-1. A proposed wastewater improvements timeline (by individual year) is shown in Table 7-1. The timeline shown in Table 4-39 corresponds to the project implementation schedule (developed in 5-year increments) discussed previously.

Table 4-39 Projected Timeline for WWTP Improvements				
Year	**Project Completed**	**Projected Flow Loading at Super Regional WWTP (MGD) [1]**	**Flow Loading - Based on the Percent of Super Regional WWTP Capacity [2]**	**Improvements Required [3]**
2011	-	-	-	-
2012	Reroute Harris County MUD #122 WWTP to Harris County WC&ID-Fondren Rd WWTP	-	-	-
2013	Construct new transfer PS at Palmer Plantation WWTP and transfer all plant flow to SB-FB WWTP	1.89	63%	Initiate planning for SB-FB WWTP expansion
2014	Construct new transfer PS at Sienna North WWTP and transfer all plant flow to SB-FB WWTP	2.30	77%	**Initiate design for SB-FB expansion**
2015	-	2.37	79%	-
2016	**Construct 4.0 MGD expansion at SB-FB WWTP**	2.45	35%	-
2017	Construct new transfer PS at Fort Bend County MUD #26 WWTP and transfer all plant flow to Palmer Plantation WWTP PS	2.92	42%	-
2018	Construct new transfer PS at Sienna South WWTP and transfer all plant flow to Sienna North WWTP PS	4.11	59%	-
2019	-	4.24	61%	-
2020	-	4.38	63%	Initiate planning for SB-FB WWTP expansion
2021	Construct new transfer PS at Quail Valley UD WWTP and transfer all plant flow to SB-FB WWTP	6.02	86%	**Initiate design for SB-FB expansion**
2022	**Construct 4.0 MGD expansion at SB-FB WWTP**	6.21	56%	-
2023	Construct new transfer PS at Blue Ridge West WWTP and transfer all plant flow to Fort Bend County MUD #26 WWTP PS	7.50	68%	Initiate planning for SB-FB WWTP expansion
2024	Construct new transfer PS in Sienna development and transfer all plant flow to Sienna South WWTP PS	8.49	77%	**Initiate design for SB-FB expansion**
2025	-	8.77	80%	-

Year	Project Completed	Projected Flow Loading at Super Regional WWTP (MGD) [1]	Flow Loading - Based on the Percent of Super Regional WWTP Capacity [2]	Improvements Required [3]
2026	Construct new transfer PS at Harris County WC&ID-Fondren Rd WWTP and transfer all plant flow to Blue Ridge West WWTP PS	9.74	89%	-
2027	**Construct 4.0 MGD expansion at SB-FB WWTP**	10.05	67%	-
2028	Construct new transfer PS at Fort Bend County MUD #1 WWTP and transfer all plant flow to Harris County WC&ID-Fondren Rd WWTP PS	10.56	70%	-
2029	-	10.90	73%	Initiate planning for SB-FB WWTP expansion
2030	-	11.24	75%	**Initiate design for SB-FB expansion**
2031	Construct new transfer PS at Mustang Bayou WWTP and transfer all plant flow to Palmer Plantation WWTP PS	12.37	82%	-
2032	-	12.77	85%	-
2033	-	13.18	88%	-
2034	-	13.60	91%	-
2035	**Construct 4.0 MGD expansion at SB-FB WWTP**	14.04	74%	-
2036	-	14.48	76%	-
2037	-	14.95	79%	-
2038	-	15.43	81%	-
2039	-	15.92	84%	-
2040	-	16.43	86%	-

Notes:
1 - This flow loading is based on 3% growth in each service area, except those areas already built out, such as Quail Valley UD and Sienna South.
2 - The percent capacity is based on the total projected loading at the Super Regional WWTP, allowing for the existing 3 MGD treatment capacity plus additional expansions of 4 MGD each.
3 - Recommended years to initiate planning/design/construction based on maintaining compliance with the TCEQ's 75/90 Rule.

A full cash flow analysis was developed for the wastewater improvements (refer to Table 4-40) to provide a basis for comparison of existing/future WWTP O&M costs, along with the impact of the potential debt service to be incurred from consolidating the various existing WWTPs. A cumulative loss/gain analysis was also completed and was included in Table 4-40 which reflects a potential net gain

in revenue from wastewater fees during the course of the project due to reduced WWTP O&M cost as each existing WWTP consolidates into the proposed super-regional WWTP.

Annual debt service costs were developed based on a 30-year period at an interest rate of 3%. Revenue generated is based on the billing data provided by the utility districts (also referenced in Section 1), which reflects an average residential wastewater charge of $3.58 per 1,000 gallons. In addition, the available revenue to offset WWTP O&M and debt service was based on an assumption of 75% allocation of wastewater revenues for WWTP operations allowing for the remaining 25% for wastewater collection O&M and administration O&M. The revenue is anticipated to increase at an approximate annual growth rate of 3% to match development growth in the City. Therefore, as wastewater flows increase, the revenues generated from wastewater service fees should also increase.

Based on the potential revenue/cost streams evaluated, it appears that the savings in O&M by consolidating WWTPs may allow for the wastewater revenues to start paying for the O&M and debt service as early as 2021 (the first year with an annual net gain of revenue), using the implementation schedule included in this Section. However, depending on actual current O&M costs attributed to each WWTP, the likely "break even" point in the proposed implementation schedule could happen earlier or later than 2021.

Table 4-40
Projected Cash Flow Analysis for Proposed Wastewater Improvements

Year	Wastewater Improvements Project	Annual Debt Service Cost for WWTP Projects [1]	Total O&M Cost for Super Regional WWTP and Transfer PS Operation [2]	Total O&M Cost for Existing WWTP Operations [2]	Total Annual Cost for Wastewater Improvements and Operations	Total Annual Revenue for Utility Districts for WWTP Operations [3]	Cumulative Net Loss/Gain During Project
2011	-	-	-	$6,261,000	$6,261,000	$6,371,000	$110,000
2012	Reroute Harris County MUD #122 WWTP to Harris County WC&ID-Fondren Rd WWTP	$4,219,000	$397,000	$5,662,000	$10,278,000	$6,575,000	($3,593,000)
2013	Construct new transfer PS at Palmer Plantation WWTP and transfer all plant flow to SB-FB WWTP	$4,219,000	$508,000	$5,207,000	$9,934,000	$6,786,000	($6,741,000)
2014	Construct new transfer PS at Sienna North WWTP and transfer all plant flow to SB-FB WWTP	$4,219,000	$630,000	$4,802,000	$9,651,000	$7,004,000	($9,388,000)
2015	-	$4,219,000	$653,000	$4,971,000	$9,843,000	$7,229,000	($12,002,000)
2016	Construct 4.0 MGD expansion at SB-FB WWTP	$4,219,000	$488,000	$5,145,000	$9,852,000	$7,461,000	($14,393,000)

Year	Wastewater Improvements Project	Annual Debt Service Cost for WWTP Projects [1]	Total O&M Cost for Super Regional WWTP and Transfer PS Operation [2]	Total O&M Cost for Existing WWTP Operations [2]	Total Annual Cost for Wastewater Improvements and Operations	Total Annual Revenue for Utility Districts for WWTP Operations [3]	Cumulative Net Loss/Gain During Project
2017	Construct new transfer PS at Fort Bend County MUD #26 WWTP and transfer all plant flow to Palmer WWTP PS	$4,219,000	$621,000	$4,551,000	$9,391,000	$7,700,000	($16,084,000)
2018	Construct new transfer PS at Sienna South WWTP and transfer all plant flow to Sienna North WWTP PS	$4,219,000	$872,000	$3,282,000	$8,373,000	$7,947,000	($16,510,000)
2019	-	$4,219,000	$903,000	$3,397,000	$8,519,000	$8,202,000	($16,827,000)
2020	-	$4,219,000	$935,000	$3,516,000	$8,670,000	$8,465,000	($17,032,000)
2021	Construct new transfer PS at Quail Valley UD WWTP and transfer all plant flow to SB-FB WWTP	$4,219,000	$1,294,000	$2,472,000	$7,985,000	$8,736,000	($16,281,000)
2022	Construct 4.0 MGD expansion at SB-FB WWTP	$4,219,000	$1,187,000	$2,559,000	$7,965,000	$9,016,000	($15,230,000)
2023	Construct new transfer PS at Blue Ridge West WWTP and transfer all plant flow to Fort Bend County MUD #26 WWTP PS	$4,219,000	$1,523,000	$1,718,000	$7,460,000	$9,305,000	($13,385,000)
2024	Construct new transfer PS in Sienna development and transfer all plant flow to Sienna South WWTP PS	$4,219,000	$1,742,000	$1,779,000	$7,740,000	$9,603,000	($11,522,000)
2025	-	$4,219,000	$1,803,000	$1,842,000	$7,864,000	$9,911,000	($9,475,000)
2026	Construct new transfer PS at Harris County WC&ID-Fondren Rd WWTP and transfer all plant flow to Blue Ridge West WWTP PS	$4,219,000	$1,991,000	$1,463,000	$7,673,000	$10,229,000	($6,919,000)
2027	Construct 4.0 MGD expansion at SB-FB WWTP	$4,219,000	$2,061,000	$1,515,000	$7,795,000	$10,557,000	($4,157,000)
2028	Construct new transfer PS at Fort Bend County MUD #1 WWTP and transfer all plant flow to Harris County WC&ID-Fondren Rd WWTP PS	$4,219,000	$2,039,000	$1,338,000	$7,596,000	$10,895,000	($858,000)
2029	-	$4,219,000	$2,111,000	$1,385,000	$7,715,000	$11,244,000	$2,671,000
2030	-	$4,219,000	$2,185,000	$1,434,000	$7,838,000	$11,604,000	$6,437,000
2031	Construct new transfer PS at Mustang Bayou WWTP and transfer all plant flow to Palmer Plantation WWTP PS	$4,219,000	$2,390,000	$0	$6,609,000	$11,976,000	$11,804,000
2032	-	$4,219,000	$2,474,000	$0	$6,693,000	$12,360,000	$17,471,000
2033	-	$4,219,000	$2,561,000	$0	$6,780,000	$12,756,000	$23,447,000
2034	-	$4,219,000	$2,651,000	$0	$6,870,000	$13,165,000	$29,742,000
2035	Construct 4.0 MGD expansion at SB-FB WWTP	$4,219,000	$2,316,000	$0	$6,535,000	$13,587,000	$36,794,000
2036	-	$4,219,000	$2,398,000	$0	$6,617,000	$14,022,000	$44,199,000
2037	-	$4,219,000	$2,482,000	$0	$6,701,000	$14,471,000	$51,969,000

Year	Wastewater Improvements Project	Annual Debt Service Cost for WWTP Projects [1]	Total O&M Cost for Super Regional WWTP and Transfer PS Operation [2]	Total O&M Cost for Existing WWTP Operations [2]	Total Annual Cost for Wastewater Improvements and Operations	Total Annual Revenue for Utility Districts for WWTP Operations [3]	Cumulative Net Loss/Gain During Project
2038	-	$4,219,000	$2,569,000	$0	$6,788,000	$14,935,000	$60,116,000
2039	-	$4,219,000	$2,659,000	$0	$6,878,000	$15,413,000	$68,651,000
2040	-	$4,219,000	$2,753,000	$0	$6,972,000	$15,907,000	$77,586,000
Total Debt Service (Principal and Interest)		**$122,351,000**					

Notes:
1 - This debt service cost is based on a 30-year payment period.
2 - This O&M cost includes a 3.5% annual cost escalation factor to account for anticipated increases in inflation in the future.
3 - The WWTP operations revenue based on allocating 75% of the annual wastewater revenue to WWTP operations. Revenue based on average utility district wastewater fee of $3.58 per 1,000 gallons. Revenue increases annually by approximately 3% due to increased development and growth in the City, resulting in a proportional increase in wastewater flows.

Section 5: Environmental Assessment

5.1 Environmental Setting

The majority of the Study area is located in Fort Bend County and extends to the northeast into a portion of Harris County in the southeast part of Texas. Although much of the land within Fort Bend County is still in agricultural use, the land use for the Study area is primarily residential. The terrain is level to gently sloping toward the coast. Elevations range from 150 feet to 70 feet. The average rainfall is 45.3 inches. The counties are drained by the Brazos and San Bernard Rivers, as well as Oyster Creek. The Gulf of Mexico is located 50 miles from Fort Bend County. Exhibit 1-1 provides a general location map. An overview map for the proposed interconnections between the various water distributions is shown on Exhibit 2-2 and the proposed locations for new ESTs are shown on Exhibit 2-3. The alternative wastewater pipeline locations associated with the wastewater treatment consolidation alternatives are shown on Exhibit 4-1. All of the water and wastewater Study projects that are recommended herein with a proposed construction location (project options) are shown on US Geological Survey Topographic Maps and Aerial Photos. These are included in Appendix E.

5.1.1 Geological Elements

The geologic units within the Study area range in age from Miocene to Holocene. From oldest to youngest, they are Oakville Sandstone, Fleming Formation, Goliad Sand, Willis Sand, Bentley Formation, Montgomery Formation, Beaumont Clay and Quaternary Alluvium. These units generally consist of alternating beds of sand, gravel, clay and silt.

The Beaumont Clay, Montgomery Formation and Quaternary Alluvium outcrop in the Study area. One or more of the geological units may be absent at any specific project location due to nondeposition or erosion. All formations dip toward the Gulf of Mexico at an angle greater than the slope of the land surface and generally thicken with depth in the downdip gulfward direction. The Geologic Atlas Map of the Study area is included in Appendix E.

Soils Maps for the project options were prepared indicating the proposed construction location of the interconnection, EST and wastewater pipelines, as applicable. These Soils Maps are found in Appendix E. Note that the soil classification keys used on each Soil Map are defined in Table 5-1 and are not defined in Appendix E; however, a more detailed explanation of the soils suitability for each soil type is included in Appendix E. The soils within the Study area are clays, clay loams and sandy loams. A summary of the soil types and soil suitability for excavations within each project option are presented in Table 5-1.

Table 5-1 Soils Summary			
Proposed Option	**Soil Classifications**	**Soils Descriptions**	**Soils Suitability for Shallow Excavation**
Water System Interconnection Alternatives – see Section 2.3.1			
Water Option 1 First Colony MUD #9 and Fort Bend County MUD #115 Interconnect	Ma, Mc	Brazoria clay, 0-1% slopes, rarely flooded; Clemville silty clay loam, 0-1% slopes, rarely flooded	Very Limited (VL), Somewhat Limited (SWL)
Water Option 2 Mustang Bayou and Sienna Plantation Interconnect No. 2	Be, Ea, Lb	Bernard-Edna complex 0-1% slopes; Edna fine sandy loam, 0-1% slopes; Lake Charles clay, 1-4% slopes	VL, SWL, VL
Water Option 3 Mustang Bayou and Sienna Plantation Interconnect No.3	Be, Ea, La, Ma, Nc	Bernard-Edna complex 0-1% slopes; Edna fine sandy loam, 0-1% slopes; Lake Charles clay, 0-1% slopes; Brazoria clay, 0-1% slopes, rarely flooded; Norwood silty loam	VL, SWL, VL, VL, SWL
Water Option 4 Sienna Plantation Internal Interconnect	Ma, Nc, Nd	Brazoria clay, 0-1% slopes, rarely flooded; Norwood silty loam; Norwood silty clay loam	VL, SWL, SWL
Water Option 5 Sienna Plantation and Palmer Plantation Interconnect No. 1	Ra	Sumpf clay	VL
Water Option 6 Silver Ridge Development and Sienna Plantation Interconnect No. 1	Nc	Norwood silty loam	SWL
Water Option 7 Fort Bend County MUD #149 and Sienna Plantation MUD #1 Interconnect No. 1	Ma	Brazoria clay, 0-1% slopes	VL
Water Option 8 Blue Ridge West MUD, Permanently Open Interconnect with Fort Bend County MUD #26	Not Applicable, No construction required		
Water Option 9 Blue Ridge West MUD, Permanently Open Interconnect with Fort Bend County WC&ID No. 2	Not Applicable, No construction required		
Water Option 10 Fort Bend County MUD Nos. 47 & 48, Permanently Open Interconnect	Not Applicable, No construction required		
Water Option 11 Mustang Bayou and Sienna Plantation Interconnect, Permanently Open	Not Applicable, No construction required		

Proposed Option	Soil Classifications	Soils Descriptions	Soils Suitability for Shallow Excavation
Water Option 12 Mustang Bayou and Palmer Plantation Interconnect	Be, Ea	Bernard-Edna complex 0-1% slopes; Edna fine sandy loam, 0-1% slopes	VL, SWL
Water Option 13 Mustang Bayou and Quail Valley Interconnect	Ka, Kc, Wa	Katy fine sandy loam, 0-1% slopes; Katy-Waller complex; Waller soils	SWL, SWL, VL
Water System Storage Alternatives – See Section 2.3.2			
1. New EST at Sienna Plantation #1 WTP	Nc, Nd, Ra	Norwood silty loam; Norwood silty clay loam; Sumpf clay	SWL, SWL, VL
2. New EST at Mustang Bayou WTP	La	Lake Charles clay, 0-1% slopes	VL
3. New EST at Fort Bend County MUD #149 WTP	Ma, Nd, Ra	Brazoria clay, 0-1% slopes, rarely flooded; Norwood silty clay loam; Sumpf clay	VL, SWL, VL
4. New EST at Palmer Plantation MUD #2 WTP	Ea	Edna fine sandy loam, 0-1% slopes	SWL
5. New EST at Thunderbird UD System 1 WTP #2	Nc	Norwood silty loam	SWL
6. New EST at Harris County WC&ID – Fondren Rd WTP #2	LcA	Lake Charles clay, 0-1% slopes	VL
Wastewater Treatment System Alternatives – See Section 3			
1. Blue Ridge West MUD WWTP to SB-FB WWTP	Be, Ea, Kc, La, W, Wa	Bernard-Edna complex 0 to 1 percent slopes; Edna fine sandy loam, 0 to 1 percent slopes; Katy-Waller complex; Lake Charles clay, 0 to 1 percent slopes; Water, Waller soils	VL, SWL, SWL, VL, Not Rated (NR), VL
2. Fort Bend County MUD #26 WWTP to SB-FB WWTP	Ab, Bb, Bd, Be, Ea, Kc, La, Lb, Lu, Ma, Nb, Nc, Pa, Ra, W, Wa	Asa silty clay loam; Bernard clay loam; Bernard clay loam, 0 to 1 percent slopes; Bernard-Edna complex 0 to 1 percent slopes; Edna fine sandy loam, 0 to 1 percent slopes; Katy-Waller complex; Lake Charles clay, 0 to 1 percent slopes; Lake Charles clay, 1 to 4 percent slopes; Lake Charles-Urban land complex; Brazoria clay, 0 to 1 percent slopes, rarely flooded; Belk clay; Norwood silt loam; Pledger clay; Sumpf clay; Water, Waller soils	SWL, VL, VL, VL, SWL, SWL, VL, VL, VL, SWL, SWL,VL, VL, NR, VL

Proposed Option	Soil Classifications	Soils Descriptions	Soils Suitability for Shallow Excavation
3. Harris County MUD #122 WWTP to SB-FB WWTP	Ab, Bb, Be, Ea, Kc, La, Lb, Lu, Ma, Nb, Nc, Pa, Ra, W, Wa	Asa silty clay loam; Bernard clay loam, 0 to 1 percent slopes; Bernard-Edna complex 0 to 1 percent slopes; Edna fine sandy loam, 0 to 1 percent slopes; Katy-Waller complex; Lake Charles clay, 0 to 1 percent slopes; Lake Charles clay, 1 to 4 percent slopes; Lake Charles-Urban land complex; Brazoria clay, 0 to 1 percent slopes, rarely flooded; Belk clay; Norwood silt loam; Pledger clay; Sumpf clay; Water, Waller soils	SWL, VL, VL, SWL, SWL, VL, VL, VL, VL, SWL, SWL,VL, VL, NR, VL
4. Harris County WC&ID – Fondren Rd WWTP to SB-FB WWTP	Same as above		
5. Mustang Bayou WWTP to SB-FB WWTP	Ab, Be, Ea, La, Lb, Ma, Nb, Nc, Pa, Ra, W	Asa fine sandy loam; Bernard-Edna complex 0 to 1 percent slopes; Edna fine sandy loam, 0 to 1 percent slopes; Lake Charles clay, 0 to 1 percent slopes; Lake Charles clay, 1 to 4 percent slopes; Brazoria clay, 0-1% slopes, rarely flooded; Belk clay; Norwood silt loam; Pledger clay; Sumpf clay; Water	SWL, VL, SWL, VL, VL, VL, VL, SWL, VL, VL, NR
6. Palmer Plantation WWTP to SB-FB WWTP	Ab, Ma, Nb, Nc, Pa, Ra	Asa fine sandy loam; Brazoria clay, 0-1% slopes, rarely flooded; Belk clay; Norwood silt loam, Pledger clay; Sumpf clay	SWL, VL, VL, SWL, VL, VL
7. Quail Valley UD WWTP to SB-FB WWTP	Ab, Ma, Nc, Pa, Ra	Asa fine sandy loam; Brazoria clay, 0-1% slopes, rarely flooded; Norwood silt loam, Pledger clay; Sumpf clay	SWL, VL, SWL, VL, VL
8. Sienna South WWTP to SB-FB WWTP	Aa, Ma, Mc, Md, Nb, Nc, Nd, Pa, Ra	Asa fine sandy loam; Brazoria clay, 0-1% slopes, rarely flooded; Clemville silt loam, 0 to 1 percent slopes, rarely flooded; Clemville silty clay loam, 0 to 1 percent slopes, rarely flooded; Belk clay; Norwood silt loam; Norwood silty clay loam; Pledger clay; Sumpf clay	SWL, VL, SWL, SWL, VL, SWL, SWL, VL, VL
9. Sienna Plantation North WWTP to SB-FB WWTP	Aa, Ma, Mc, Md, Nb, Nd, Pa, Ra	Asa fine sandy loam; Brazoria clay, 0-1% slopes, rarely flooded; Clemville silt loam, 0 to 1 percent slopes, rarely flooded; Clemville silty clay loam, 0 to 1 percent slopes, rarely flooded; Belk clay; Norwood silt loam; Pledger clay; Sumpf clay	SWL, VL, SWL, SWL, VL, SWL, VL, VL

Proposed Option	Soil Classifications	Soils Descriptions	Soils Suitability for Shallow Excavation
10. Sienna Plantation South WWTP to SB-FB WWTP	Aa, Ma, Mc, Md, Nb, Nd, Pa, Ra	Asa fine sandy loam; Brazoria clay, 0 to 1 percent slopes, rarely flooded; Clemville silt loam, 0 to 1 percent slopes, rarely flooded; Clemville silty clay loam, 0 to 1 percent slopes, rarely flooded; Belk clay; Norwood silty clay loam; Pledger clay; Sumpf clay	SWL, VL, SWL, SWL, VL, SWL, VL, VL
11. Southwest Harris County MUD #1 WWTP to SB-FB WWTP	Ab, Bb, Be, Ea, Kc, La, Lb, Lu, Ma, Nb, Nc, Pa, Ra, W, Wa	Asa silty clay loam; Bernard clay loam, 0 to 1 percent slopes; Bernard-Edna complex 0 to 1 percent slopes; Edna fine sandy loam, 0 to 1 percent slopes; Katy-Waller complex; Lake Charles clay, 0 to 1 percent slopes; Lake Charles clay, 1 to 4 percent slopes; Lake Charles-Urban land complex; Brazoria clay, 0 to 1 percent slopes, rarely flooded; Belk clay; Norwood silt loam; Pledger clay; Sumpf clay; Water, Waller soils	SWL, VL, VL, SWL, SWL, VL, VL, VL, VL, SWL, SWL,VL, VL, NR, VL
12. Convert SB-FB WWTP to Super Regional WWTP	Ma, Pa	Brazoria clay, 0 to 1 percent slopes, rarely flooded; Pledger clay	VL, VL

Notes:
1 - Soils information obtained from http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx.
2 - Soil type key found in Appendix E.
3 - The water interconnect option number corresponds to the projects listed in Section 2.3.1.
4 - The EST option number corresponds to the projects listed in Section 2.3.2.
5 - The wastewater option number corresponds to the projects listed in Section 3.3

5.1.2 Hydrological Elements

The hydrologic units within the Study area starting with the oldest are the Jasper Aquifer, Burkeville confining system, Evangeline Aquifer and the Chicot Aquifer. The Jasper Aquifer consists of terrigenous clastic sediments of the Oakville Sandstone which form sand and clay interbeds. This aquifer does not contain fresh water in the Study area. The thickness of the Jasper Aquifer ranges from 600 to 1,600 feet.

The Burkeville confining system is composed primarily of silt and clay of the Oakville Sandstone and Fleming Formation. The thickness ranges from 300 to 500 feet. The Burkeville confining system separates the Jasper and the Evangeline aquifers and acts as a confining unit to slow the flow of water between the two aquifers.

The Evangeline aquifer overlies the Burkeville confining system and underlies the Chicot aquifer. It is composed of sediments of the Goliad Sand and Fleming Formation. In the Study area, the Evangeline aquifer contains 400 to 700 feet of sand.

The Chicot aquifer's beds of sand and clay overlie the Evangeline aquifer. Geologic units which make up the Chicot aquifer are the Willis Sand, Bentley Formation, Montgomery Formation, Beaumont Clay and overlying Quaternary alluvium. The thickness of the aquifer in the Study area ranges from 300 to 800 feet.

Both the Evangeline and the Chicot aquifers are sources of good quality groundwater. However, due to the increased demand, the FBCSD has set requirements to reduce groundwater usage in the City by a minimum of 30% by 2013 and a minimum of 60% by 2025. As noted previously in Section 1.2 of this Study, the proposed project options provide mechanisms to send surface water to several utility district WTPs to aid in meeting the groundwater reduction goals.

The Study area is crossed with natural waterways and manmade channels. There is a levee on the northeast side of SH 6 near Water Options 4 & 5. There is one permanently floatable waterway in the Study area, Oyster Creek south of SH 6.

5.1.3 Floodplains and Wetlands

Maps of each proposed project option are overlaid on Flood Insurance Rate Map and on National Wetlands Inventory Maps. These Flood Maps and Wetlands Maps are found in the Appendix E. For construction of each project option, summaries of the floodplain zones and impacted wetland designations are presented in Table 5-2.

Table 5-2
Floodplains & Wetland Summary

Proposed Option	Floodplain Zone	Impacted Wetland Designation
Water Option 1 First Colony MUD #9 and Fort Bend County MUD #115 Interconnect	X	None
Water Option 2 Mustang Bayou and Sienna Plantation Interconnect No. 2	X	PEMICx
Water Option 3 Mustang Bayou and Sienna Plantation Interconnect No.3	X	PEMIF, PFOIC
Water Option 4 Sienna Plantation Internal Interconnect	A & X	R2UBF, PFOIA
Water Option 5 Sienna Plantation and Palmer Plantation Interconnect No. 1	X & A	None
Water Option 6 Silver Ridge Development and Sienna Plantation Interconnect No. 1	AE	None
Water Option 7 Fort Bend County MUD #149 and Sienna Plantation MUD #1 Interconnect No. 1	AE	R2UBHx

Proposed Option	Floodplain Zone	
Water Option 8 Blue Ridge West MUD, Permanently Open Interconnect with Fort Bend County MUD #26	Not Applicable, No construction required	
Water Option 9 Blue Ridge West MUD, Permanently Open Interconnect with Fort Bend County WC&ID No. 2	Not Applicable, No construction required	
Water Option 10 Fort Bend County MUD Nos. 47 & 48, Permanently Open Interconnect	Not Applicable, No construction required	
Water Option 11 Mustang Bayou and Sienna Plantation Interconnect, Permanently Open	Not Applicable, No construction required	
Water Option 12 Mustang Bayou and Palmer Plantation Interconnect	AE & X	PEMIAd
Water Option 13 Mustang Bayou and Quail Valley Interconnect	AE & X	PEMIFx, PEMIA, PEMIAd
Water System Storage Alternatives – See Section 2.3.2		
1. New EST at Sienna Plantation #1 WTP	X	None
2. New EST at Mustang Bayou WTP	X	None
3. New EST at Fort Bend County MUD #149 WTP	AE	None
4. New EST at Palmer Plantation (System 1) MUD #2 WTP	AE	None
5. New EST at Thunderbird UD System 1 WTP #2	X	PEMIF
6. New EST at Harris County WC&ID – Fondren Rd WTP #2	X	None
Wastewater Treatment System Alternatives – See Section 3		
1. Blue Ridge West MUD WWTP to SB-FB WWTP	AE, X	PEMIA, PEMIAo, PEMICx, PEMIFx, PFOAI, PUBHx, R2UBHx, R2UBH
2. Fort Bend County MUD #26 WWTP to SB-FB WWTP	AE, X	PEMIA, PEMIAo, PEMICx, PEMIFx, PFOAI, PUBHx, R2UBHx, R2UBH
3. Harris County MUD #122 WWTP to SB-FB WWTP	AE, X, flood map not available for this part of Harris County	PEMIA, PEMIAo, PEMICx, PEMIFx, PFOAI, PUBHx, R2UBHx, R2UBH, R4SBCx
4. Harris County WC&ID – Fondren Rd WWTP to SB-FB WWTP	AE, X, flood map not available for this part of Harris County	PEMIA, PEMIAo, PEMICx, PEMIFx, PFOAI, PUBHx, R2UBHx, R2UBH, R4SBCx
5. Mustang Bayou WWTP to SB-FB WWTP	A, AE, X	PEMIA, PEMIFx, PFOAI, PSSICx, PUBHx, R2UBHx, R2UBH

Proposed Option	Floodplain Zone	Impacted Wetland Designation
6. Palmer Plantation WWTP to SB-FB WWTP	AE, X	PEMIA, PEMIFx, PFOAI, PUBHx, R2UBHx, R2UBH
7. Quail Valley UD WWTP to SB-FB WWTP	A, AE, X	PEMIC, PEMIFx, PFOIA, PUBHx, R2UBH,
8. Sienna South WWTP to SB-FB WWTP	AE, X	PEMIA, PEMICx, PEMIF, PFOIA, PFOIC, PUBHx, PUSC, PUSCx, R2UBHx
9. Sienna Plantation North WWTP to SB-FB WWTP	A, AE, X	PEMICx, PFOIA, PUBHx, R2UBHx
10. Sienna Plantation South WWTP to SB-FB WWTP	AE, X	PEMIA, PEMICx, PEMIF, PFOIA, PFOIC, PUBHx, PUSC, PUSCx, R2UBHx
11. Southwest Harris County MUD #1 WWTP to SB-FB WWTP	AE, X, flood map not available for this part of Harris County	PEMIA, PEMIAo, PEMICx, PEMIFx, PFOAI, PUBHx, R2UBHx, R2UBH, R4SBCx
12. Convert SB-FB WWTP to Super Regional WWTP	Not Applicable, Construction at existing WWTP site	

Notes:
Floodplain Zone AE - Special flood hazard zone areas inundated by 100-year flood. Base flood elevations determined.
Floodplain Zone X - Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.
Wetlands Legend Key - Included in Appendix E

The United States Army Corps of Engineers (USACE) reviews proposed construction projects in accordance with Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899. Under Section 404, the USACE regulates the discharge of dredged and fill material into waters of the United States, including wetlands. Under Section 10, the USACE regulates any work in, or affecting, navigable waters of the Unites States. Any selected project option involving construction must be submitted to the USACE for review. The USACE will review the project and will provide a determination of the type of permit required, if any. In addition, the USACE addresses the project's effects on threatened and endangered species within the Study area. The proposed options involving interconnections appear to meet the requirements of Nationwide Permit (NWP) 12 for utility line activities and will require USACE authorization. Generally, once the USACE authorizes a project, the authorization remains valid for two years. The current NWPs expire on March 18, 2012. It is recommended to submit selected proposed projects for USACE review, under new NWP conditions, after March 18, 2012.

The Study area is located within the USACE Galveston District. All USACE correspondence should be directed to this district office. In addition to the standard permit review as described above, the Galveston District will determine if stream mitigation requirements are applicable for a selected proposed project. Stream mitigation requirements may apply when direct impacts occur within the stream bed of a water of the United States. For any selected project, the design should avoid and minimize project impacts to aquatic resources.

5.1.4 Coastal Zones

The Study area is located within Fort Bend County and the southwest part of Harris County. No proposed project options are located within the Texas Coastal facility designation area, as indicated on the Texas Coastal Management Program map included in Appendix E.

5.1.5 Climatic Elements

The climate in the Study area is humid subtropical. The temperatures range from an average high of 94° F in July to an average low of 44° in January. Rainfall averages 45.3 inches annually in the project area. Rainfall amounts are fairly consistent each month throughout the year. Prevailing winds are from the south and southeast, bringing heat and moisture from the Gulf of Mexico. The average wind speeds are from 11 to 16 knots. However, during the summer season the air tends to be still with high relative humidity, often 90 to 100%. Afternoon summer thunderstorms are common.

The air quality in the Study area is generally good. The EPA has provided a scale called the Air Quality Index (AQI) for rating air quality. This scale is based on the National Ambient Air Quality Standards and is described in 40 Code of Federal Regulations (CFR), Part 58, Appendix G. Fort Bend County has an air quality monitoring station, designation C696, located at University of Houston – Sugarland. The air quality station monitors for the critical pollutant, Ozone 3. Annually, the annual AQI ranges from good (0 to 50) to unhealthy for sensitive groups (101 to 150). High AQIs occur most often in August within the Study area.

5.1.6 Biological Elements

Biological elements of concern may be present within the Study area. In accordance with the TPWD form PWD 1059 preliminary investigation of recommended projects was accomplished by review at county-level using the Texas Natural Diversity Database (TXNDD). These steps were pursued in lieu of a wildlife habitat assessment. The TPWD's web site located at: www.tpwd.state.tx.us/landwater/land/maps/gis/ris/endangered_species was consulted for the current Fort Bend County and Harris County lists for rare species. County-listed species include amphibians, birds, fishes, mammals, mollusks, reptiles and plants. The descriptions of each potential species within the Study area counties are found in Appendix E. A preliminary project review data request through TXNDD was submitted. This TXNDD response is included in Appendix E.

The first page of the TXNDD references general considerations, each of which are discussed in relation to this Study as follows:

- The Study area is not located in Travis, Williams, or Bexar County.

- The Bald Eagle is listed as a species of concern on the TXNDD report. The TPWD must be contacted prior to initiating any proposed projects for up-to-date information and project construction considerations.

- The Study does not include construction of a communication tower.

- The Study does not involve wind energy.

- The TXNDD report does not list the Texas trailing phlox.

The U.S. Fish and Wildlife Services' (USFWS) Information, Planning and Conservation system was used to research additional considerations such as threatened and endangered species, migratory birds, National Refuge lands, Coastal Barrier Resource Units and the management of invasive species within the Study area. The search indicates that endangered species may be present in the Study area. The Texas prairie dawn-flower (*Hymenoxys texana*), is found in both Harris and Fort Bend Counties and the whooping crane (*Grus americana*) migrates to Fort Bend county.

Texas prairie dawn is an annual flower that grows one to six inches tall. It has yellow flower heads, less than 1/2 inch in diameter and tends to stand out brightly in the patches of dull gray barren sand in which the species is normally found. It grows in sparsely vegetated areas at the base of mima mounds or other nearly barren areas on slightly saline soils in coastal prairie grasslands.

The whooping crane, at nearly 5 feet tall, is North America's tallest bird. It is only found in North America. Whooping cranes are white with rust-colored patches on the top and back of their head, lack feathers on both sides of the head and have yellow eyes and long, black legs and bills. Their primary wing feathers are black but are visible only in flight. Whooping cranes migrate to Texas' coastal plains from November through March.

Precautions should be taken during any construction activity to avoid impacts to rare species or habitats, natural plant communities, or special features should they be present. Riparian habitats in the Study area provides valuable habitat for many wildlife species and are frequently used as travel corridors. Loss and fragmentation of these travel corridors can inhibit the movement of these species between food, cover and breeding locations. Impacts to riparian vegetation and aquatic habitat at water crossings should be avoided by boring under waterways, when allowable. Staging areas during construction should be located outside of the riparian corridors. Once project options are selected and design is initiated, updated species lists should be reviewed and a wildlife habitat assessment should be processed to obtain current project-specific mitigation measure recommendations.

Environmental receptors within the Study area were reviewed by using topographic maps and by consulting the TXNDD results. Types of environmental receptors include national or state parks, forests and monuments; officially designated wildlife sanctuaries, preserves, or refuges; and Federal wilderness areas. There are no state-designated or federally-designated environmental receptors in the Study area.

5.1.7 Cultural Resources

In the preliminary planning stages of a project, identification of historic and prehistoric resources is not recommended since the Texas Historical Commission generally requires an archeological survey of the specific project area to be conducted if no survey has been conducted for the proposed routes. It is recommended that a formal cultural resources review be conducted upon selection of a project location or alignment.

5.1.8 Economic Conditions

The Study area is located in one of the fastest growing areas in Texas. The population in the Study area is a skilled residential workforce with 39% college educated. The average household income of residents is $119,000. Approximately 80% of the residents are families.

The 2010 Census Count for the Study area is 81,079. Current and projected population counts are found in Table 1-4. Detailed population estimates are found in Table 1-5.

The Study area is anticipated to grow in residential, commercial and retail developments. The current businesses located in the Study area include agriculture, petrochemicals and technology industries. New companies, including additional technology-based businesses, are anticipated to relocate to the Study area, providing a strong economic forecast.

5.1.9 Land Use

The Study area includes residential, commercial and retail developments. As stated previously, the primary goals of the project options are to improve the area water distribution systems and consolidate the wastewater treatment systems for improved treatment efficiencies. A summary of the current land use and projected use at each project option location is found in Table 5-3.

Table 5-3
Land Use Summary

Proposed Option	Current Land Use	Anticipated Land Use
Water Option 1 First Colony MUD #9 and Fort Bend County MUD #115 Interconnect	Built out residential to commercial corridor connection.	No change anticipated.
Water Option 2 Mustang Bayou and Sienna Plantation Interconnect No. 2	SH 6 corridor, undeveloped.	Potential commercial development.

Proposed Option	Current Land Use	Anticipated Land Use
Water Option 3 Mustang Bayou and Sienna Plantation Interconnect No.3	Directly behind SH 6 corridor of Water Option 2. Abuts established residential development.	Potential commercial development on SH 6 corridor.
Water Option 4 Sienna Plantation Internal Interconnect	SH 6 corridor, undeveloped & developed. HEB located on east end of proposed pipeline.	Potential commercial development on SH 6 corridor on northwest end. Limited growth in Central section due to significant elevation differenced.
Water Option 5 Sienna Plantation and Palmer Plantation Interconnect No. 1	SH 6 corridor, undeveloped. Levee along on east side of Hwy.	Commercial development on west side more likely than on east side due to levee.
Water Option 6 Silver Ridge Development and Sienna Plantation Interconnect No. 1	Commercial and residential.	No change anticipated.
Water Option 7 Fort Bend County MUD #149 and Sienna Plantation MUD #1 Interconnect No. 1	Residential and undeveloped.	Potential residential development.
Water Option 8 Blue Ridge West MUD, Permanently Open Interconnect with Fort Bend County MUD #26	Not Applicable, No construction required.	
Water Option 9 Blue Ridge West MUD, Permanently Open Interconnect with Fort Bend County WC&ID No. 2	Not Applicable, No construction required.	
Water Option 10 Fort Bend County MUD Nos. 47 & 48, Permanently Open Interconnect	Not Applicable, No construction required.	
Water Option 11 Mustang Bayou and Sienna Plantation Interconnect, Permanently Open	Not Applicable, No construction required.	
Water Option 12 Mustang Bayou and Palmer Plantation Interconnect	Residential & undeveloped.	Potential residential development.
Water Option 13 Mustang Bayou and Quail Valley Interconnect	Residential & undeveloped.	Potential residential development.
Water System Storage Alternatives – See Section 2.3.2		
1. New EST at Sienna Plantation #1 WTP	Residential development.	No change anticipated.
2. New EST at Mustang Bayou WTP	Residential & undeveloped.	Potential residential development.
3. New EST at Fort Bend County MUD #149 WTP	Residential, commercial and undeveloped.	Potential commercial & residential development.
4. New EST at Palmer Plantation MUD #2 WTP	Residential and undeveloped.	Potential development.

Proposed Option	Current Land Use	Anticipated Land Use
5. New EST at Thunderbird UD System 1 WTP #2	Residential developments, Lake Olympia Middle School, and FBISD Transportation Center.	No change anticipated.
6. New EST at Harris County WC&ID – Fondren Rd WTP #2	Sam Houston Parkway corridor, Commercial, residential and undeveloped.	Potential development.
Wastewater Treatment System Alternatives – See Section 3.3		
1. Blue Ridge West MUD WWTP to SB-FB WWTP	Built-out residential developments.	No change anticipated.
2. Fort Bend County MUD #26 WWTP to SB-FB WWTP	Built-out residential developments.	No change anticipated.
3. Harris County MUD #122 WWTP to SB-FB WWTP	Residential and undeveloped.	Potential residential development.
4. Harris County WC&ID – Fondren Rd WWTP to SB-FB WWTP	Residential and undeveloped.	Potential development.
5. Mustang Bayou WWTP to SB-FB WWTP	Residential and undeveloped.	Potential development.
6. Palmer Plantation WWTP to SB-FB WWTP	Residential developments, Lake Olympia Middle School, and FBISD Transportation Center.	No change anticipated.
7. Quail Valley UD WWTP to SB-FB WWTP	Built-out residential developments.	No change anticipated.
8. Sienna South WWTP to SB-FB WWTP	Undeveloped.	Potential development.
9. Sienna Plantation North WWTP to SB-FB WWTP	Residential developments and Elkins High School at Thompson Ferry Rd & Knights Ct	No change anticipated.
10. Sienna Plantation South WWTP to SB-FB WWTP	Commercial, residential and undeveloped.	Potential development.
11. Southwest Harris County MUD #1 WWTP to SB-FB WWTP	Residential & undeveloped.	Potential development.
12. Convert SB-FB WWTP to Super Regional WWTP	Not Applicable, Construction at existing WWTP site.	

5.1.10 Site Assessment

In the planning stages of project selection, a site assessment is not recommended. When projects options are selected and in preliminary design, an initial site assessment may be required to assess the potential for hazardous materials contamination on any property being acquired or constructed upon as a part of the project that may result in liability under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). If necessary, a Phase I Environmental Site Assessment should be conducted according to current ASTM standards. The assessment documents contain existing and prior uses of the site and include a survey for unusual soil discoloration, vegetation anomalies and odors from the property and adjacent properties. If the initial assessment

indicates a potential for hazardous material contamination, a more detailed environmental site assessments should be conducted according to current ASTM standards.

5.1.11 Other Programs and Projects

Due to the high anticipated growth rate of the Study area, consultation with the local Texas Department of Transportation (TxDOT) is recommended for any projects selected in the SH 6 corridor during the preliminary design phase. Coordination with TxDOT will ensure a cohesive construction timeline.

5.2 Future Environment without Project Options

All proposed projects within this Study provide some degree of water and wastewater infrastructure improvement. The future environment without any of the proposed project alternatives may restrict further growth and perpetuate the existing water distribution system shortfalls and wastewater treatment system redundancies. Long-term impacts may include potential compliance issues which may compromise the public's health and safety due to lack of infrastructure.

5.3 Potential Impacts to Social, Economic and Environmental Resources

5.3.1 Direct and Indirect Impacts to Social Resources

Social issues involved with all proposed projects within this Study are likely to be both positive and negative. The negative social impact will be the inconveniences to the public caused by the water and wastewater system improvements. Temporary street closures, dust and dirt caused by construction and increased noise and traffic from construction vehicles and equipment are typical problems associated with these types of projects. These inconveniences can be addressed by rerouting traffic away from the working areas. Dirt and dust can be controlled by timely applications of water. In addition, the contractors should be requested to obtain a Texas Pollution Discharge Elimination System (TPDES) Stormwater Construction permit. Compliance with the TPDES permit will limit, if not eliminate, potential pollutants such as sediments from entering area water courses. Noise from construction will be temporary. Properly equipped and functioning equipment will reduce the amount of noise generated by the construction equipment. In addition, no night work is anticipated; therefore, noise should not be a significant issue.

The main indirect impact to social resources will be the ability for the Study area to expand and grow. The water and wastewater system improvements will provide adequate, compliant water and wastewater services for the current users, as well as future users throughout the Study area.

5.3.2 Direct and Indirect Impacts to Economic Resources

As funding sources are researched, the economic impacts should be considered. Generally, the impacts to economic resources occur when a utility rate increase is proposed to offset project costs.

5.3.3 Direct and Indirect Impacts to Environmental Resources

Alterations to Land Forms, Streams and Natural Drainage Patterns: The proposed project alternatives that involve construction will temporarily alter the land form during construction and may create a short-term modification to natural drainage. These impacts will be short-term, as the terrain should be compacted and restored to preconstruction contours on the same day as placement. There should be no indirect impacts to land forms from the water and wastewater system improvements.

There should be no direct impacts to either Oyster Creek or Mustang Bayou. Both water courses should be crossed by boring under the water courses. The indirect impact of boring the line as opposed to installing the line by the cut and fill methods will prevent the temporary disturbance of the water course channels and should allow the activities to be permitted under the USACE NWP program. The boring method will not temporarily or permanently alter the water course contours or drainage patterns.

An indirect impact of boring the line as opposed to installing it by the cut and fill method is that it is more expensive.

Erosion Control Measures: In accordance with the EPA Storm Water Rule (40 CFR 122.26) and TPDES Rule (Chapter 26 of the Texas Water Code), construction permit(s) for stormwater discharges associated with construction activities will be required. The permit should be obtained by the contractor. The permit will require the project owner and the contractor to prepare a Stormwater Pollution Prevention Plan (SWP3) which identifies potential sources of water contamination and preventative measures to be taken during and after project construction. Compliance with this regulation will minimize the impacts of erosion during and after construction.

Siltation and Sedimentation of Waterways: There should be no direct impact to waterways by siltation or sedimentation. Any waterway crossings should be performed by boring beneath the waterway channels. Utility line trenches should be covered daily following laying of the pipe. Re-vegetation of the soils following reclamation of the affected areas will reduce sedimentation and siltation.

Effects of Dredging, Tunneling and Trenching on Area Water Courses: No project options propose dredging of water courses. Boring of the lines under the Oyster Creek and Mustang Bayou will generate excess soil. This soil should be removed from the project site to an approved location away from area water courses. There will be no direct or indirect impacts to the water courses by tunneling or trenching. However, the project

options with line installations away from the water courses will be trenched. In an effort to preserve top soil, the upper 6 inches of soil should be removed and stockpiled during trenching. The backfill should be redressed with the topsoil after the line has been placed to enhance re-vegetation and thus, controlling erosion.

Precaution to Avoid Injury to Cover Vegetation: The majority of the proposed line installation options would be installed within or adjacent to existing ROWs. Within developed areas, the direct impact to vegetation would be minimal. However, in undeveloped areas and areas outside of existing ROWs, existing vegetation would require mitigation during construction. Potential impacts include trees, which are generally located within riparian corridors associated with the Oyster Creek and Mustang Bayou. The vegetation provides valuable habitat for many wildlife species and are frequently used as travel corridors. Loss and fragmentation of these travel corridors can inhibit the movement of these species between food sources, cover and breeding locations. Therefore, in an effort to preserve these habitats, impacts to riparian vegetation should be minimized by boring under the waterways and locating staging areas for boring equipment outside of the riparian corridors. Unavoidable impacts to woody vegetation should be mitigated by replacing native trees removed during construction. A replacement ratio of three trees for each tree lost is the current rule of thumb. A maintenance plan should be developed as part of the design to ensure an 80% survival rate for the first two years.

Re-vegetation of disturbed areas and landscaping within developed areas should use only site-specific native plant species. Coordination with the Natural Resource Conservation Service will identify native plant species needed for re-vegetation of disturbed and developed areas.

404 Requirements: The Galveston District of the USACE should be contacted to review selected projects to determine permitting requirements under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899.

Rare and Protected Species: The USFWS, TPWD and USACE should be contacted to review selected projects for potential impacts to Federal- and State- listed species which could occur within the project corridor.

5.4 Adverse Impacts which cannot be Avoided Should the Projects be Implemented

Adverse impacts which cannot be avoided should the projects be implemented would be the activities associated with the installation of the lines and system improvements. Equipment noise, dust emissions and the disruption and rerouting of traffic during construction will be the primary adverse effects of proceeding with any of the construction projects. Some land clearing will be necessary along the line corridors. Land

clearing will be minimal and restricted to the line corridor and ROW. The nature of the existing project plant sites and utility alignment preclude the need for extensive cutting. If certain construction operations produce excessive temporary noise levels impairing the normal activities of individuals or businesses in the area, the contractor would have to take reasonable actions to minimize construction noise through abatement measures such as work controls and maintenance of equipment muffler systems. Excessive dust will be controlled during construction with timely applications of water, as necessary. The volume of construction related traffic in the majority of the project options is expected to be minor and should not cause a significant disruption of traffic patterns. The crossing of SH 6 will be subject to TXDOT permit requirements. Traffic plans for these high traffic areas should be prepared to minimize impacts on the traffic flow during construction.

5.5 Trade Offs between Short-term Environmental Losses and Long-term Gains or Vice Versa

Construction of the proposed water and wastewater improvements can be considered a short-term use of the environment during which energy and labor are expended and the community may be slightly inconvenienced by noise and/or construction traffic. This short-term usage of the environment is expected to enhance and maintain long-term productivity in the Study area by continuing to provide adequate, efficient and compliant water and wastewater utility service facilities to meet the needs of the community.

The primary long-term environmental gain from the proposed RWTP is the reduction of groundwater usage, which not only meets the FBCSD Joint GRP groundwater usage reduction goals, but also ensures the continued viability of groundwater resources throughout the Study area. Long-term environmental gain results from any of the proposed WWTP consolidation projects. Reducing the number of point sources discharges through consolidation of individual WWTPs that ensures that discharged water quality limits are consistently met.

5.6 Future of the Environment without Proposed Projects

All project options provide some degree of water and wastewater infrastructure improvement. The future environment without any of the project options will restrict further growth and perpetuate the existing water utility shortfalls and wastewater treatment system redundancies. Long-term impacts may include potential compliance issues which may compromise the public's health and safety due to lack of modern infrastructure.

Section 6: Funding and Consolidation Alternatives

6.1 Funding Alternatives

This Study identified various water projects for interconnects, ESTs, RWTP expansion and water transmission lines. There are 9 interconnect projects totaling $4,795,000. There are 6 ESTs recommended at a total cost of $22,302,000. The two expansions require for the RWTP total to be $77,880,000. Finally, there are 2 transmission line projects for a total cost of $16,540,000. The total cost for the recommended water projects is $121,517,000.

The Study did not identify any stand-alone wastewater collection or conveyance projects that would benefit the Study area; however, the single recommendation to consolidate the existing WWTPs into a super-regional WWTP does include costs for conveyance and pumping to re-route wastewater flows and convey re-use water. The total cost for the super-regional WWTP project is $82,689,000.

The total cost for all of the projects identified in the Study is $204,206,000.

Obviously not all of the funding would be needed at the same time, but with the tightening of the bond market and the fact that the requests for water and wastewater funding are always greater than the funding available, the identification of funding sources is crucial.

The primary source of funding for water and wastewater improvements in Texas has been the TWDB. TWDB financial assistance programs are funded through state-backed bonds, a combination of state bond proceeds and federal grant funds, or limited appropriated funds. Since 1957, the Legislature and voters approved constitutional amendments authorizing the TWDB to issue up to $2.68 billion in Texas Water Development Bonds. To date, the TWDB has sold nearly $1.55 billion of these bonds to finance the construction of water- and wastewater-related projects.

In 1987, the TWDB added the Clean Water State Revolving Fund (CWSRF) to its portfolio of financial assistance programs. Low-interest loans from the CWSRF finance costs associated with the planning, design, construction, expansion or improvement of wastewater treatment facilities, wastewater recycling and reuse facilities, collection systems, stormwater pollution control projects and nonpoint source pollution control projects. Funded in part by federal grant money, the CWSRF provides loans at interest rates lower than the market can offer to any eligible applicant. The CWSRF offers 20-year loans using either a traditional long-term, fixed-rate or a short-term, variable-rate construction period loan that converts to a long-term, fixed-rate loan on project completion.

With either option, the borrower will receive a net long-term interest rate that is effectively 0.7 percent below the rate the borrower would receive on the open market at the time of closing. This 0.7 percent interest rate reduction equates to a savings of approximately $100,000 per $1 million borrowed during the life of a loan.

The TWDB also administers the Drinking Water State Revolving Fund (DWSRF). Through the DWSRF, the TWDB will make low-interest loans for financing public drinking water systems that facilitate compliance with primary and secondary drinking water regulations or otherwise significantly further the health protection objectives of the federal Safe Drinking Water Act (SDWA), as amended in 1996.

Loans from the DWSRF finance all costs associated with the planning, design and construction of projects to upgrade or replace water supply infrastructure, to correct exceedances of SDWA health standards, to consolidate water supplies and to purchase capacity in water system. Funded in part by federal grant money, the DWSRF provides loans at interest rates lower than the market can offer to any eligible applicant. Initially, the DWSRF offers 20-year loans with a net long-term interest rate that is effectively 1.2 percent below the rate the borrower would receive on the open market at the time of closing. This 1.2 percent interest rate reduction equates to a savings of approximately $165,000 per $1 million borrowed during the life of a loan.[1]

However, the competition for DWSRF and CWSRF is fierce. For example, the TWDB received funding requests for wastewater improvements totaling $1,460,381,105 while only $330,355,000 in funding was available for SFY 2012 CWSRF. Similarly, the SFY 2012 DWSRF received funding requests totaling $705,196,856 while only $70,658,400 of funding was available. [2]

The addition of new funding mechanisms, such as the Water Infrastructure Fund, to facilitate state water plan implementation, coupled with declining market conditions, has dramatically increased demand for the Board's financial assistance. With additional water plan funds received in 2007, the Board more than quadrupled the financial commitments it provided from 2006 to 2010. In fiscal year 2010, the Board committed approximately $1.5 billion in loans and grants to 92 different entities across all programs.[3]

The table on the following pages shows the various funding programs administered by the TWDB and their general characteristics.

[1] Texas Water Development Web Site
[2] Draft Intended Use Plans, CWSRF and DWSRF
[3] Texas Water Development Board Sunset Advisory Commission Report

Table 6-1 Texas Water Development Board Funding Programs			
Name	**Description**	**Applicants**	**Availability**
DWSRF	Loan and Loan Subsidies (grant for disadvantaged) available for planning, acquisition and construction of water-related infrastructure, including Water Supply and Source. Funding division include disadvantaged, green and Source Water Protection. Interest rate is 130 – 150 basis points below market.	Community Water System Owners and Non-Profits and political subdivisions of the state and private.	Annual Priority Rating Process applies to all projects.
CWSRF	Loan and Loan Subsidies (grant for disadvantaged) for planning, acquisition and construction of wastewater treatment, stormwater and nonpoint source pollution control and reclamation/reuse projects. Funding division include disadvantaged, green and Source Water Protection. Interest rate is 130 – 150 basis points below market.	Political subdivisions. Individuals are eligible for nonpoint source projects.	Annual Priority Rating Process applies to all projects.
Rural Water Assistance Fund (RWAF)	Planning, acquisition and construction of water and wastewater related infrastructure. May also be used to obtain service or to finance consolidation/regionalization. Loan only – very limited funds available.	Political Subdivisions and Nonprofit Water Supply Corporations.	Open Year Round.
Water Infrastructure Fund (WIF)	Water-related projects that must be recommended in water management strategies in the most recent TWDB approved regional plan or approved State Water Plan. May not be used to maintain a system or develop a retail distribution system. In summary, funding to implement regional water plan components - $998 million funded to date.	Political Subdivisions of the State and Water Supply Corporations.	Multiple invitations annually.
State Participation Program	Construction only of regional water and wastewater construction projects when the local sponsors are unable to assume the debt for optimal sizing of the facility. Deferred Interest loan (State has temporary ownership interest in a facility). State's ownership is purchased by the applicant as the customer base grows.	Political Subdivisions of the State and Water Supply Corporations.	Open year around but limited funds.

Name	Description	Applicants	Availability
Regional Facility Planning Grant Program	Studies and analyses to evaluate and determine the most feasible alternatives to meet regional water supply and wastewater facility needs, estimate the costs associated with implementing feasible regional water supply and wastewater facility alternatives, and identify institutional arrangements to provide regional facilities in Texas. Grant for 50% of Study Cost (75% for disadvantaged) with usual amount of $225,000 per Study. Usually $1 million available annually	Political Subdivisions with legal authority to plan, develop, and operate regional facilities and Nonprofit Water Supply Corporations.	Annual Priority Rating Process applies to all projects.
Texas Water Development Fund (DFund)	Planning, acquisition, and construction of water related infrastructure, including water supply, wastewater treatment, stormwater and nonpoint source pollution control, flood control, reservoir construction, storage and acquisition, and agricultural water conservation projects and municipal solid waste facilities. Loan with limited funds – interest rate at market.	Political Subdivisions of the State and Nonprofit Water Supply Corporations.	Open Year-Round
Economically Distressed Areas Program (EDAP)	Grant up to 100%, Loan or combination of both to bring water and wastewater services to economically distressed areas (designated by the TWDB state-wide) where the present water and wastewater are inadequate to meet the minimal needs of the residents. The program includes measures to prevent future substandard development.	Political Subdivisions and Nonprofit Water Supply Corporations.	Open Year-Round

While the list above is not all inclusive (there are certain funding programs dedicated solely to specific groups such as regional water planning), it does provide some idea of the breadth and depth of the funding types available for the proposed projects. Each program will have their own unique conditions and they change each legislative session or congressional act. For example, recently the TWDB notified applicants that all CWSRF and DWSRF will have to comply with the Davis-Bacon Act (payroll monitoring/reporting of contracts for regional minimum standards).

Another alternative for financing projects is bond issuance. Utility districts provide developers a vehicle for getting their investment back through the sale of bonds, which are repaid with property taxes. Typically the amount of bond issuance is calculated for build-out and the appropriate bonds are issued as the utility district develops. Since the majority of utility districts are more than 50% developed, the issuance of bonds for new facilities will be limited in the future. However, it should be noted that Sienna MUDs #1, 4, 5, 6, 7 and 13 are currently undeveloped and new bonds to provide infrastructure in these areas will be issued in the future.

While utility districts have the capacity to issue bonds, a municipality such as Missouri City, by its very nature, typically enjoys economic advantages over utility districts in terms of bond issuance costs and interest charges. That advantage is that interest rates are usually much lower for municipal bonds when compared to utility districts or Investor Owned Utilities (IOUs). A prime example of this is the financing for the RWTP. The 28 utility districts agreed to let the City sponsor the Joint GRP and issue bonds for design and construction of the RWTP.

The City backed these bonds with a tax pledge, had the bonds rated and issued the bonds on the open market. The City received a very favorable interest rate when compared to having the utility districts finance the project. In turn the utility districts pay a Groundwater Reduction Fee based on a price per thousand gallons. These revenues are kept in a separate account by the City to pay for administration and operation of the GRP Group and the debt service associated with the RWTP and water transmission lines.

Another alternative that can be used for financing consolidation projects that affect only a few utility districts could be an interlocal agreement between the utility districts to pay for the project in their proportionate shares through a utility fee. Many of the smaller water distribution consolidation projects could be financed by this method. However, for larger regional projects such as the SB-FB WWTP expansion to incorporate the Palmer Plantation influent, having the City sponsor the financing would probably be the most cost-effective method of funding.

Conclusions and Summary

Based on the consolidation projects identified in this Study, the majority of projects that would require significant funding are the water and wastewater projects. As such, using the model established by the RWTP, financing is strongly recommended for the super-regional WWTP. In addition, the TWDB CWSRF Program should be considered based on their subsidized interest rates and the additional points given to projects that result in consolidation of facilities. It should also be noted that this Study, funded in part by the TWDB, improves the chances of a project making the fundable list.

The conclusions regarding the funding of consolidation or regional projects are listed below.

- Municipalities can typically issue bonds at lower interest rates than utility districts or IOUs.

- Using the Joint GRP financing model for the RWTP is applicable to the larger wastewater consolidation projects.

- The smaller consolidation water distribution projects and interconnects are best financed via interlocal agreements between the affected utility districts.

6.2 Consolidation Alternatives

The term "Regionalization" has political connotations that infer a single, regional authority which is not the intent when the term is used in this Study. The direction and goal for this Study has been to identify win-win consolidation opportunities between the participants that benefit the area in a regional manner. Consequently, as we go forward in the discussion of the retroactive regionalization, the term "consolidation" is used interchangeably to convey the identification of "win-win projects" that achieve the objectives of this Study.

Regionalization is a general concept that encourages the orderly planning of water and wastewater facilities and services areas. The goal of regionalization is to limit the number of smaller, less efficient plants by planning larger service areas and larger, more efficient treatment, distribution, storage, pumping and collection facilities. The Study area experienced rapid growth during the past 20 years. This rapid growth was partially enabled by the expanded use of utility districts, which allowed landowners and developers to finance and construct the necessary infrastructure improvements relatively quickly.

As way of background, a utility district is a political subdivision of the State of Texas authorized by the Texas Water Code and TCEQ to provide water, wastewater, drainage and other services within the utility district boundaries. Upon creation of the utility district, temporary board members are appointed by the TCEQ as the utility district's interim Board of Directors until an election is held to elect the individual members. Upon election of the Board of Director's, the utility district's creation is confirmed and bonds are authorized and establishment of taxing authority for bond repayment is established.

There are advantages of a utility district, which are listed below.

- Utility Districts match those who benefit with those who pay.
- Utility Districts allow desirable land closer to a city to be developed without having to depend on individual lot wells or septic tanks.

Fueled by a strong economy, the utility district process expedited development in the City and the surrounding areas. The proliferation of small water and wastewater treatment plants can be attributed to rapid, uncontrolled growth in the region. Independence among developers, landowners and utility districts, coupled with minimal oversight/assistance from local government and regulatory agencies resulted in a tradeoff of efficiency in water and wastewater service.[4]

Regionalization can occur in two ways. Proactive regionalization occurs prior to development of an area and involves agreements and contracts between political

[4] Domestic Wastewater Regionalization, August 2000, H-GAC

subdivisions, businesses and property owners. This is the preferred method of regionalization as it allows for pre-development planning and proper sizing of treatment facilities and sites, collection, distribution and storage facilities. Obviously the opportunity for proactive regionalization is lost given the establishment of 11 WWTPs, 24 WTPs and almost 30 utility districts in the Study area alone.

Retroactive regionalization, on the other hand, is consolidation of interim/small facilities at a later date. There are inherent disadvantages to relying on a retroactive approach that are listed below.

- Physical barriers (highways, toll roads, drainage facilities) have been established that will prevent or escalate the cost of consolidation.

- Costly diversion infrastructure (pump stations, force mains) may prevent diversion of existing WWTPs or make the diversion process cost-prohibitive.

- Agreements and contracts among political subdivisions are much harder to complete once independent service areas are established.

- Sites ideal or suitable for regional facilities may already be developed.

- Determination of an overall rate structure for combined service areas is very difficult to establish once single-service areas and rate schedules have been established. Especially when trying to consolidate an older utility district and a newer utility district that typically has a much higher debt service component.

- There usually is not an economic incentive for consolidation or regionalization after infrastructure is established.

The regionalization of infrastructure was the primary focus of this Study. However, the type of regional authority that could be feasible to implement the regional infrastructure recommendations contained herein was examined. In other words, in addition to just agreement between all parties to implement regional projects, is a single-management authority better for the Study area?

The type of entity to promote and implement regionalization can be in the form of the Joint GRP that was created in response to requirements for reduced groundwater usage or in the form of the creation of a quasi-governmental organization. It should be noted that neither of these vehicles for the creation of regional entities is exclusive; there are a variety of methods and forms of agreements that are available. However, by and large, the use of an organization similar to the Joint GRP or a quasi-governmental entity is very common. Since the creation and purpose of the Joint GRP has been discussed in detail in this Study already, a brief discussion of the potential for the establishment of a quasi-governmental entity is provided below.

A quasi-governmental entity is not an agency of government; rather it is a hybrid organization that has been assigned by law some of the legal characteristics of both government and the private sector. It should be noted here that there are numerous types of quasi-governments, including non-profits, research organizations and utilities. The creation of a quasi-governmental entity separate from City government is not new. One of the most well-known examples is the San Antonio Water System (SAWS).

SAWS was created by the City Council in 1991 to establish a single utility responsible for water, wastewater, stormwater and reuse. This creation involved the consolidation of three City agencies: the City Water Board; the City Wastewater Department; and the Alamo Water Conservation and Reuse District. SAWS is governed by the SAWS Board of Trustees which consists of the Mayor and six members appointed by the City Council.

Of significance and applicability to the current situation between the City and utility districts in the Study area, the consolidation of these agencies required the refinancing of $635 million in water and wastewater bonds. Similar to the concept of regional infrastructure, the creation of a quasi-governmental entity could provide a single, autonomous authority to plan and manage future water and wastewater improvements while conducting the day-to-day operations of providing water and wastewater services.

While the creation of a single, regional entity sounds appealing, there are a number of factors, not limited to those listed below, that could prevent or severely limit the effectiveness of such an agency.

- In creating a single entity, how do you ensure equal representation among over 30 utility districts in the region?

- Will the creation of a quasi-governmental entity require the dissolution of the utility districts or simply a legal agreement between the entities?

- How can a utility rate structure be developed fairly that accounts for significant differences between the utility districts current rates and debt service?

- Finally what is the incentive to create a quasi-governmental entity versus the local representation and system familiarity offered by the local utility districts?

While the answer for many of the questions listed above would constitute a separate Study in and of themselves, an attempt was made to list some of the advantages associated with creating a quasi-governmental entity for the Study area.

- The ability to plan and manage long-term water supply, treatment, distribution and storage on a regional level through a single authority.

- The ability to manage wastewater collection, treatment and reuse on a regional level through a single authority.

- The ability to take advantage of the City's favorable bond rating and variety of finance options to implement regional water and wastewater improvements.

- A single rate structure for water and wastewater services throughout the Study area.

As noted above there are a number of pros and cons associated with the creation of a quasi-governmental entity. Given the current conditions, this Study does not recommend that a quasi-governmental entity be established to plan and manage the implementation of regional facilities. Perhaps the creation of a regional quasi-governmental entity will be attractive as the utility districts mature and/or the continued operation of the Joint GRP leads to a shift in views regarding regional management and infrastructure.

Consequently, the most feasible alternative to implement a single, regional wastewater treatment and conveyance system is to copy the paradigm established by the Joint GRP - each entity participates but maintains their autonomy via a legal agreement.

Water Treatment & Supply Consolidation

In regard to water treatment and supply, the City and the utility districts have managed to achieve what was unthinkable just a few years ago with the agreement for the new RWTP.

As way of background, the FBCSD adopted a Regulatory Plan for groundwater reduction for Missouri City and the various utility districts in 2003. The Plan established a policy for the FBCSD regarding groundwater regulation. These policies are designed to support the regulation of groundwater withdrawals to control subsidence on a regular basis. The Plan outlines specific permitting procedures and guidelines as well as fees for permits for groundwater withdrawal. Further, the Plan outlines groundwater reduction requirements that permittees are required to reach.

As discussed in previous sections, the City has joined together with other utility districts within the city limits and its ETJ to form a Joint GRP group that identified a plan for which as a whole, the participants will meet the groundwater reduction requirements set forth by the FBSD.

The participants of the Joint GRP group have determined that the most cost effective means of meeting the requirements set forth by the FBCSD is a complete conversion from groundwater to surface water in a portion of the City's service area, while leaving the remaining service area on groundwater supplies. Initial converting entities consist of those utilities located in the southern portion of the City and its ETJ for the initial conversion of groundwater to surface water, required by 2013. As the 60% reduction

requirement is approached in 2025, additional entities will be converted to surface water, generally moving northward on the system.

The initial RWTP size is 10 MGD (Phase I), which is anticipated to meet the City's required maximum demand through 2018, at which time the RWTP is intended to be expanded. Exhibit 1-6 identifies the initial converting entities, which will generally consist of Sienna Plantation utility districts. The first phase of the RWTP is currently under construction and is anticipated to be fully operational by the first of the year in 2012.

As the number of customers on the system grows, and thereby the amount of surface water to be supplied increases, and as the increased conversion requirements in 2025 are realized, it will become necessary to convert additional entities to surface water. The City anticipates two additional conversion phases. Phase 2 is anticipated to consist of converting Sienna MUD #s 1, 4, 5, 6 and 7, Fort Bend County MUD #s 46, 47, 48 and 149, and the Mustang Bayou Service Area. Phase 3 is anticipated to consist of converting Fort Bend County MUDs #129 and 115.

In regard to water distribution, the City's new RWTP has a transmission, pumping and storage component associated with it. Other opportunities for consolidation have also been identified in this Study and are primarily focused on interconnects between the service areas and providers, ESTs and transmission lines. Greater discussion of these opportunities can be found in Sections 2 and 4 of this Study.

Wastewater Treatment, Collection & Conveyance

As stated previously the agreement for a regional approach to water treatment, supply and distribution would have been very unlikely without the regulatory driver provided by the FBCSD. The consolidation of any current wastewater facilities will probably require a similar driver in the form of stricter regulatory requirements such as total maximum daily loads (TMDLs) for the affected streams that receive discharge effluent from the WWTPs in the region.

Overall the concept of regionalization or consolidation is adverse to the development attitudes and practices of the Study area. The current system of financing infrastructure improvements allows a developer or group of landowners to create a utility district and dictate the development process with minimal assistance or directives from local government. Combine this with the fact that past regionalization efforts have offered no financial incentives, and then regionalization becomes very difficult to institute.

The Houston-Galveston Area Council (H-GAC) 2000 Domestic Wastewater Regionalization White Paper listed some general impediments to wastewater regionalization that are still applicable today for this Study area. These are listed below.

- Regionalization is optional. Currently a regulation does not exist to force regionalization of utilities. Regionalization of infrastructure is encouraged by the regulatory agencies but not required.

- Lack of Financial Incentives. Just as there is not a "stick" to force regionalization, a "carrot" does not exist either to encourage regionalization. For example, if abutting utility districts are better off constructing individual plants from a construction cost perspective, there is no mechanism to bridge the financial gap to make regionalization a viable option.

- Individual Control. While costs are important, control is paramount. Generally speaking the number one problem of regionalization involves the fear of losing autonomy, including concerns about loss of control or power by one group or another and not being able to control their own destiny.

- Occupational Resistance. With the proliferation of utility districts in the Study area and the nature of providing wastewater services, there are numerous professions involved in the industry through the operation and maintenance, billing, engineering, financial and legal services. In addition to resistance to regionalization by a utility district board due to control reasons, resistance is also encountered from those who work for the utility districts. With a reduced number of plants and plant owners through regionalization or consolidation, there may be the perception that the wastewater industry will turn into a "winner take all" system of engineering, financial, legal and maintenance contracts.

There are 11 WWTPs in the Study region varying in size from 0.25 MGD to 4.0 MGD for a total capacity of 13.75 MGD for the Study area. Most importantly, 7 of the WWTPs are less than 1.0 MGD. For the most part, the common wisdom states that it is inherently difficult to complete consolidation or regionalization of numerous small WWTPs due to the following reasons listed below.

- Usually the costs for diversion of the existing influent flows from a smaller WWTP to a larger WWTP are not cost effective. By and large, it is still cheaper to operate non-regional plants than to bear capital costs required to divert those plants to larger facilities. While there are certainly reductions in treatment costs with a larger plant due to the economy of scale, the up-front diversion/construction costs associated with consolidation usually dissuade municipalities and utility districts from consolidating existing plants. However, it should be noted that this dynamic can change when the smaller plant requires expansion or needs significant rehabilitation due to age or changes in regulatory treatment requirements.

- In addition to costs, there are control issues that compel utility districts to continue to operate small WWTPs. For utility districts, diverting flow to a better-

equipped, larger facility may involve relinquishing control of operations to an outside entity (a municipality or other utility district). By having sole control over a WWTP, a utility district can control operation and maintenance expenditures, and ensure that available capacity exists for future growth within the utility district.[5]

Several scenarios were developed to determine anticipated capital and O&M costs for various WWTP consolidation scenarios. The first scenario was developed to determine the 30-year life-cycle cost to maintain all the existing WWTPs in operation through 2040, along with construction of a new regional WWTP in the Sienna South area. The second, third and fourth scenarios were developed to evaluate various methods of consolidation with the ultimate goal of reducing the total number of active WWTPs to roughly half the current number of operating WWTPs at this time.

During the development of Scenarios 1 through 4, it was determined that as the total number of active WWTPs was reduced, economies of scale for capital and O&M cost resulted in a lower life-cycle cost. As a result, a fifth scenario was developed with the concept of utilizing one WWTP site to create a super-regional WWTP that would treat the entire wastewater flows for the Study area, even at buildout.

The five scenarios include:

- Rehab/Expand all WWTPs and include solids improvements;
- Consolidate WWTPs based on utility district engineering firm recommendations;
- Consolidate WWTPs using Quail Valley UD WWTP as a regional facility;
- Consolidate WWTPs using Blue Ridge West WWTP as a regional facility; and,
- Consolidate all WWTPs into a single, super-regional facility at the SB-FB WWTP.

Life-cycle costs were developed for each WWTP with respect to the alternatives discussed in Section 3 and with regard to the five scenarios discussed previously. The goal was to identify which WWTPs were best suited for expansion, rehabilitation or consolidation into another offsite WWTP facility, and how best the recommended alternative for each WWTP would fit in with an overall consolidation scenario.

A total of over 60 scenarios were completed to evaluate capital, O&M and life-cycle costs. The result was surprising in that consolidation to a single, super-regional WWTP was the most cost effective scenario despite the costs for re-routing and pumping of flows

[5] Domestic Wastewater Regionalization, August 2000, H-GAC

from other service areas. The various methods of analysis and conclusions are discussed in detail in Section 4.

The recommended scenario of consolidating all flows to the SB-FB WWTP will have its share of challenges for the reasons discussed previously in this section. However, after exhaustive analyses of costs comparisons, it is the most cost effective alternative for the long-term wastewater treatment needs of the Study area.

Conclusions and Summary

The City and the utility districts have successfully implemented the steps to achieve regionalization for water supply and treatment to meet the reduction in groundwater withdrawals. This living example of cooperation and success can and should be a model for future regionalization or consolidation efforts. There are still opportunities remaining for storage and pumping, especially as the distribution systems become mature and the use of hydro-pneumatic pressure tanks is lessened and elevated storage use is increased.

The recommendation to establish a super-regional WWTP at SB-FB referenced could follow the same model as the RWTP allowing the various utility districts to retain their autonomy. However, the issues of costs to divert the flows, of control and of how costs are apportioned in accordance with utility rates will play a major role in deciding whether or not a regional approach is taken. One thing is certain – 8 of the current WWTPs only have 5-10 years of life remaining. Subtract the time for permitting, design and possible acquisition of land necessary for expansion, and a decision will have to be made in the very near future on which direction the small package plants will take.

Section 7: Proposed Implementation Schedule

7.1 Water & Wastewater Implementation Schedule

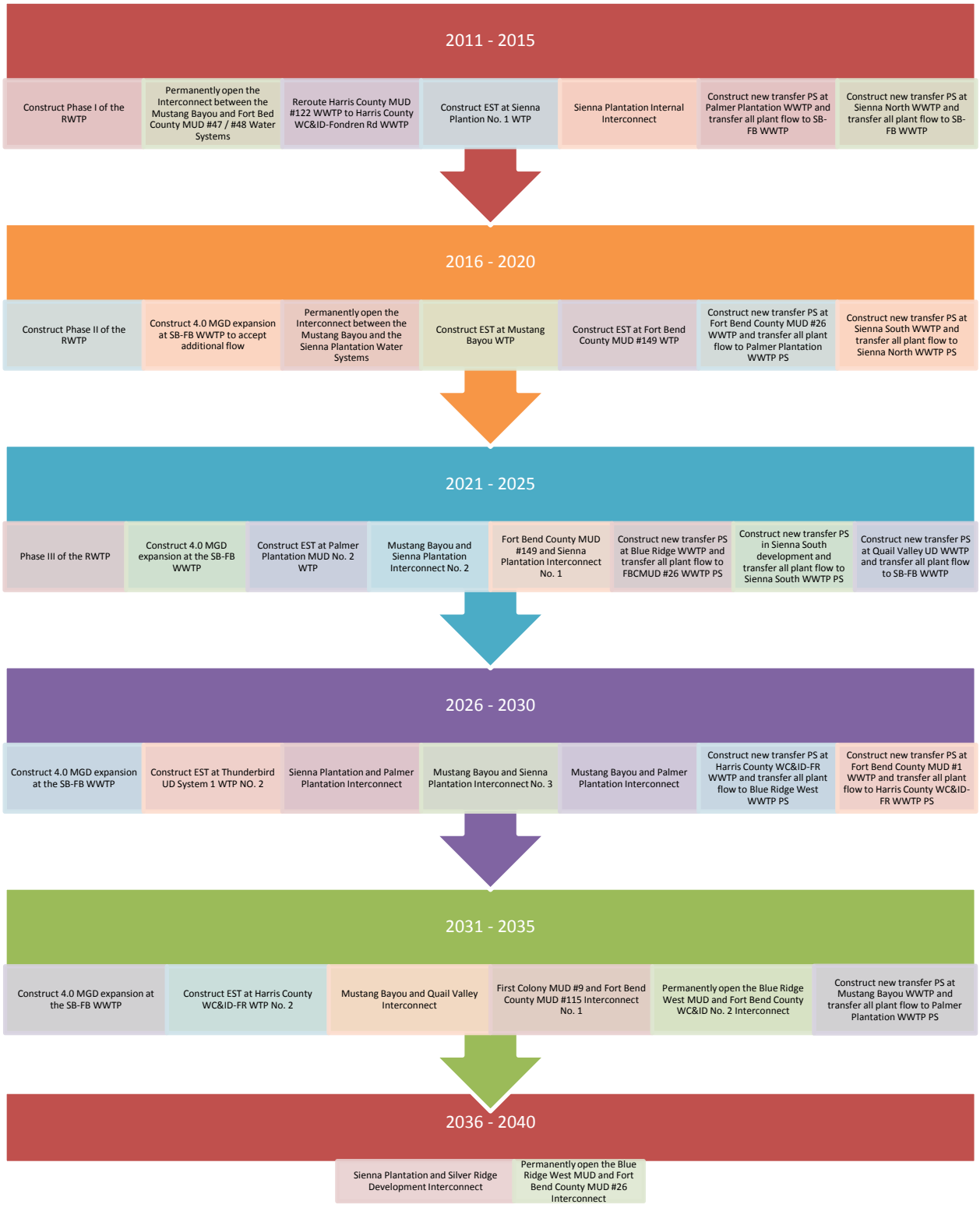
A schedule for the implementation of various water and wastewater consolidation projects that were identified in Section 4 of this Study was prepared. The timing of the implementation for these projects was based on information from the utility districts and the inherent nature of the projects.

For example, some of the projects that re-route influent to a regional WWTP are dependent on when the existing local WWTP becomes too old and/or expensive to maintain, too expensive to rehabilitate, if insufficient space is available for expansion, or if additional capacity is needed and the cost for re-routing influent is cheaper than plant expansion. The implementation period matches the projected growth discussed in Section 1.12 so the projects are scheduled in 5-year increments.

It should be noted that a number of factors may impact the schedule presented in the flow chart in this Section. These include, but are not limited to, the following influences:

- The projects identified are at a pre-planning level at this point. Preliminary design may delay or accelerate the projects once begun.
- Implementation of the projects is dependent on available funding.
- Utility conflicts, ROW and easement acquisition may delay projects.
- Many of the recommended consolidation projects will involve agreements and contracts between the individual utility districts, including project costs and payment agreements. These negotiated agreements may delay implementation.
- A slow down or acceleration in projected growth will impact the implementation schedule.
- Stricter water or wastewater treatment regulations may accelerate the implementation schedule.

Implementation Schedule



Based on the project data developed in Section 4 and the implementation schedule shown previously, a projected cash draw analysis was developed for the proposed water and wastewater system improvements projects, which are shown in Tables 7-1 and 7-2, respectively.

Table 7-1
Projected Cash Draw for Proposed Water Improvements

Year	Project 1	Project 2	Project 3	Project 4	Total Cost for Water Projects
2011-2015	Construct Phase I of the RWTP and Pipeline Improvements	Permanently open the Interconnect between the Mustang Bayou and Fort Bend County MUD #47 / #48 Water Systems	Construct EST at Sienna Plantation No. 1 WTP	Sienna Plantation Internal Interconnect	-
Project Cost [1]	-	-	$4,925,000	$490,000-	**$5,415,000**
2016-2020	Construct Phase II of the RWTP and Pipeline Improvements	Permanently open the Interconnect between the Mustang Bayou and the Sienna Plantation Water Systems	Construct EST at Mustang Bayou WTP	Construct EST at Fort Bend County MUD #149 WTP	-
Project Cost [1]	$61,317,000	-	$2,425,000	$7,934,000	**$71,676,000**
2021-2025	Construct Phase III of the RWTP and Pipeline Improvements	Construct EST at Palmer Plantation MUD No. 2 WTP	Mustang Bayou and Sienna Plantation Interconnect No. 2	Fort Bend County MUD #149 and Sienna Plantation Interconnect No. 1	-
Project Cost [1]	$64,142,000	$5,279,000	$1,135,000	$823,000	**$71,379,000**
2026-2030	Construct EST at Thunderbird UD System 1 WTP NO. 2	Sienna Plantation and Palmer Plantation Interconnect	Mustang Bayou and Sienna Plantation Interconnect No. 3	Mustang Bayou and Palmer Plantation Interconnect	-
Project Cost [1]	$5,929,000	$1,480,000	$1,091,000	$476,000	**$8,976,000**
2031-2035	Construct EST at Harris County WC&ID-Fondren Rd WTP No. 2	Mustang Bayou and Quail Valley Interconnect	First Colony MUD #9 and Fort Bend County MUD #115 Interconnect No. 1	Permanently open the Blue Ridge West MUD and Fort Bend County WC&ID No. 2 Interconnect	-
Project Cost [1]	$3,447,000	$512,000	$1,075,000	-	**$5,034,000**
2036-2040	Sienna Plantation and Silver Ridge Development Interconnect	Permanently open the Blue Ridge West MUD and Fort Bend County MUD #26 Interconnect	-	-	
Project Cost [1]	$300,000	-	-	-	**$300,000**
Total	**$162,780,000**				

Notes:
1 - Please note that these costs are different from the costs discussed in Section 4 (shown in 2011 dollars), as these costs include a 3.5% annual cost escalation factor to account for proposed delay in implementation from the time of this report. This cost is based on the timeline for projects discussed in Section 4 and 7 and assumes that projects will be funded toward the middle of each 5-year implementation period.

Table 7-2

Projected Cash Draw for Proposed Wastewater Improvements

Year	Project - Year 1	Project - Year 2	Project - Year 3	Project - Year 4	Project - Year 5	Total Cost for Wastewater Projects
2011-2015	-	Reroute Harris County MUD #122 WWTP to Harris County WC&ID-Fondren Rd WWTP	Construct new transfer PS at Palmer Plantation WWTP and transfer all plant flow to SB-FB WWTP	Construct new transfer PS at Sienna North WWTP and transfer all plant flow to SB-FB WWTP	-	-
Project Cost [1]	-	**$652,000**	**$1,679,000**	**$4,422,000**	-	**$6,753,000**
2016-2020	Construct 4.0 MGD expansion at SB-FB WWTP	Construct new transfer PS at Fort Bend County MUD #26 WWTP and transfer all plant flow to Palmer WWTP PS	Construct new transfer PS at Sienna South WWTP and transfer all plant flow to Sienna North WWTP PS	-	-	-
Project Cost [1]	**$17,470,000**	**$4,049,000**	**$6,986,000**	-	-	**$28,505,000**
2021-2025	Construct new transfer PS at Quail Valley UD WWTP and transfer all plant flow to SB-FB WWTP	Construct 4.0 MGD expansion at SB-FB WWTP	Construct new transfer PS at Blue Ridge West WWTP and transfer all plant flow to Fort Bend County MUD #26 WWTP PS	Construct new transfer PS in Sienna South development and transfer all plant flow to Sienna South WWTP PS	-	-
Project Cost [1]	**$2,104,000**	**$20,593,000**	**$1,604,000**	**$3,478,000**	-	**$27,779,000**
2026-2030	Construct new transfer PS at Harris County WC&ID-Fondren Rd WWTP and transfer all plant flow to Blue Ridge West WWTP PS	Construct 4.0 MGD expansion at SB-FB WWTP	Construct new transfer PS at Southwest Harris County MUD #1 WWTP and transfer all plant flow to Harris County WC&ID-Fondren Rd WWTP PS	-	-	-
Project Cost [1]	**$2,296,000**	**$23,195,000**	**$396,000**	-	-	**$25,887,000**
2031-2035	Construct new transfer PS at Mustang Bayou WWTP and transfer all plant flow to Palmer Plantation WWTP PS	-	-	-	Construct 4.0 MGD expansion at SB-FB WWTP	-
Project Cost [1]	**$2,093,000**	-	-	-	**$27,358,000**	**$29,451,000**
2036-2040	-	-	-	-	-	-
Project Cost [1]	-	-	-	-	-	-
Total	**$118,375,000**					

Notes:
1 - Please note that these costs are different from the costs discussed in Section 4 (shown in 2011 dollars), as these costs include a 3.5% annual cost escalation factor to account for proposed delay in implementation from the time of this report. This cost is based on the timeline for projects discussed in Section 4 and 7.

Section 8: Public Meetings

As required by the contract with the TWDB, public meetings are to be held at commencement of the project, at 50% completion, and following the Study completion date. Attendees included the project participants, consultants, local entities, the TCEQ, the TWDB and other interested parties.

8.1 Public Meeting #1: Kick-Off Presentation

Public Meeting #1 was held on November 29, 2010. This meeting was held at commencement of the project and provided an introduction, presentation of the project goals and description of the project deliverables. The meeting notice, sign-in sheet and copies of the Power Point slides used in the presentation are attached.

PUBLIC MEETING

Notice is hereby given of a Public Meeting to be held on **Monday, November 29, 2010,** at **1:30 p.m.** at: **City Hall, Council Chambers, 2nd Floor**, 1522 Texas Parkway, Missouri City, Texas, for the purposes of providing an introduction and overview of the proposed Missouri City Regional Water and Wastewater Planning Study funded by the Texas Water Development Board and Missouri City as follows.

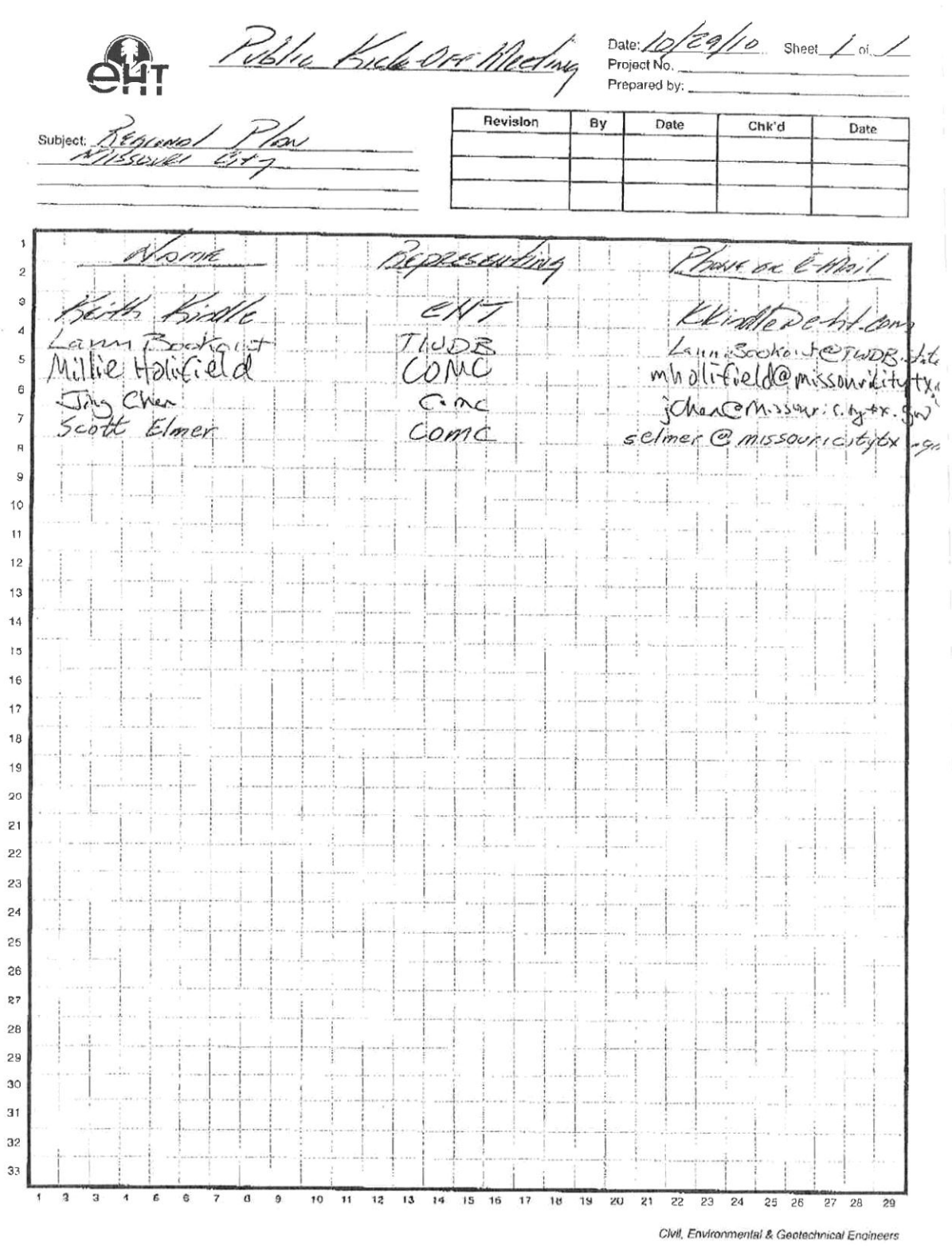
1. INTRODUCTION
2. GOALS & OBJECTIVES
3. REVIEW OF PLANNING STUDY SCOPE & DELIVERABLES
4. DISCUSSION

In compliance with the Americans with Disabilities Act, the City of Missouri City will provide for reasonable accommodations for persons attending City Council and Parks Board meetings. To better serve you, requests should be received 24 hours prior to the meetings. Please contact Patrice Fogarty, City Secretary, at 281-403-8685.

CERTIFICATION

I certify that a copy of the November 29, 2010, agenda of the first Public Meeting for the Missouri City Regional Water & Wastewater Planning Study was posted on the City Hall bulletin board on November 15, 2010, at 1:30 p.m.

_____
Maria Gonzalez, Deputy City Secretary



Public Kick-Off Meeting

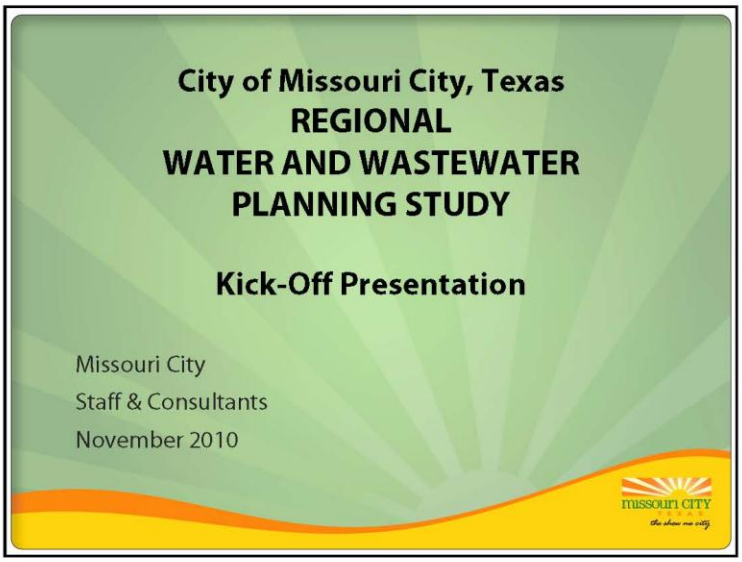
Date: 10/29/10 Sheet 1 of 1
Project No.
Prepared by:

Subject: Regional Plan
Missouri City

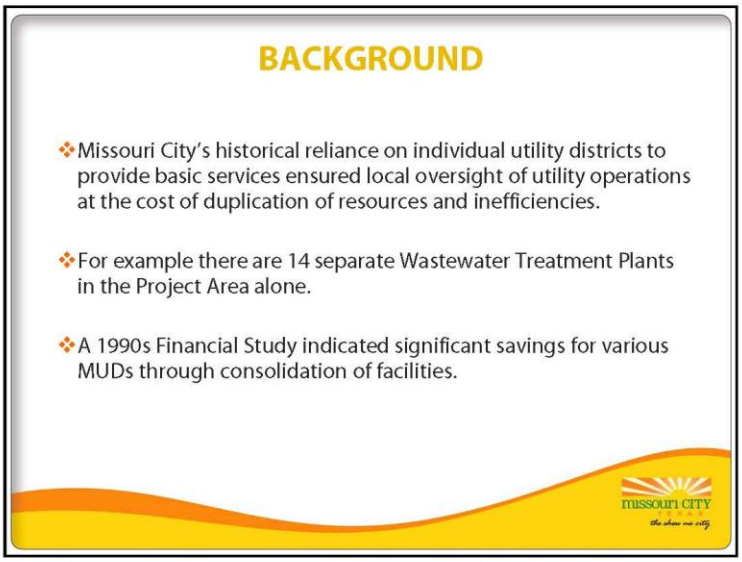
Revision	By	Date	Chk'd	Date

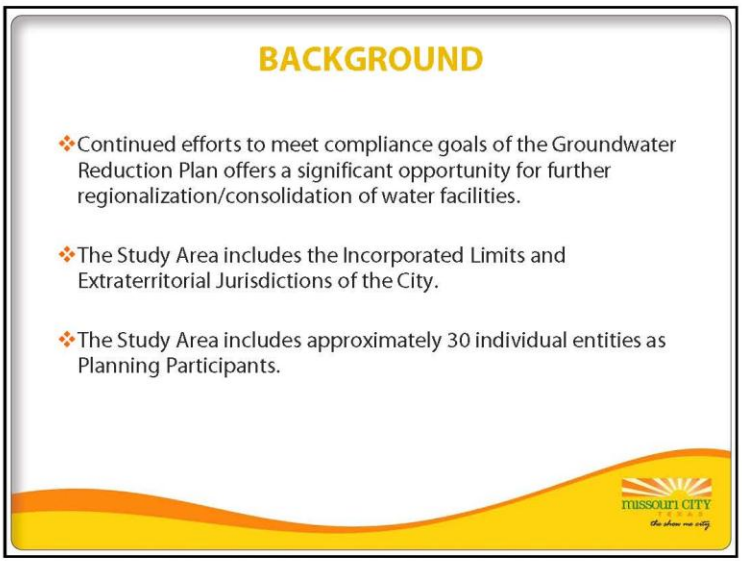
Name	Representing	Phone or E-Mail
Keith Riddle	EHT	KRiddle@eht.com
Lawn Bookout	TWDB	Lawn.Bookout@TWDB.state.tx.us
Millie Hollifield	COMC	mhollifield@missouricitytx.gov
Jing Chen	COMC	jchen@missouricitytx.gov
Scott Elmer	COMC	selmer@missouricitytx.gov

Civil, Environmental & Geotechnical Engineers


City of Missouri City, Texas
REGIONAL
WATER AND WASTEWATER
PLANNING STUDY
Kick-Off Presentation
Missouri City
Staff & Consultants
November 2010
missouri CITY

INTRODUCTION
Scott Elmer, P.E.
Public Works Director/Planning Director
Jing Chen, P.E., CFM
City Project Manager
Lann Bookout, P.E.
TWDB Project Manager
Keith Kindle, P.E.
eHT Project Manager
missouri CITY


BACKGROUND
Missouri City's historical reliance on individual utility districts to provide basic services ensured local oversight of utility operations at the cost of duplication of resources and inefficiencies.
For example there are 14 separate Wastewater Treatment Plants in the Project Area alone.
A 1990s Financial Study indicated significant savings for various MUDs through consolidation of facilities.
missouri CITY


BACKGROUND
Continued efforts to meet compliance goals of the Groundwater Reduction Plan offers a significant opportunity for further regionalization/consolidation of water facilities.
The Study Area includes the Incorporated Limits and Extraterritorial Jurisdictions of the City.
The Study Area includes approximately 30 individual entities as Planning Participants.
missouri CITY

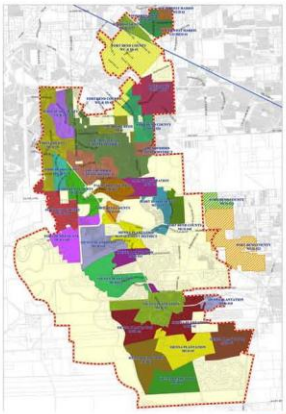
REGIONAL PLANNING PARTICIPANTS

- City of Missouri City
- Sienna Plantation Management District
- Sienna Plantation MUD 2
- Sienna Plantation MUD 3
- Sienna Plantation MUD 4
- Sienna Plantation MUD 5
- Sienna Plantation MUD 6
- Sienna Plantation MUD 7
- Sienna Plantation MUD 10
- Sienna Plantation MUD 12
- Sienna Plantation MUD 13
- Sienna Plantation MUD 149
- Fort Bend County MUD 129
- Fort Bend County MUD 49
- Fort Bend County MUD 47
- Fort Bend County MUD 48
- Fort Bend County MUD 26
- Fort Bend County MUD 46
- Fort Bend County MUD 115
- Fort Bend County MUD 42
- Palmer Plantation MUD 1
- Palmer Plantation MUD 2
- Quail Valley Utility District
- Thunderbird Utility District
- First Colony MUD 9
- Meadow Creek MUD
- Blue Ridge West MUD
- Harris County MUD 122
- Southwest Harris County MUD 1
- Fondren Road WC&ID

Fort Bend County MUD 23 and 24 are not included since they are out of City's ETJ.
WCID 2 is also excluded due to three controlling jurisdictions.

missouri CITY texas
the show me city

PROJECT AREA MAP



missouri CITY texas
the show me city

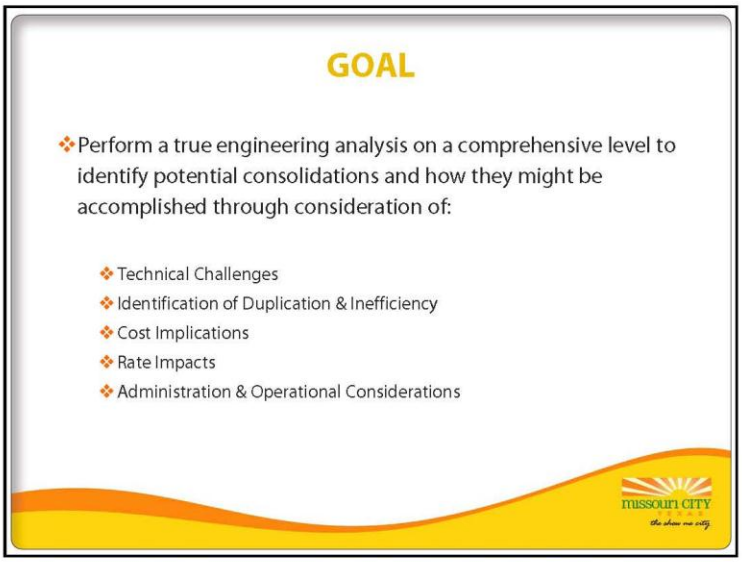
3

PROJECT TASKS & BUDGET

Task	Description	Amount ($'s)
Task I	Service Area Description	$15,000
Task II	Determination of Water System Demands	$10,000
Task II	Prepare Water Distribution System Alternatives	$30,000
Task IV	Prepare Water Treatment System Alternatives	$25,000
Task V	Water Operation Alternatives	$5,000
Task VI	Determination of Sewerage System Flows	$10,000
Task VII	Prepare Collection System Alternatives	$35,000
Task VIII	Prepare Wastewater Treatment System Alternatives	$30,000
Task IX	Wastewater Operation Alternatives	$5,000
Task X	Implementation Schedule	$5,000
Task XI	Determination of Costs and Recommendations	$15,000
Task XII	Evaluation of Funding Options and Alternative District Consolidations/Regional Structure	$20,000
Task XIII	Development of Regional Water Conservation and Drought Management Plans	$10,000
Task XIV	Reports	$10,000
Task XV	Environmental Assessment	$15,000
Task XVI	Meetings	$10,000
TOTAL		$250,000

PROJECT SCHEDULE
9 MONTHS

- 2 Months for Review of Existing Information
- 1 Month for Determination of Water & Wastewater Flows via GRP
- 2 Months Evaluation of Alternatives
- 3 Months for Evaluation of Alternatives for Costs, Structures and Recommendations
- 1 Month for Final Report Preparation
- Completion of Study by July 2011


GOAL
Perform a true engineering analysis on a comprehensive level to identify potential consolidations and how they might be accomplished through consideration of:
Technical Challenges
Identification of Duplication & Inefficiency
Cost Implications
Rate Impacts
Administration & Operational Considerations
missouri CITY

OBJECTIVES
Identify and Quantify Consolidation Opportunities for Water Distribution Facilities.
Identify and Quantify Consolidation Opportunities for Wastewater Collection and Treatment Facilities.
Determine Costs & Recommendations for Water & Wastewater Consolidation Opportunities.
Develop an Implementation Schedule.
Identify Funding Options and Alternative Consolidation Structures.
Prepare a Report Summarizing the Findings.
missouri CITY

PLANNING SCOPE
WATER SYSTEM DEMANDS
Collect Information and develop Population / Water Demand Projections for each Entity in Planning Area.
Prepare Average Day Water Demand and Peak Water Demands.
Maps developed to include:
Water Pipelines
Water Treatment Facilities
Areas of Projected Population Growth
Examine Effects of Proposed Infrastructure Growth in the Planning Area.
missouri CITY
the show me city

PLANNING SCOPE
DISTRIBUTION SYSTEM ALTERNATIVES
Alternatives will be developed to connect existing distribution lines into regional or consolidated water distribution systems within Study Area.
Draft Memorandum will be developed regarding Alternatives for 5-year increments through the year 2040.
missouri CITY
the show me city

PLANNING SCOPE
WATER TREATMENT SYSTEMS

- The City's Leadership in Implementing a Regional Surface Water Treatment Plant to Comply with the Groundwater Reduction Plan serves as an Example of how Cooperation led to a Cost-Effective way to meet a Shared-Mandate.

PLANNING SCOPE
WATER OPERATION ALTERNATIVES

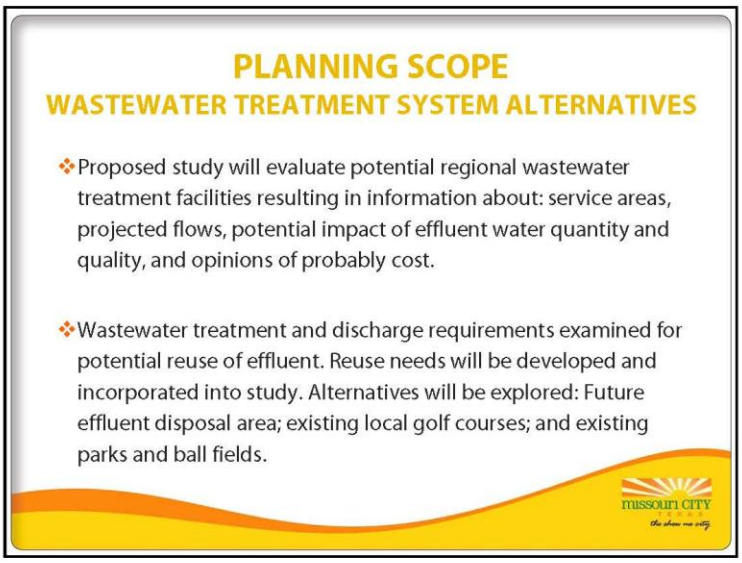
Study will examine various operation alternatives for each treatment facility option which will include operation of treatment facilities as:

- Independent Facility
- Regional System
- Multiple Independent Regional Facilities

PLANNING SCOPE
SEWERAGE SYSTEM FLOWS
Collect information and develop population / wastewater flow projections for each entity in 5-year increments through 2040.
Prepare average day, maximum month and peak dry-weather wastewater flows.
Maps developed to include:
Wastewater Collection Pipelines
Wastewater Treatment Facilities
Areas of Projected Population Growth and/or anticipated Service Area Expansions
Study will examine potential effects of proposed infrastructure in planning area including impact on existing infrastructure.
missouri CITY

PLANNING SCOPE
COLLECTION SYSTEM ALTERNATIVES
Develop alternatives for connecting existing lines into overall regional wastewater collection system within study area.
Investigate integrating into regional wastewater system those areas primarily served by duplication of existing collection lines and lift stations.
Alternatives will include:
Conventional Gravity and/or Pressure Systems.
Alternatives for Main Trunk Lines and Lift Stations.
All Requirements and Costs to decommission existing Booster Stations and install Common, Larger Trunk Lines.
missouri CITY

PLANNING SCOPE
WASTEWATER TREATMENT SYSTEM ALTERNATIVES
Existing facilities examined to determine:
Useful life of each Facility
Current Treatment Capacity
Design Capacity
Available Capacity
Facilities evaluated for potential of regional operation and expandability.
Treatment system alternatives will include: single treatment facility; multiple treatment facilities; and package treatment plants.
missouri CITY


PLANNING SCOPE
WASTEWATER TREATMENT SYSTEM ALTERNATIVES
Proposed study will evaluate potential regional wastewater treatment facilities resulting in information about: service areas, projected flows, potential impact of effluent water quantity and quality, and opinions of probably cost.
Wastewater treatment and discharge requirements examined for potential reuse of effluent. Reuse needs will be developed and incorporated into study. Alternatives will be explored: Future effluent disposal area; existing local golf courses; and existing parks and ball fields.
missouri CITY

PLANNING SCOPE
OPERATION ALTERNATIVES
Study will examine various operation alternatives for each treatment facility option which will include operation of treatment facilities as:
Independent Facility
Regional System
Multiple Independent Regional Facilities
missouri CITY

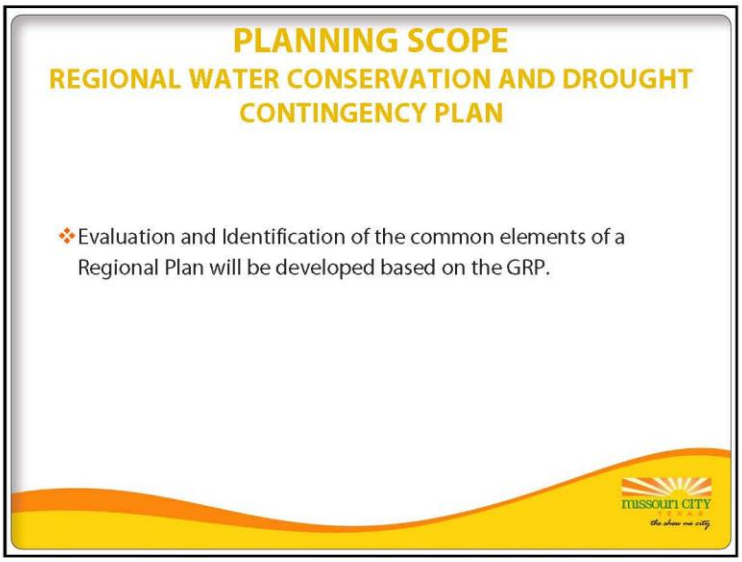
PLANNING SCOPE
IMPLEMENTATION SCHEDULE
An implementation plan will be developed for phased construction of recommended regional water distribution, water treatment, wastewater collection and wastewater treatment facilities for the study area through 2040.
The plan will take into consideration the Ground Water Reduction Plan Requirements, existing system capacities, water quality issues, future developments, anticipated growth, future annexation plans, and costs.
Development of the implementation schedule will be based on trigger points, such as regional cost/administrative benefits, population growth, water demand, wastewater flows and available capacity.
missouri CITY

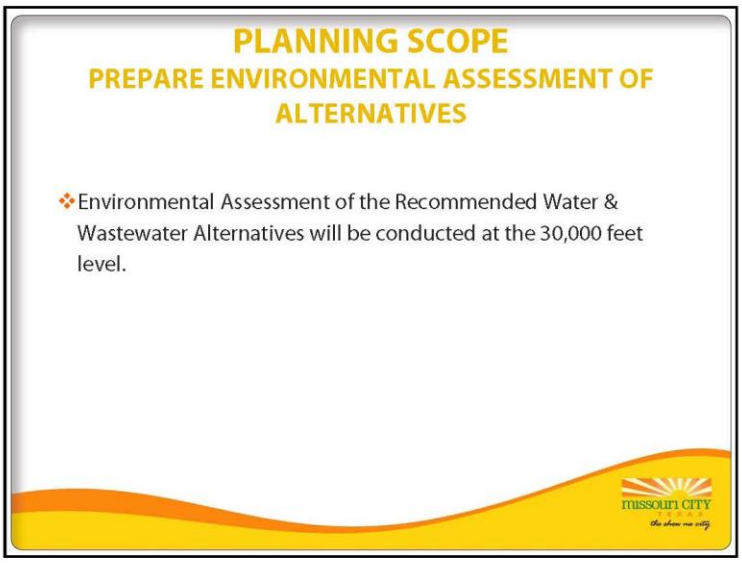
PLANNING SCOPE
COSTS AND RECOMMENDATIONS

- Estimates of Capital and O&M costs for each Participating Entity compiled for entities providing Water and Wastewater services independently to Service Areas.
- Costs will include Water Distribution and Water Treatment expansion, Wastewater Systems, and Rehabilitation, Repair or Replacement Costs for existing Distribution, Collection and Treatment Systems.

PLANNING SCOPE
EVALUATION OF FUNDING OPTIONS AND ALTERNATIVE CONSOLIDATION STRUCTURES

- Examination of Advantages & Disadvantages of Organizational Alternatives such as Consolidation of Districts, Establishment Quasi- Governmental Entities and Inter-Local Agreements.
- Identification of Potential Funding Sources for Water & Wastewater Infrastructure for the various Structures Identified.


PLANNING SCOPE
REGIONAL WATER CONSERVATION AND DROUGHT CONTINGENCY PLAN
Evaluation and Identification of the common elements of a Regional Plan will be developed based on the GRP.
missouri CITY


PLANNING SCOPE
PREPARE ENVIRONMENTAL ASSESSMENT OF ALTERNATIVES
Environmental Assessment of the Recommended Water & Wastewater Alternatives will be conducted at the 30,000 feet level.
missouri CITY

PLANNING SCOPE
PREPARATION OF REPORT

- The Results of the Study will be summarized initially in a Draft Report and distributed for public review and comment.
- A Final Report will be prepared incorporating review comments from the Public, City, Participants and TWDB.
- A Final Public Meeting will be held to present the results of the Study.

POTENTIAL BENEFITS OF STUDY

- Implementation of a Regional Plan will reduce the number of state permits, monitoring, reporting and enforcement via consolidation of numerous state-regulated utilities in the planning area.
- Implementation of a Regional Plan will reduce operations, administration, and staff training/certification and provide significant operations and maintenance savings.
- Implementation of a Regional Plan will reduce the number of effluent discharge points and may improve water quality in the region by providing a common, unified treatment level for the region's wastewater flows.

13

POTENTIAL BENEFITS OF STUDY

- Implementation of a Regional Plan would result in significant savings in utility payments over 90% of the existing MUDs.
- Implementation of a Regional Plan would allow the City to eliminate the disparity in the cost of service within its City limits (older MUDs have lower rates, newer MUDs have higher rates).
- Implementation of Regional or Consolidation Plan(s) will enable economies of scale and result in lower costs for utilities service across the region.

POTENTIAL BENEFITS OF STUDY

- Missouri City has proven that they can lead and implement a "*regional*" solution as shown by the City's Ground Water Reduction Plan Surface Water Treatment Plant that is currently under construction.
- Implementation of a Regional Plan or Consolidation will result in increased water conservation, a unified drought management plan, and a more efficient approach towards regional water planning.

15

8.2 Public Meeting #2: 50% Completion

Public Meeting #2 was held on August 19, 2011. This meeting was held at 50% completion of the project and provided a summary of the information collected on the existing conditions of the project area and an overview of the consolidation project that were identified during the Study. The meeting notice, sign-in sheet and copies of the Power Point slides used in the presentation are attached.

PUBLIC MEETING NOTICE

Notice is hereby given of a Public Meeting to be held on **Friday, August 19, 2011,** at **11:00 a.m.** at: **City Hall, Council Chambers, 2nd Floor**, 1522 Texas Parkway, Missouri City, Texas, for the purposes of providing a Status Report at 50% Completion of the proposed Missouri City Regional Water and Wastewater Planning Study funded by the Texas Water Development Board and Missouri City as follows.

1. INTRODUCTION OF STUDY OBJECTIVES & DELIVERABLES
2. EXISTING CONDITIONS
3. RECOMMENDED CONSOLIDATION PROJECTS
4. DISCUSSION

In compliance with the Americans with Disabilities Act, the City of Missouri City will provide for reasonable accommodations for persons attending City Council and Parks Board meetings. To better serve you, requests should be received 24 hours prior to the meetings. Please contact Patrice Fogarty, City Secretary, at 281-403-8685.

CERTIFICATION

I certify that a copy of the August 19, 2011, agenda of the Second Public Meeting for the Missouri City Regional Water & Wastewater Planning Study was posted on the City Hall bulletin board on or before Tuesday, August 16, 2011 at 11 a.m.

_____
Maria Gonzalez, Deputy City Secretary

Enprotec / Hibbs & Todd

missouri CITY TEXAS
the show me city

Sign In Sheet
For
City of Missouri City, Texas
TWDB/City Comprehensive Utility Study - 50% Public Meeting
August 19, 2011

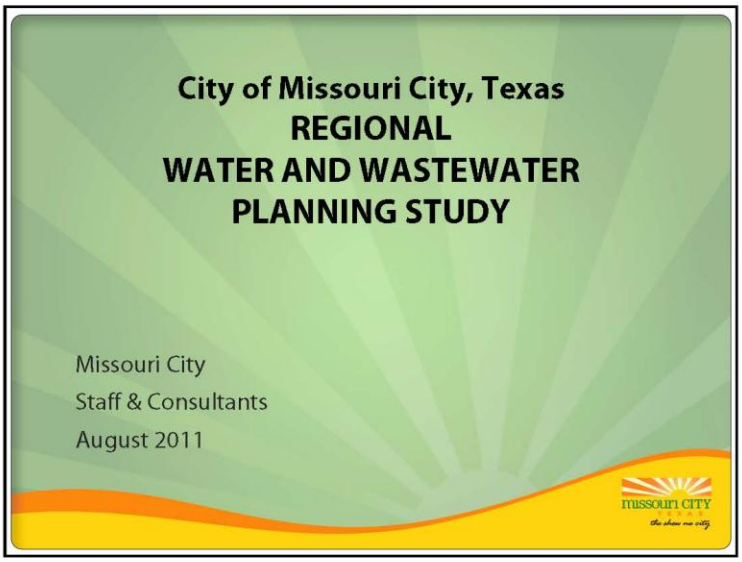
NAME	REPRESENTING	PHONE	E-MAIL
Keith Kindle, PE	EHT	325 698-5560	keith.kindle@e-ht.com
Lann Bookout	TWDB	936 512 9439	lann.Bookout@TWDB.state.Tx.us
Dolois Moore	FB MUD #36	281 499 2618	Drm2417real.com
BILL BAIRD	ASS ENGINEERS - HCWCID-FOURTEEN RD	713-942-2725	wdb@as-engineers.com
Gina A. Nelson	Century Engineering Ft Bend MUD #46	713-780-8871	gnelson@centuryengineering.com
CHRIS ESHELMAN	CENTURY ENGINEERING FBMUD 46	713 213 - 0840	CESHELMAN@CENTURYENGINEERING.COM
NIKESH PATEL	COMC	281-403-8576	npatel@missouricitytx.gov
Millie Holifield	COMC	281-403-8576	mholifield@missouricitytx.gov
GARY MENSIK	LJA	(713)953-5249	GMENSIK@LJAENGINEERING.COM
MORRIS R MITCHELL	QV	281-499-5539	
JOE TAYLOR	QVUD	281-499-5539	jtaylor@quailvalleyud.org

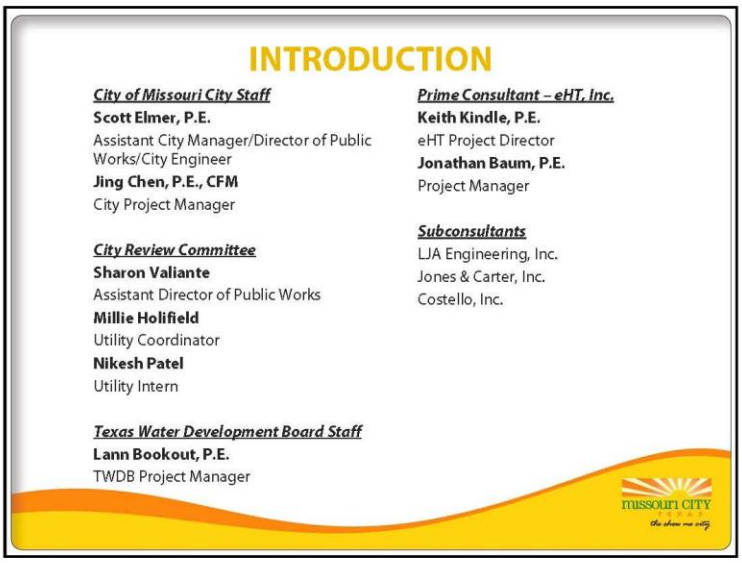
Enprotec / Hibbs & Todd

missouri CITY TEXAS
the show me city

Sign In Sheet
For
City of Missouri City, Texas
TWDB/City Comprehensive Utility Study - 50% Public Meeting
August 19, 2011

NAME	REPRESENTING	PHONE	E-MAIL
DENNIS SANDER	SW #1	713-724-4683	dsander@sanderengineering.com
Michael Rusk	LJA	713-953-5181	MRusk@LJAEngineering.com
JAMES BROWN	LJA	713 953 5200	JBROWN@LJAENGINEERING.COM
Sharon Valiante	COMC	281 403 8574	svaliante@missouricitytx.gov
Randy Woods	MUD # 26	713-292-4252	RWOODSMUD26@AOL.COM
WAYNE SALIGER	FBC MUD #26	281.858.4021	WSALIGER@SUREU.NET
David Rivers	LJA		
Jonathan Baum	eHT	(325) 698-5560	jonathan.baum@e-ht.com


City of Missouri City, Texas
REGIONAL
WATER AND WASTEWATER
PLANNING STUDY
Missouri City
Staff & Consultants
August 2011
missouri CITY


INTRODUCTION
City of Missouri City Staff
Scott Elmer, P.E.
Assistant City Manager/Director of Public Works/City Engineer
Jing Chen, P.E., CFM
City Project Manager
City Review Committee
Sharon Valiante
Assistant Director of Public Works
Millie Holifield
Utility Coordinator
Nikesh Patel
Utility Intern
Texas Water Development Board Staff
Lann Bookout, P.E.
TWDB Project Manager
Prime Consultant – eHT, Inc.
Keith Kindle, P.E.
eHT Project Director
Jonathan Baum, P.E.
Project Manager
Subconsultants
LJA Engineering, Inc.
Jones & Carter, Inc.
Costello, Inc.
missouri CITY

BACKGROUND

- Continued efforts to meet compliance goals of the Groundwater Reduction Plan offers a significant opportunity for further regionalization/consolidation of water facilities.
- The Study Area includes the Incorporated Limits and Extraterritorial Jurisdictions of the City.
- The Study Area includes approximately 30 individual entities as Planning Participants.

REGIONAL PLANNING PARTICIPANTS

- City of Missouri City
- Sienna Plantation Management District
- Sienna Plantation MUD 2
- Sienna Plantation MUD 3
- Sienna Plantation MUD 4
- Sienna Plantation MUD 5
- Sienna Plantation MUD 6
- Sienna Plantation MUD 7
- Sienna Plantation MUD 10
- Sienna Plantation MUD 12
- Sienna Plantation MUD 13
- Sienna Plantation MUD 149
- Fort Bend County MUD 129
- Fort Bend County MUD 49
- Fort Bend County MUD 47
- Fort Bend County MUD 48
- Fort Bend County MUD 26
- Fort Bend County MUD 46
- Fort Bend County MUD 115
- Fort Bend County MUD 42
- Palmer Plantation MUD 1
- Palmer Plantation MUD 2
- Quail Valley Utility District
- Thunderbird Utility District
- First Colony MUD 9
- Meadow Creek MUD
- Blue Ridge West MUD
- Harris County MUD 122
- Southwest Harris County MUD 1
- Fondren Road WC&ID

Fort Bend County MUD 23 and 24 are not included since they are out of City's ETJ. WCID 2 is also excluded due to three controlling jurisdictions.

GOAL

- Perform a true engineering analysis on a comprehensive level to identify potential consolidations and how they might be accomplished through consideration of:
  - Technical Challenges
  - Identification of Duplication & Inefficiency
  - Cost Implications
  - Administration & Operational Considerations

OBJECTIVES

- Identify and Quantify Consolidation Opportunities for Water Distribution Facilities.
- Identify and Quantify Consolidation Opportunities for Wastewater Collection and Treatment Facilities.
- Determine Costs & Recommendations for Water & Wastewater Consolidation Opportunities.
- Develop an Implementation Schedule.
- Identify Funding Options and Alternative Consolidation Structures.
- Prepare a Report Summarizing the Findings.

EXISTING CONDITIONS

- Current Connections
- Projected Connections
- Current Population
- Projected Population
- Current & Projected Water Demands
- Current & Projected Wastewater Flows
- Current & Projected WTPs
- Current & Projected WWTPs
- Current Water & Wastewater Capacity Used
- Current MUD Billing Rates

CURRENT CONNECTIONS

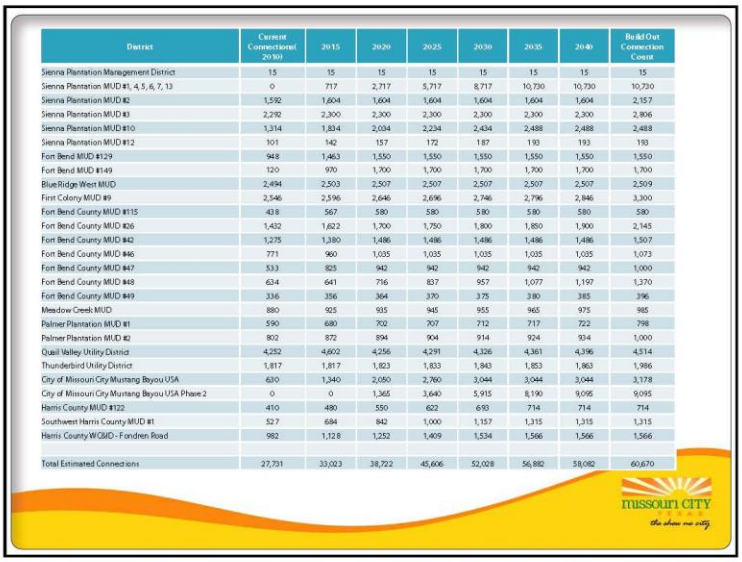
- Information on the current connections was gathered from the districts participating in the planning study. The following table presents the current connection count for each district:

District	Current Connections (2010)
Sienna Plantation Management District	15
Sienna Plantation MUD #1, 4, 5, 6, 7, 13	0
Sienna Plantation MUD #2	1,592
Sienna Plantation MUD #3	2,292
Sienna Plantation MUD #10	1,314
Sienna Plantation MUD #12	101
Fort Bend MUD #129	948
Fort Bend MUD #149	120
Blue Ridge West MUD	2,494
First Colony MUD #9	2,546
Fort Bend County MUD #115	438
Fort Bend County MUD #26	1,432
Fort Bend County MUD #42	1,275
Fort Bend County MUD #46	771
Fort Bend County MUD #47	533
Fort Bend County MUD #48	634
Fort Bend County MUD #49	336
Meadow Creek MUD	880
Palmer Plantation MUD #1	590
Palmer Plantation MUD #2	802
Quail Valley Utility District	4,252
Thunderbird Utility District	1,817
City of Missouri City Mustang Bayou USA	630
City of Missouri City Mustang Bayou USA Phase 2	0
Harris County MUD #122	410
Southwest Harris County MUD #1	527
Harris County WCID - Fondren Road	982
Total Connections	27,731

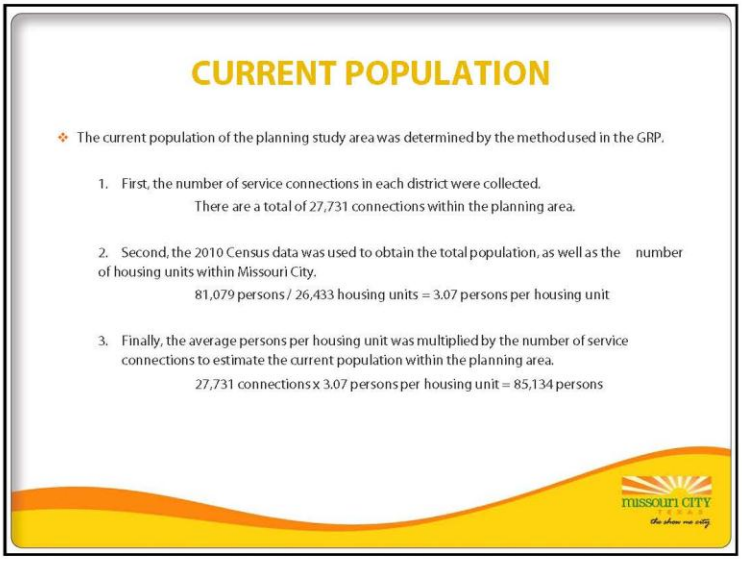
PROJECTED CONNECTIONS

- Using the updated actual connection counts collected from the districts rather than the 2010 projected counts from the GRP, but following the same expected growth patterns used in the GRP, the projected connection counts were estimated in 5 year increments to the year 2040. The results are presented in the following table:

5



District	Current Connections (2010)	2015	2020	2025	2030	2035	2040	Build Out Connection Count
Sienna Plantation Management District	15	15	15	15	15	15	15	15
Sienna Plantation MUD #1, 4, 5, 6, 7, 13	0	717	2,717	5,717	8,717	10,730	10,730	10,730
Sienna Plantation MUD #2	1,592	1,604	1,604	1,604	1,604	1,604	1,604	2,157
Sienna Plantation MUD #3	2,292	2,300	2,300	2,300	2,300	2,300	2,300	2,806
Sienna Plantation MUD #10	1,314	1,834	2,034	2,234	2,434	2,488	2,488	2,488
Sienna Plantation MUD #12	101	142	157	172	187	193	193	193
Fort Bend MUD #129	948	1,463	1,550	1,550	1,550	1,550	1,550	1,550
Fort Bend MUD #149	120	970	1,700	1,700	1,700	1,700	1,700	1,700
Blue Ridge West MUD	2,494	2,503	2,507	2,507	2,507	2,507	2,507	2,509
First Colony MUD #9	2,546	2,596	2,646	2,696	2,746	2,796	2,846	3,300
Fort Bend County MUD #115	438	567	580	580	580	580	580	580
Fort Bend County MUD #26	1,432	1,622	1,700	1,750	1,800	1,850	1,900	2,145
Fort Bend County MUD #42	1,275	1,380	1,486	1,486	1,486	1,486	1,486	1,507
Fort Bend County MUD #46	771	960	1,035	1,035	1,035	1,035	1,035	1,073
Fort Bend County MUD #47	533	825	942	942	942	942	942	1,000
Fort Bend County MUD #48	634	641	716	837	957	1,077	1,197	1,370
Fort Bend County MUD #49	336	356	364	370	375	380	385	396
Meadow Creek MUD	880	905	935	945	955	965	975	985
Palmer Plantation MUD #1	590	680	702	707	712	717	722	798
Palmer Plantation MUD #2	802	872	894	904	914	924	934	1,000
Quail Valley Utility District	4,252	4,602	4,256	4,291	4,326	4,361	4,396	4,514
Thunderbird Utility District	1,817	1,817	1,823	1,833	1,843	1,853	1,863	1,986
City of Missouri City Mustang Bayou USA	630	1,340	2,050	2,760	3,044	3,044	3,044	3,178
City of Missouri City Mustang Bayou USA Phase 2	0	0	1,365	3,640	5,915	8,190	9,095	9,095
Harris County MUD #122	410	480	550	622	693	714	714	714
Southwest Harris County MUD #1	527	684	842	1,000	1,157	1,315	1,315	1,315
Harris County WCID - Fondren Road	982	1,128	1,252	1,409	1,534	1,566	1,566	1,566
Total Estimated Connections	27,731	33,023	38,722	45,606	52,028	56,882	58,082	60,670



PROJECTED POPULATION

- Using the projected connection counts previously determined and assuming the average persons per housing unit will remain the same over time, the projected population was estimated in 5 year increments to the year 2040. The results are presented in the following table:

District	Current Population (2010)	2015	2020	2025	2030	2035	2040	Build Out Population Estimate
Sienna Plantation Management District	46	46	46	46	46	46	46	46
Sienna Plantation MUD #1, 4, 5, 6, 7, 13	0	2,201	8,341	17,551	26,761	32,941	32,941	32,941
Sienna Plantation MUD #2	4,887	4,924	4,924	4,924	4,924	4,924	4,924	6,622
Sienna Plantation MUD #3	7,036	7,061	7,061	7,061	7,061	7,061	7,061	8,614
Sienna Plantation MUD #10	4,034	5,630	6,244	6,858	7,472	7,638	7,638	7,638
Sienna Plantation MUD #12	310	436	482	528	574	593	593	593
Fort Bend MUD #129	2,910	4,491	4,759	4,759	4,759	4,759	4,759	4,759
Fort Bend MUD #149	368	2,978	5,219	5,219	5,219	5,219	5,219	5,219
Blue Ridge West MUD	7,657	7,684	7,696	7,696	7,696	7,696	7,696	7,703
First Colony MUD #9	7,816	7,970	8,123	8,277	8,430	8,584	8,737	10,131
Fort Bend County MUD #115	1,345	1,741	1,781	1,781	1,781	1,781	1,781	1,781
Fort Bend County MUD #26	4,396	4,980	5,219	5,373	5,526	5,680	5,833	6,585
Fort Bend County MUD #42	3,914	4,237	4,562	4,562	4,562	4,562	4,562	4,626
Fort Bend County MUD #46	2,367	2,947	3,177	3,177	3,177	3,177	3,177	3,294
Fort Bend County MUD #47	1,636	2,533	2,892	2,892	2,892	2,892	2,892	3,070
Fort Bend County MUD #48	1,946	1,968	2,198	2,570	2,938	3,306	3,675	4,206
Fort Bend County MUD #49	1,032	1,093	1,117	1,136	1,151	1,167	1,182	1,216
Meadow Creek MUD	2,702	2,840	2,870	2,901	2,932	2,963	2,993	3,024
Palmer Plantation MUD #1	1,811	2,088	2,155	2,170	2,186	2,201	2,217	2,450
Palmer Plantation MUD #2	2,462	2,677	2,745	2,775	2,806	2,837	2,867	3,070
Quail Valley Utility District	13,054	14,128	13,066	13,173	13,281	13,388	13,496	13,858
Thunderbird Utility District	5,578	5,578	5,597	5,627	5,658	5,689	5,719	6,097
City of Missouri City Mustang Bayou USA	1,934	4,114	6,294	8,473	9,345	9,345	9,345	9,756
City of Missouri City Mustang Bayou USA Phase 2	0	0	4,191	11,175	18,159	25,143	27,902	27,902
Harris County MUD #122	1,259	1,474	1,689	1,910	2,128	2,192	2,192	2,192
Southwest Harris County MUD #1	1,618	2,100	2,585	3,070	3,552	4,037	4,037	4,037
Harris County WCID - Fondren Road	3,015	3,463	3,944	4,326	4,709	4,808	4,808	4,808
Total Estimated Population	85,134	101,381	118,877	140,010	159,726	174,628	178,312	186,257

7

CURRENT & PROJECTED WATER DEMANDS

- The expected water demand was obtained by multiplying the number of service connections by the average usage per connection per month.
- The average usage per connection per month was calculated in the GRP by dividing the annual pumpage by the connection count times 12 months.
- The districts which were not included in the GRP directly provided their average usage per connection per month.
- The current and projected water demand results are presented in the following table:

District	Average Usage Per Connection Per Month (Gallons)	Current Water Demand (2010)	2015	2020	2025	2030	2035	2040	Build Out Water Demand
Sienna Plantation Management District	64,350	965,250	965,250	965,250	965,250	965,250	965,250	965,250	965,250
Sienna Plantation MUD #1, 4, 5, 6, 7, 13	14,618	0	10,481,106	39,717,106	83,571,106	127,425,106	156,851,140	156,851,140	156,851,140
Sienna Plantation MUD #2	14,618	23,271,856	23,447,272	23,447,272	23,447,272	23,447,272	23,447,272	23,447,272	31,531,026
Sienna Plantation MUD #3	14,618	33,504,456	33,621,400	33,621,400	33,621,400	33,621,400	33,621,400	33,621,400	41,018,108
Sienna Plantation MUD #10	14,618	19,208,052	26,809,412	29,733,012	32,656,612	35,580,212	36,369,584	36,369,584	36,369,584
Sienna Plantation MUD #12	14,618	1,476,418	2,075,756	2,295,026	2,514,296	2,733,566	2,821,274	2,821,274	2,821,274
Fort Bend MUD #129	22,008	20,863,584	32,197,704	34,112,400	34,112,400	34,112,400	34,112,400	34,112,400	34,112,400
Fort Bend MUD #149	11,873	1,424,760	11,516,810	20,184,100	20,184,100	20,184,100	20,184,100	20,184,100	20,184,100
Blue Ridge West MUD	11,538	28,775,772	28,879,614	28,925,766	28,925,766	28,925,766	28,925,766	28,925,766	28,948,842
First Colony MUD #9	12,372	31,499,112	32,117,712	32,736,312	33,354,912	33,973,512	34,592,112	35,210,712	40,827,600
Fort Bend County MUD #115	22,008	9,639,504	12,478,536	12,764,640	12,764,640	12,764,640	12,764,640	12,764,640	12,764,640
Fort Bend County MUD #126	8,393	12,018,776	13,613,446	14,268,100	14,687,750	15,107,400	15,527,050	15,946,700	18,002,985
Fort Bend County MUD #142	12,825	16,351,875	17,698,500	19,057,950	19,057,950	19,057,950	19,057,950	19,057,950	19,327,275
Fort Bend County MUD #146	16,620	12,814,020	15,953,200	17,201,700	17,201,700	17,201,700	17,201,700	17,201,700	17,833,260
Fort Bend County MUD #147	12,783	6,813,339	10,545,975	12,041,586	12,041,586	12,041,586	12,041,586	12,041,586	12,783,000
Fort Bend County MUD #148	12,783	8,104,422	8,193,903	9,152,628	10,699,371	12,233,331	13,767,291	15,301,251	17,512,710
Fort Bend County MUD #149	26,448	8,886,528	9,415,488	9,627,072	9,785,760	9,918,000	10,050,240	10,182,480	10,473,408
Meadow Creek MUD	8,762	7,710,560	8,104,850	8,192,470	8,280,090	8,367,710	8,455,330	8,542,950	8,630,570
Palmer Plantation MUD #1	26,448	15,604,320	17,984,640	18,566,496	18,698,736	18,830,976	18,963,216	19,095,456	21,105,504
Palmer Plantation MUD #2	14,003	11,230,406	12,210,616	12,518,692	12,658,712	12,798,742	12,938,772	13,078,802	14,003,000
Quail Valley Utility District	10,940	46,516,880	50,345,880	46,560,640	46,943,540	47,326,440	47,709,340	48,092,240	49,383,160
Thunderbird Utility District	10,344	18,795,048	18,795,048	18,857,112	18,960,552	19,063,992	19,167,432	19,270,872	20,543,184
City of Missouri City Mustang Bayou USA	11,873	7,479,990	15,909,820	24,339,650	32,769,480	36,141,412	36,141,412	36,141,412	37,732,394
City of Missouri City Mustang Bayou USA Phase2	11,873	0	0	16,206,645	43,217,720	70,228,795	97,239,870	107,984,935	107,984,935
Harris County MUD #122	8,190	3,357,900	3,931,200	4,504,500	5,094,180	5,675,670	5,847,660	5,847,660	5,847,660
Southwest Harris County MUD #1	5,310	2,798,370	3,632,040	4,471,020	5,310,000	6,143,670	6,982,650	6,982,650	6,982,650
Harris County WCID- Fondren Road	6,750	6,628,500	7,614,000	8,451,000	9,510,750	10,354,500	10,570,500	10,570,500	10,570,500
Total Monthly Water Demand (Gallons)		355,739,698	428,541,178	502,519,535	591,035,631	674,225,098	736,316,937	750,612,682	785,110,159
Total Water Demand (MGD)		11.7	14.1	16.5	19.4	22.2	24.2	24.7	25.8

8

CURRENT & PROJECTED WASTEWATER DEMANDS

- To determine current and projected wastewater demands, the provided information on the wastewater treatment plant flows gathered from the MUDs was divided by the connection counts.
- This wastewater usage per connection was compared to the average water usage per connection.
- It was determined that the average wastewater usage per connection is approximately 60% of the water usage per connection.
- The estimated current and projected wastewater demands are presented in the following table:

District	Percentage of Water Returned to Sewer Collection System	Current Wastewater Demand (2010)	2015	2020	2025	2030	2035	2040	Build Out Wastewater Demand
Sienna Plantation Management District	60	579,150	579,150	579,150	579,150	579,150	579,150	579,150	579,150
Sienna Plantation MUD #1, 4, 5, 6, 7, 13	60	0	6,288,664	23,830,264	50,142,664	76,455,064	94,110,684	94,110,684	94,110,684
Sienna Plantation MUD #2	60	13,963,114	14,068,363	14,068,363	14,068,363	14,068,363	14,068,363	14,068,363	18,918,616
Sienna Plantation MUD #3	60	20,102,674	20,172,840	20,172,840	20,172,840	20,172,840	20,172,840	20,172,840	24,610,865
Sienna Plantation MUD #10	60	11,524,831	16,085,647	17,839,807	19,593,967	21,348,127	21,821,750	21,821,750	21,821,750
Sienna Plantation MUD #12	60	885,851	1,245,454	1,377,016	1,508,578	1,640,140	1,692,764	1,692,764	1,692,764
Fort Bend MUD #129	60	12,518,150	19,318,622	20,467,440	20,467,440	20,467,440	20,467,440	20,467,440	20,467,440
Fort Bend MUD #149	60	854,856	6,910,086	12,110,460	12,110,460	12,110,460	12,110,460	12,110,460	12,110,460
Blue Ridge West MUD	60	17,265,463	17,327,768	17,353,460	17,353,460	17,353,460	17,353,460	17,353,460	17,369,305
First Colony MUD #9	60	18,899,467	19,270,627	19,641,787	20,012,947	20,384,107	20,755,267	21,126,427	24,496,560
Fort Bend County MUD #115	60	5,783,702	7,487,122	7,658,784	7,658,784	7,658,784	7,658,784	7,658,784	7,658,784
Fort Bend County MUD #26	60	7,211,266	8,168,068	8,560,860	8,812,650	9,064,440	9,316,230	9,568,020	10,801,791
Fort Bend County MUD #42	60	9,811,125	10,619,100	11,434,770	11,434,770	11,434,770	11,434,770	11,434,770	11,596,365
Fort Bend County MUD #46	60	7,688,412	9,573,120	10,321,020	10,321,020	10,321,020	10,321,020	10,321,020	10,699,956
Fort Bend County MUD #47	60	4,088,003	6,327,585	7,224,952	7,224,952	7,224,952	7,224,952	7,224,952	7,669,800
Fort Bend County MUD #48	60	4,862,653	4,916,342	5,491,577	6,419,623	7,339,999	8,260,375	9,180,751	10,507,626
Fort Bend County MUD #49	60	5,331,917	5,649,293	5,776,243	5,871,456	5,950,800	6,030,144	6,109,488	6,284,045
Meadow Creek MUD	60	4,626,336	4,862,910	4,915,482	4,968,054	5,020,626	5,073,198	5,125,770	5,178,342
Palmer Plantation MUD #1	60	9,362,592	10,790,784	11,139,898	11,219,242	11,298,586	11,377,930	11,457,274	12,663,302
Palmer Plantation MUD #2	60	6,738,244	7,326,370	7,511,209	7,595,227	7,679,245	7,763,263	7,847,281	8,401,800
Quail Valley Utility District	60	27,910,128	30,207,528	27,936,384	28,166,124	28,395,864	28,625,604	28,855,344	29,629,896
Thunderbird Utility District	60	11,277,029	11,277,029	11,314,267	11,376,331	11,438,395	11,500,459	11,562,523	12,325,910
City of Missouri City Mustang Bayou USA	60	4,487,994	9,545,892	14,603,790	19,661,688	21,684,847	21,684,847	21,684,847	22,619,436
City of Missouri City Mustang Bayou USA Phase2	60	0	0	9,723,987	25,930,632	42,137,277	58,343,922	64,790,961	64,790,961
Harris County MUD #122	60	2,014,740	2,358,720	2,702,700	3,046,508	3,405,402	3,508,596	3,508,596	3,508,596
Southwest Harris County MUD #1	60	1,679,022	2,179,224	2,682,612	3,186,000	3,686,202	4,189,590	4,189,590	4,189,590
Harris County WCID- Fondren Road	60	3,977,100	4,568,400	5,070,600	5,706,450	6,212,700	6,342,300	6,342,300	6,342,300
Total Monthly Wastewater Demand (Gallons)		213,443,819	257,124,707	301,511,721	354,621,379	404,535,059	441,790,162	450,367,609	471,066,095
Total Wastewater Demand (MGD)		7.0	8.5	9.9	11.7	13.3	14.5	14.8	15.5

9

CURRENT WTPs

Number	Name	Location	Current Permitted Capacity
1	Southwest Harris County MUD #1 Water Treatment Plant	7843 Larochelle Cr.	0.748 MGD
2	Harris County WC&ID - Fondren Road Water Treatment Plant #1	11802 1/2 McClain Blvd.	3.760 MGD
3	Harris County WC&ID - Fondren Road Water Treatment Plant #2	9380 S. Sam Houston Pkwy. W.	
4	Blue Ridge West MUD Water Treatment Plant #1	1415 FM 2234	3.168 MGD
5	Blue Ridge West MUD Water Treatment Plant #2	903 Manor Glen	
6	Fort Bend County MUD #26 Water Treatment Plant	1812 Fresh Meadows	2.728 MGD
7	Meadow Creek MUD Water Treatment Plant	3100 N. Park	1.158 MGD
8	Quail Valley Utility District Water Treatment Plant #1	2935 Blue Lakes Ln.	8.524 MGD
9	Quail Valley Utility District Water Treatment Plant #2	2143 Cartwright	
10	Quail Valley Utility District Water Treatment Plant #3	1936 Rothwell	
11	Thunderbird Utility District (System 1) Water Treatment Plant #1	6605 Highway 6	3.060 MGD
12	Thunderbird Utility District (System 1) Water Treatment Plant #2	3003 Glenn Lakes Dr.	
13	Thunderbird Utility District (System 2) Water Treatment Plant #1	1455 Turtle Creek	0.959 MGD
14	Fort Bend County MUD #42 Water Treatment Plant	1819 1/2 Lake Winds	2.304 MGD
15	First Colony MUD #9 Water Treatment Plant	Ringrose Dr.	3.024 MGD
16	Fort Bend County MUD #115 Water Treatment Plant	20429 University Blvd.	2.174 MGD
17	Fort Bend County MUD #46 Water Treatment Plant	4835 Thompson Ferry Rd.	1.440 MGD
18	Fort Bend County MUD #149 Water Treatment Plant	Maverick Bend Ln.	0.648 MGD
19	Palmer Plantation MUD #1 Water Treatment Plant	4335 Crown Valley	2.138 MGD
20	Palmer Plantation MUD #2 Water Treatment Plant	1603 Lake Olympia Pkwy.	1.728 MGD
21	Vicksburg Joint Powers Water Treatment Plant	2775 Senior Rd.	1.440 MGD
22	Mustang Bayou Water Treatment Plant	Watts Plantation	3.159 MGD
23	Sienna Water Treatment Plant #2	Mckeever	7.380 MGD
24	Sienna Water Treatment Plant #1	Murray Ct.	
		Total Permitted Capacity	**49.540 MGD**

Note: Permitted capacities were taken from the TCEQ Water Utility Database.

missouri CITY
the show me city

CURRENT WWTPs

Number	Name	Location	Current Permitted Capacity
1	Southwest Harris County MUD #1 Wastewater Treatment Plant	Highway 90a	0.4 MGD
2	Harris County WC&ID - Fondren Road Wastewater Treatment Plant	E. Hampton Cr.	0.6 MGD
3	Harris County MUD #122 Wastewater Treatment Plant	Sunset Ln.	0.25 MGD
4	Blue Ridge West MUD Wastewater Treatment Plant	535 Independence Blvd.	1.3 MGD
5	Fort Bend County MUD #26 Wastewater Treatment Plant	Lazy Spring Dr.	0.8 MGD
6	Quail Valley UD/Thunderbird UD Wastewater Treatment Plant	Blue Lakes Ln.	4.0 MGD
7	Palmer Plantation Wastewater Treatment Plant	Lake Olympia Pkwy.	0.60 MGD
8	Steep Bank/Flat Bank Regional Wastewater Treatment Plant	6310 Oilfield Rd.	3.0 MGD
9	Vicksburg Regional Wastewater Treatment Plant	3650 Trammel Fresno Rd.	0.95 MGD
10	Sienna North Wastewater Treatment Plant	Discovery Ln.	0.902 MGD
11	Sienna South Wastewater Treatment Plant	Waters Lake Blvd.	1.2 MGD
		Total Permitted Capacity	**14.002 MGD**

Note: Permitted capacities were gathered from the TCEQ Wastewater Permitting Section.

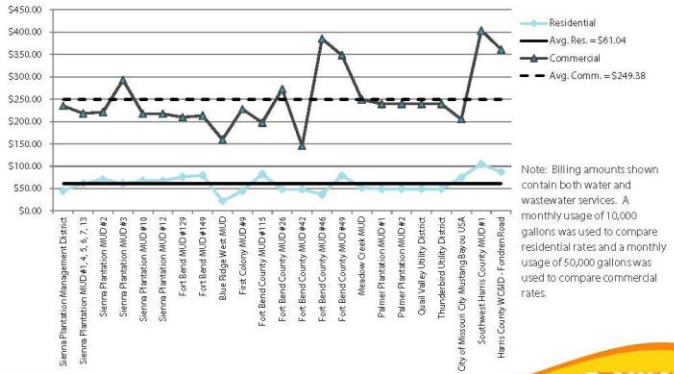
missouri CITY
the show me city

CURRENT WATER & WASTEWATER CAPACITY USED

- Current Water Demand = 11.7 MGD
- Current Water Treatment Capacity = 49.540 MGD
- Current Capacity Used – 11.7 / 49.540 = 23.6%

- Current Wastewater Demand = 7.0 MGD
- Current Wastewater Treatment Capacity = 14.002 MGD
- Current Capacity Used – 7.0 / 14.002 = 50.0%

CURRENT MUD BILLING RATES



Note: Billing amounts shown contain both water and wastewater services. A monthly usage of 10,000 gallons was used to compare residential rates and a monthly usage of 50,000 gallons was used to compare commercial rates.

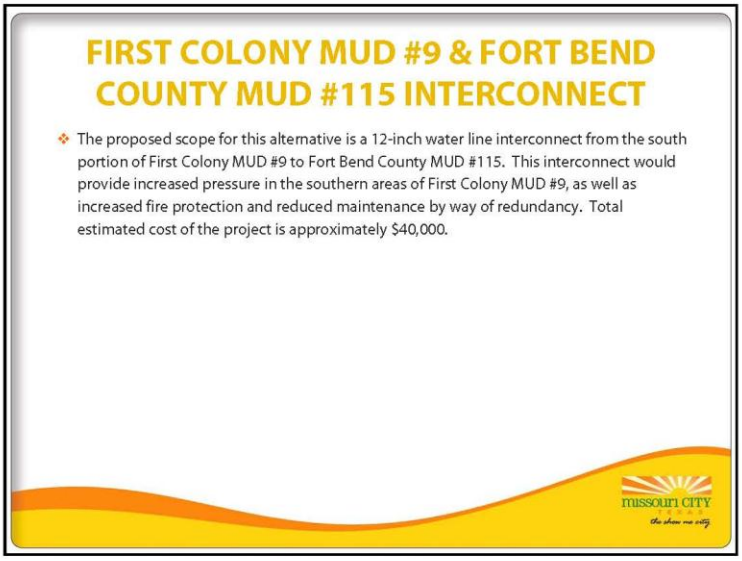
STUDY MAPS

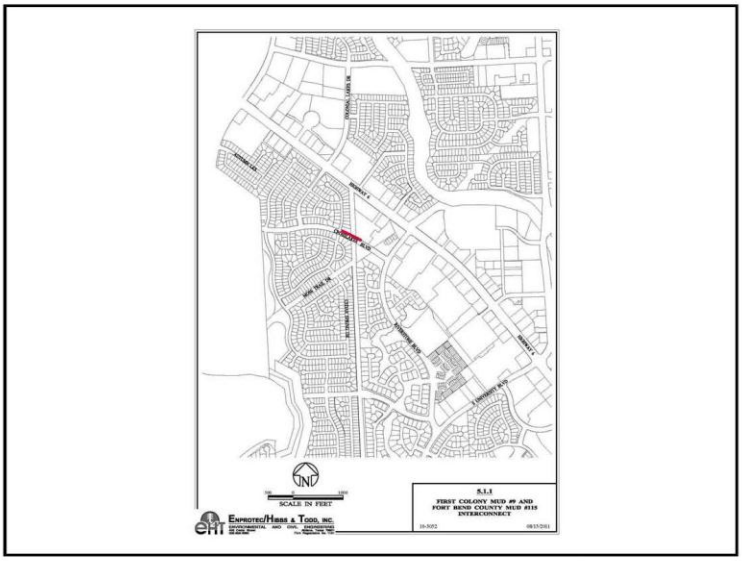
- Water Service Area
  - Showing MUD boundaries, Water Treatment Plants, and Water Distribution Lines
- Sanitary Sewer Service Area
  - Showing MUD boundaries, Wastewater Treatment Plants, Lift Stations, and Wastewater Collection Lines

CONSOLIDATION PROJECTS

- City of Missouri City Surface Water Treatment Plant
  - The City of Missouri City has joined together with a group of utility districts within the city limits and ETJ to form the Joint Groundwater Reduction Plan (GRP).
  - The goal of this group is to meet the groundwater reduction requirement set forth by the Fort Bend Subsidence District.
  - The most cost effective way to meet the requirements of the Subsidence District is a complete conversion from groundwater to surface water for a portion of the city, while leaving the remaining areas on groundwater.
  - The initial plant size is 10 MGD which will meet the City's demands until 2018.
  - The full build out size of the plant is 33 MGD.
  - The first phase of the plant is currently under construction and anticipated to be operational at the first of the year 2012.

CONSOLIDATION PROJECTS
Water Distribution Alternatives
Interconnect First Colony MUD #9 with Fort Bend County MUD #115
Mustang Bayou and Sienna Plantation Interconnect No. 2
Mustang Bayou and Sienna Plantation Interconnect No. 3
Sienna Plantation Internal Interconnect
Sienna Plantation and Palmer Plantation Interconnect No. 1
Silver Ridge Development and Sienna Plantation Interconnect No. 1
Fort Bend County MUD #149 and Sienna Plantation Interconnect No. 1
Permanently open the 12" interconnect between Fort Bend County MUD #26 and Blue Ridge West MUD
Permanently open the interconnect between Fort Bend County WC&ID No. 2 and Blue Ridge West MUD
Permanently open the interconnect between Fort Bend County MUD #47 and #48 and Mustang Bayou which will consolidate the operation of these two systems
Permanently open the 24-inch Watts Plantation interconnect between the Mustang Bayou Service Area and Sienna Plantation.
Mustang Bayou and Palmer Plantation Interconnect
Mustang Bayou and Quail Valley Interconnect
missouri CITY
the show me city

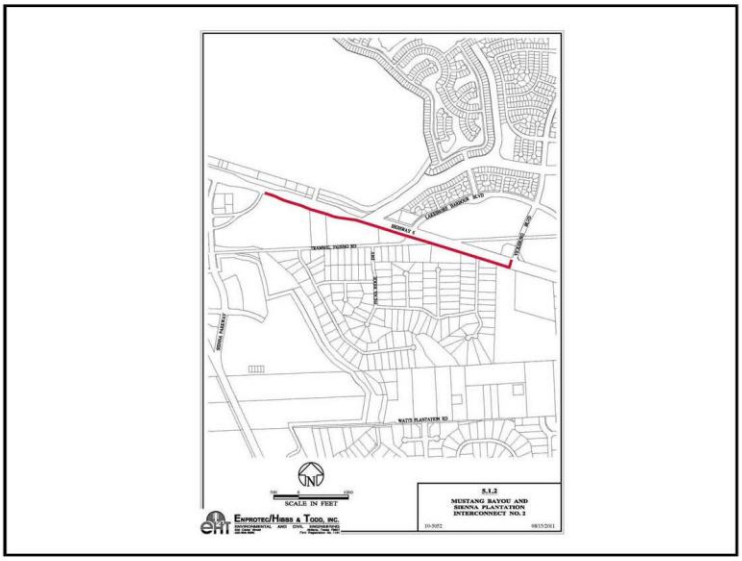

FIRST COLONY MUD #9 & FORT BEND COUNTY MUD #115 INTERCONNECT
The proposed scope for this alternative is a 12-inch water line interconnect from the south portion of First Colony MUD #9 to Fort Bend County MUD #115. This interconnect would provide increased pressure in the southern areas of First Colony MUD #9, as well as increased fire protection and reduced maintenance by way of redundancy. Total estimated cost of the project is approximately $40,000.
missouri CITY
the show me city



MUSTANG BAYOU & SIENNA PLANTATION INTERCONNECT NO. 2

- The proposed scope is a 16 and/or 12-inch water line interconnect from Vicksburg Drive to Christus Drive along State Highway 6. This interconnect would provide a second interconnect between the two systems and service to currently undeveloped property along State Highway 6. Total estimated cost of the project is approximately $800,000. This would further interconnect the system for better pressures, water quality, and fire protection. Construction can be done adjacent to undeveloped areas, thus reducing impacts if done at a later date. These improvements could potentially result in needing minor upgrades to plant facilities to fully realize the benefits.

missouri CITY TEXAS
the show me city

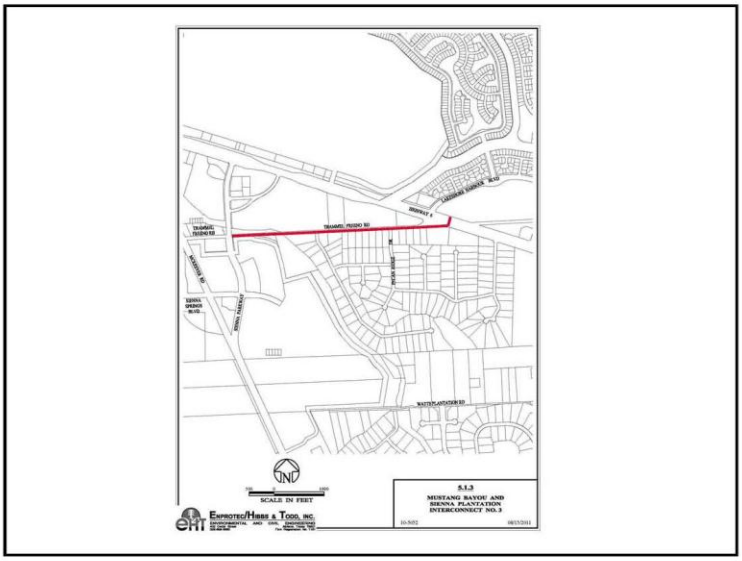


MUSTANG BAYOU & SIENNA PLANTATION INTERCONNECT NO. 3

- The proposed scope is a 12-inch water line along Trammel Fresno Road from State Highway 6 to Sienna Parkway. This interconnect would provide the third interconnect between the two water distribution systems and allow the existing residential acreage lot development south of Trammel Fresno to be converted from their existing individual well systems for each lot. This would further interconnect the system for better pressures, water quality, and fire protection. Total estimated cost of the water line project is approximately $570,000. These improvements could potentially result in needing minor upgrades to plant facilities to fully realize the benefits, but are not expected.

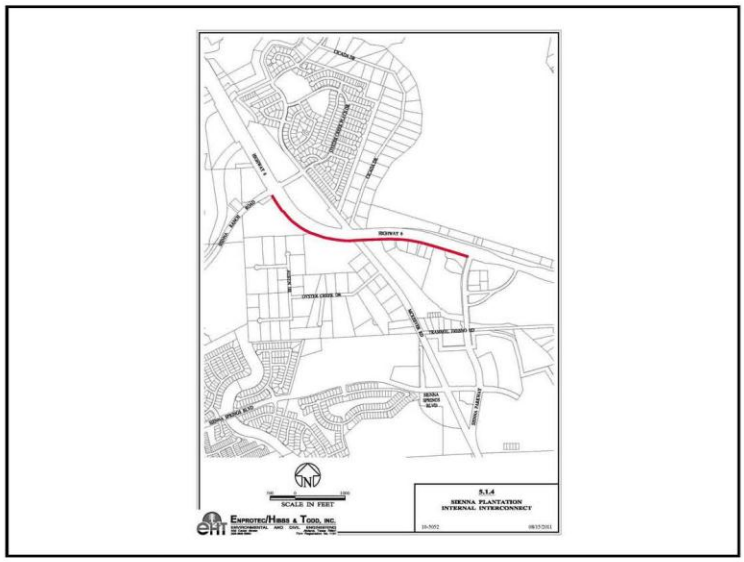
missouri CITY TEXAS
the show me city

15



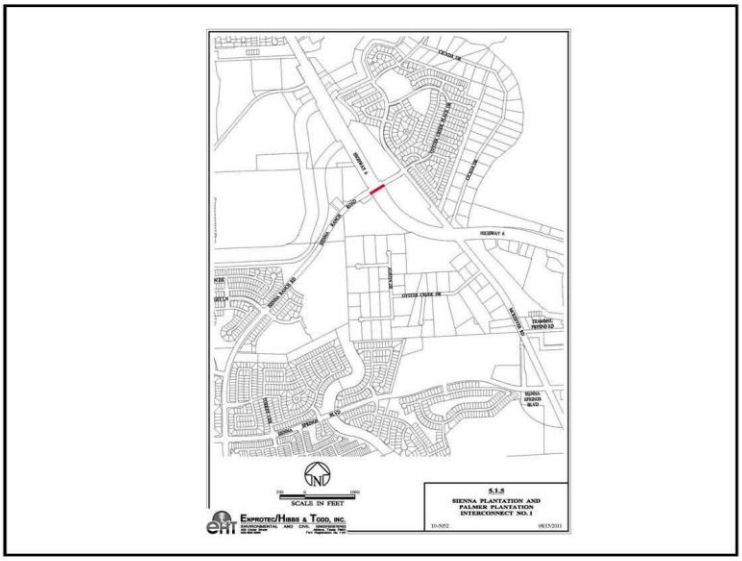
SIENNA PLANTATION INTERNAL INTERCONNECT

- The proposed scope is a 12-inch water line along State Highway 6 between the commercial development at Sienna Parkway and the commercial development at Sienna Ranch Road. This would further interconnect the system for better pressures, water quality, and fire protection. Total estimated cost of the project is approximately $465,000. These improvements could potentially result in needing minor upgrades to plant facilities to fully realize the benefits, but are not expected.



SIENNA PLANTATION & PALMER PLANTATION INTERCONNECT NO. 1

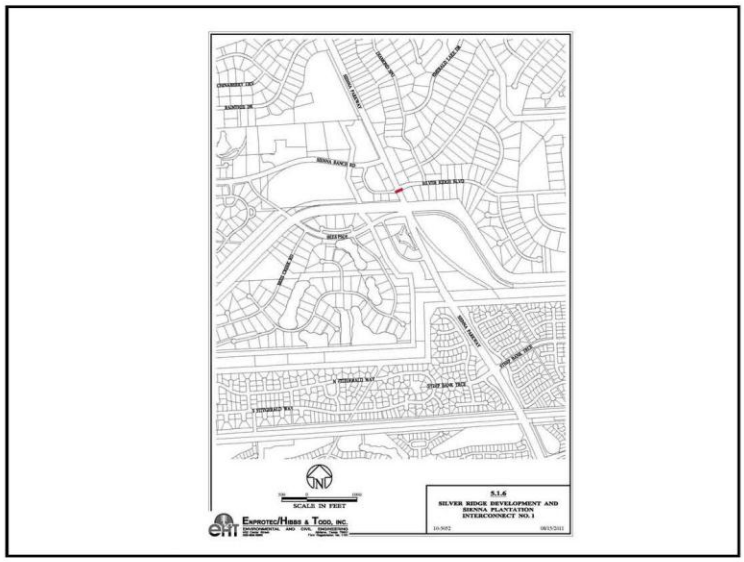
- The proposed scope is a 12-inch water line interconnect across State Highway 6. This interconnect would provide the only emergency interconnection between the Sienna system and the Palmer Plantation system. Total estimated cost of the project is approximately $235,000. The benefit would be for emergency conditions and would provide both systems with a back-up source if a problem ever occurred. These improvements could potentially result in needing minor upgrades to plant facilities to fully realize the benefits, but required improvements are not expected.



SILVER RIDGE DEVELOPMENT & SIENNA PLANTATION INTERCONNECT NO. 1

- The proposed scope is to extend a 12-inch water line across Sienna Parkway to the Silver Ridge development. This would provide an additional source of water to the Silver Ridge residents. A detailed study would need to be done to confirm the existing water supply system could provide adequate volumes and pressure for the Silver Ridge development. Total estimated cost of the project is approximately $153,000.

missouri CITY TEXAS
the show me city

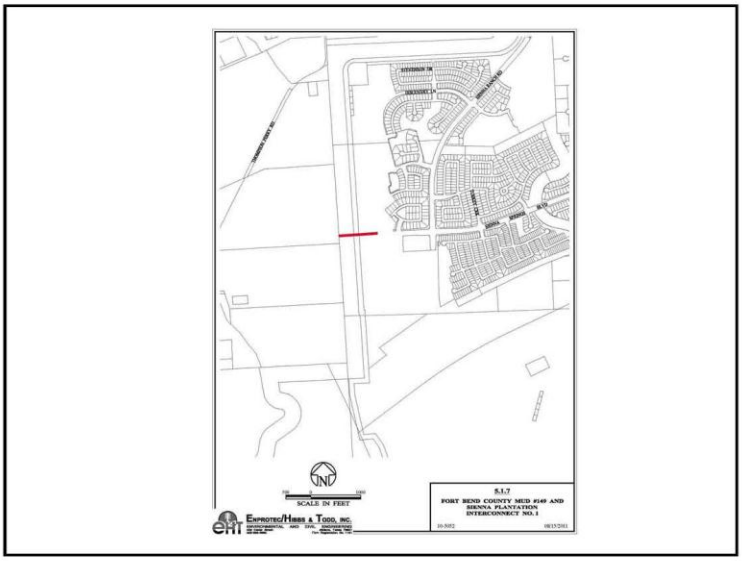


FORT BEND COUNTY MUD #149 & SIENNA PLANTATION INTERCONNECT NO. 1

- The proposed scope is to extend a 12-inch water line across the Flat Bank Creek Diversion Channel between the Sienna Plantation and Riverstone water systems along Sienna Springs Blvd. This would provide an additional source of water to both systems. In order to connect to Sienna Plantation MUD #1, chloramines conversion would be required. Costs for chloramines conversion would be paid by the GRP. After the surface water conversion, the interconnect can provide additional pressure maintenance between the two systems. Total estimated cost of the project is approximately $435,000.

missouri CITY TEXAS

19



OPEN EXISTING INTERCONNECTS

- Permanently open the interconnect between Fort Bend County MUD #26 and Blue Ridge West MUD located at intersection of Texas Pkwy. and Settegast Blvd.
- Permanently open the 10-inch interconnect between Fort Bend County WC&ID No. 2 and Blue Ridge West MUD located on Texas Pkwy. at Independence Rd.
- Fort Bend County MUD Nos. 47 & 48 are currently finalizing a water consolidation agreement with the City of Missouri City. The water system consolidation will involve permanently opening the 12-inch interconnect between the two water systems supplied by the Vicksburg water plant and the Mustang Bayou water plant.
- Permanently open the 24-inch Watts Plantation interconnect between the Mustang Bayou Service Area and Sienna Plantation.

missouri CITY

20

MUSTANG BAYOU & PALMER PLANTATION INTERCONNECT

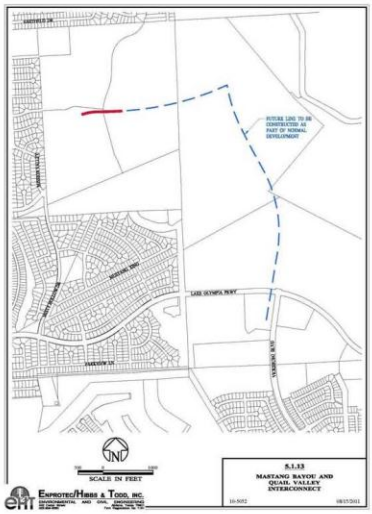
- This consolidation alternative would provide an interconnect between the Mustang Bayou Service Area and the Palmer Plantation MUDs. This would provide an additional source of water to both systems. The proposed 16-inch water line would be located at the Mustang Bayou Diversion Channel. Total estimated costs of this project are approximately $360,000.

missouri CITY
the show me city

MUSTANG BAYOU & QUAIL VALLEY INTERCONNECT

- The proposed scope of this consolidation alternative is a 12-inch water line constructed between Mustang Bayou Service Area and Quail Valley Utility District by extending a water main along future Vicksburg Blvd. to the COMC regional park.
- The benefit would be for and additional source of water for each district as well as a back-up source in an emergency situation.
- Total estimated cost of the project is approximately $248,000.

missouri CITY
the show me city



CONSOLIDATION PROJECTS

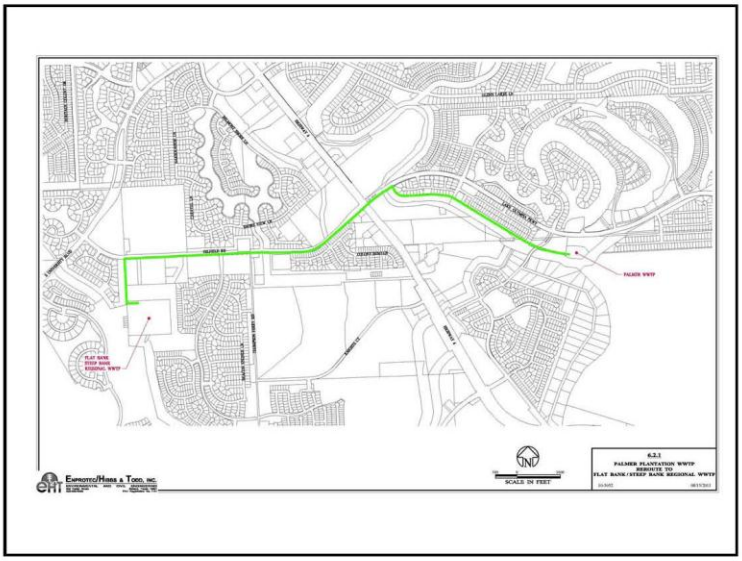
- Wastewater Treatment System Alternatives
  - Rerouting of Palmer Plantation WWTP influent to Flat Bank/Steep Bank Regional WWTP.
  - Rerouting of Sienna WWTP No. 3 influent to Flat Bank/Steep Bank Regional WWTP.
  - Replacement of Sienna WWTP No.2 Package Plant with a permanent regional WWTP.
  - Rerouting of Fort Bend County MUD #26 WWTP influent to Blue Ridge West MUD WWTP.
  - Rerouting of Harris County MUD #122 WWTP influent to Fort Bend County WC&ID No. 2 lift station on Cravens Rd.

missouri CITY
the show me city

REROUTE PALMER PLANTATION WWTP INFLUENT TO FLAT BANK/ STEEP BANK REGIONAL WWTP

- The existing Palmer Plantation Regional Wastewater Treatment Plant (WWTP) is approximately 22 years old. Components for the regional WWTP have a limited life expectancy and the plant will require increasing costs to maintain and operate in the near future as the plant approaches 30+ years of life.
- It may be cost beneficial to re-direct influent wastewater to an alternate regional WWTP when the plant exceeds capacity. The City of Missouri City Flat Bank/Steep Bank Creek Regional WWTP is the closest available WWTP that could receive flow.
- The Flat Bank/Steep Bank Creek WWTP discharges to the Flat Bank Creek diversion channel and ultimately to the Brazos River where the City of Missouri City Regional Surface Water Treatment Plant is located.
- A portion of these additional flows directed to the Flat Bank/Steep Bank Creek WWTP could also be used as a source of water for the Missouri City Surface Water Treatment Plant with the appropriate bed and banks permits.
- Approximate costs of this alternative are $6,500,000. A detailed study will need to be performed to determine if this is a cost effective consolidation of WWTP facilities. An alternative could be to upgrade the Palmer Plantation WWTP to treat to a Type I effluent and pump a portion of that effluent (or all) to the Lake Olympia or Quail Valley lake systems.

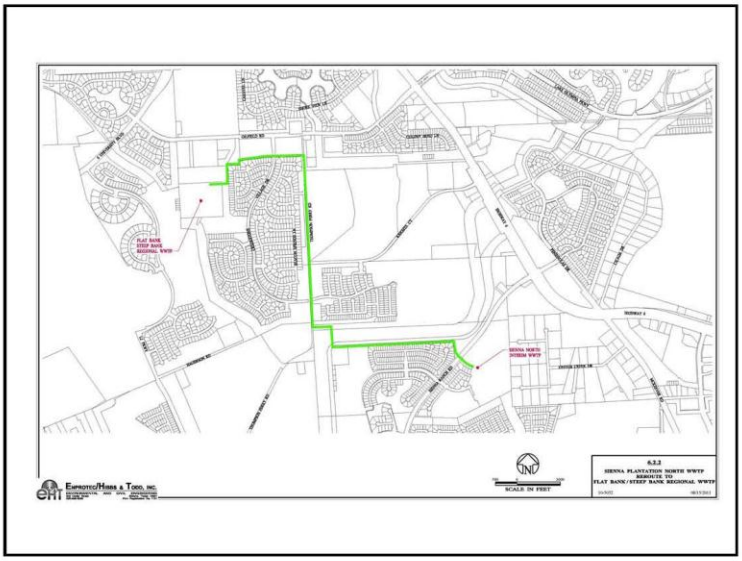
missouri CITY
the show me city



REROUTE SIENNA WWTP NO. 3 INFLUENT TO FLAT BANK/STEEP BANK REGIONAL WWTP

- The Sienna Plantation wastewater collection system is divided into two service areas separated by Flat Bank Creek. The regions north of Flat Bank Creek currently are treated with a package plant located within the service area.
- The current plan for consolidation of facilities is to construct a proposed regional lift station at the package plant location (Sienna Plantation WWTP No. 3) and pump the untreated influent to the City of Missouri City Flat Bank\Steep Bank Creek Regional Wastewater Treatment Plant.
- The Flat Bank\Steep Bank Creek Regional Wastewater Treatment Plant will be expanded to treat the additional flows from the Sienna North service area. The total estimated cost of these improvements are approximately $2,500,000.

missouri CITY texas
the show me city



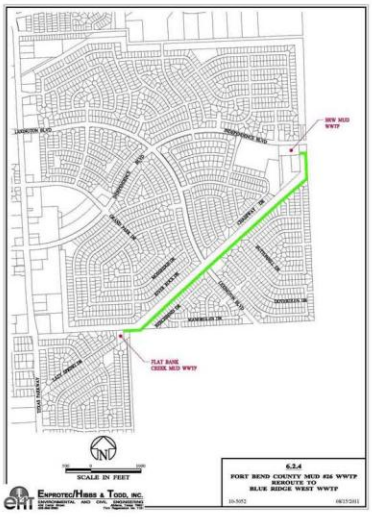
REPLACEMENT OF SIENNA WWTP NO. 2 PACKAGE PLANT WITH A PERMANENT REGIONAL WWTP

- The Sienna Plantation wastewater collection system south of flat bank creek currently is conveyed to a 1,200,000 gallon per day package wastewater treatment plant (Sienna Plantation WWTP No. 2) located in Sienna.
- The current plan for consolidation of facilities is to construct a 3,500,000 gallon per day permanent regional wastewater treatment plant to treat the total flow for the service area. The total estimated cost of these improvements are approximately $25,000,000.00.
- Effluent could be further treated and pumped to the future Channel 4 lake system in Sienna South, farther north to the Sienna Central Lake System, or into Oyster Creek for park amenity.

REROUTE FORT BEND COUNTY MUD #26 WWTP INFLUENT TO BLUE RIDGE WEST MUD WWTP

- The WWTP owned by Fort Bend County MUD #26 currently treats 0.625 MGD. An option for consolidation of facilities would be to pump the effluent flow entering the FBCMUD #26 WWTP along the drainage ditch to BRWMUD's WWTP. The total estimated cost of these improvements are approximately $6,766,000.

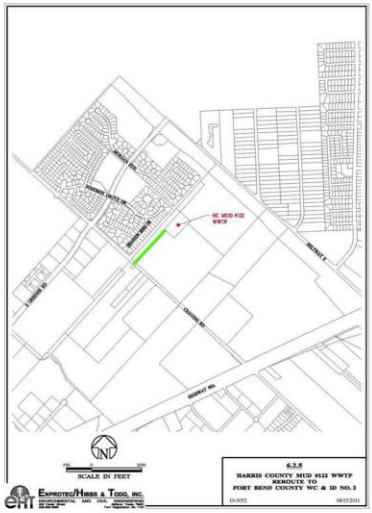
missouri CITY
the show me city



REROUTE HARRIS COUNTY MUD #122 WWTP INFLUENT TO FORT BEND COUNTY WC&ID NO. 2 LIFT STATION ON CRAVENS RD.

- The Harris County MUD #122 WWTP currently treats a flow of 0.36 MGD. An alternate option for consolidation of facilities would be to redirect the flow entering this WWTP to the Fort Bend County WC&ID No. 2 lift station located on Cravens. The total estimated cost of these improvements are approximately $3,200,000.
- Agreements will be required between the two districts and Harris County MUD #122 would be required to share operating costs of the Fort Bend County WC&ID No. 2 WWTP No. 2.

missouri CITY
the show me city

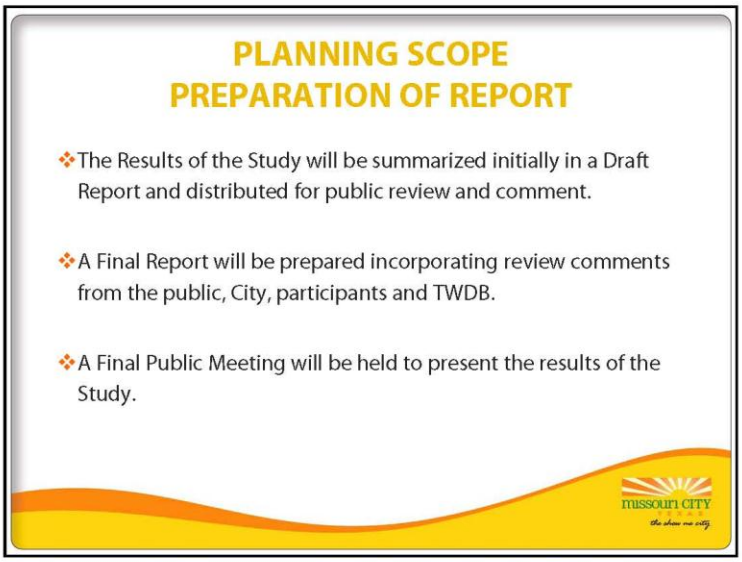


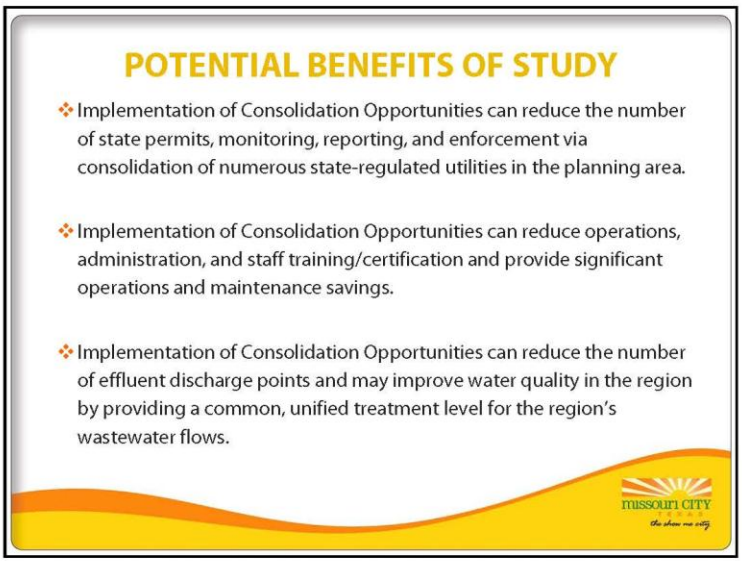
CONSOLIDATION PROJECTS SUMMARY

- Water System Consolidation Projects
  - 13 Consolidation Projects Identified
  - $3,306,000 Total Cost for all Projects
- Wastewater Consolidation Projects
  - 5 Consolidation Projects Identified
  - $43,966,000 Total Cost for all Projects

OTHER CONSOLIDATION OPPORTUNITIES

- Regional Bed & Banks Permit
- Regional Consolidation of Sludge Disposal Facilities


PLANNING SCOPE
PREPARATION OF REPORT
The Results of the Study will be summarized initially in a Draft Report and distributed for public review and comment.
A Final Report will be prepared incorporating review comments from the public, City, participants and TWDB.
A Final Public Meeting will be held to present the results of the Study.
missouri CITY


POTENTIAL BENEFITS OF STUDY
Implementation of Consolidation Opportunities can reduce the number of state permits, monitoring, reporting, and enforcement via consolidation of numerous state-regulated utilities in the planning area.
Implementation of Consolidation Opportunities can reduce operations, administration, and staff training/certification and provide significant operations and maintenance savings.
Implementation of Consolidation Opportunities can reduce the number of effluent discharge points and may improve water quality in the region by providing a common, unified treatment level for the region's wastewater flows.
missouri CITY

POTENTIAL BENEFITS OF STUDY

- Missouri City has proven that they can lead and implement a "*regional*" solution as shown by the City's Groundwater Reduction Plan Surface Water Treatment Plant that is currently under construction.
- Implementation of a Regional Plan or Consolidation may result in increased water conservation, a unified drought management plan, and a more efficient approach towards regional water planning.

REMAINING SCHEDULE

Date	Task
Mid August – Late August	Receive comments from Public Meeting
Early Sept. – Mid Sept.	Work to address comments received
Mid Sept.	95% Draft sent to City and MUDs
Mid Sept. – Late Sept.	Receive comments on 95% Draft
Early Oct. – Mid Oct.	Work to address comments received
Mid Oct.	100% Report to TWDB
January 2012	Final Report Public Meeting

DISCUSSION
missouri CITY
the show me city

8.3 Public Meeting #3: 100% Completion

Public Meeting #3 was held on January 12, 2012. This meeting was held at 100% completion of the project and provided a summary of the final report including the existing conditions, information collected during the Study and the recommended consolidation projects. The meeting notice, sign-in sheet and copies of the Power Point slides used in the presentation are attached.

PUBLIC MEETING NOTICE

Notice is hereby given of a Public Meeting to be held on **Thursday, January 12, 2012,** at **10:30 a.m.** at: **City Hall, Council Chambers, 2nd Floor**, 1522 Texas Parkway, Missouri City, Texas, for the purposes of providing a Final Report at Completion of the proposed Missouri City Regional Water and Wastewater Planning Study funded by the Texas Water Development Board and Missouri City as follows.

1. **SUMMARY OF FINAL REPORT**
    a. **STUDY OBJECTIVES**
    b. **EXISTING CONDITIONS**
    c. **RECOMMENDED CONSOLIDATION PROJECTS**
2. **DISCUSSION**

In compliance with the Americans with Disabilities Act, the City of Missouri City will provide for reasonable accommodations for persons attending City Council and Parks Board meetings. To better serve you, requests should be received 24 hours prior to the meetings. Please contact Patrice Fogarty, City Secretary, at 281-403-8685.

CERTIFICATION

I certify that a copy of the January 12, 2012, agenda of the Second Public Meeting for the Missouri City Regional Water & Wastewater Planning Study was posted on the City Hall bulletin board on or before Monday, January 3, 2012 at 10:30 a.m.

_____

Maria Gonzalez, Deputy City Secretary

Enprotec / Hibbs & Todd

missouri CITY TEXAS
the show me city

Sign In Sheet
For
City of Missouri City, Texas
Regional Planning Study - Final Presentation
January 12, 2012

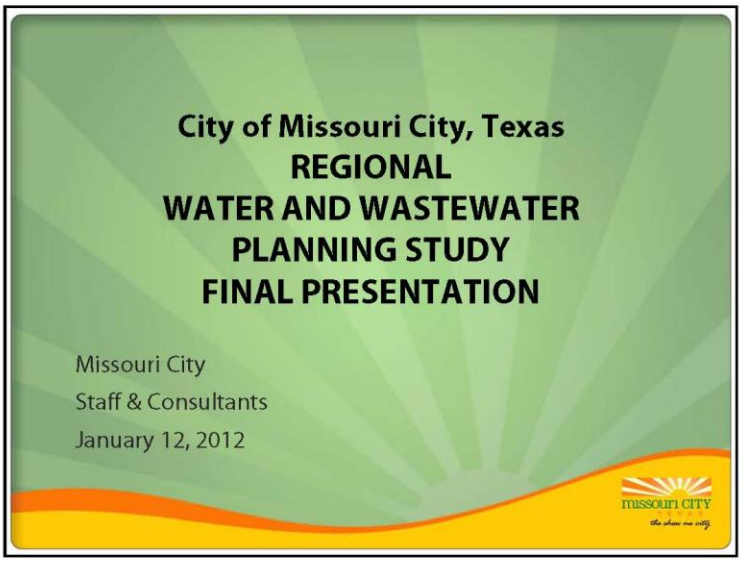
NAME	REPRESENTING	PHONE	E-MAIL
Steven Boyd	FBC MUD 47	713 869 2402	slb@landerengineers.com
WAYNE SAUGER	FBC MUD 26	713 · 817 · 8755	WSAUGER@SBCGLOBAL.NET
Sam Kruse	Costello, Inc.	713 579 3850	skruse@coseng.com
MICHAEL GURKA	JONES & CARTER	713 777 5337	mgurka@jonescarter.com
Michael Rusk	LJA Eng.	713-953-5191	MRusk@LJAEngineering.com
NOE ESCOBAR	LJA ENG.	713 953.5113	NESCOBAR@LJAEngineering.com
JAMES BROWN	LJA	713 953 5284	JBROWN@LJAENGINEERING.COM
GARY MARSIK	LJA	713 953-5249	gmarsik@ "
MORRIS MITCHELL	QV	281-499-5539	
Matt Brenzeale	FBCWCID No. 2	281-499-2041	mbrenzeale@fbcwcid2.com
Josh Berryhill	eHT	325-698-5560	joshua.berryhill@e-ht.com

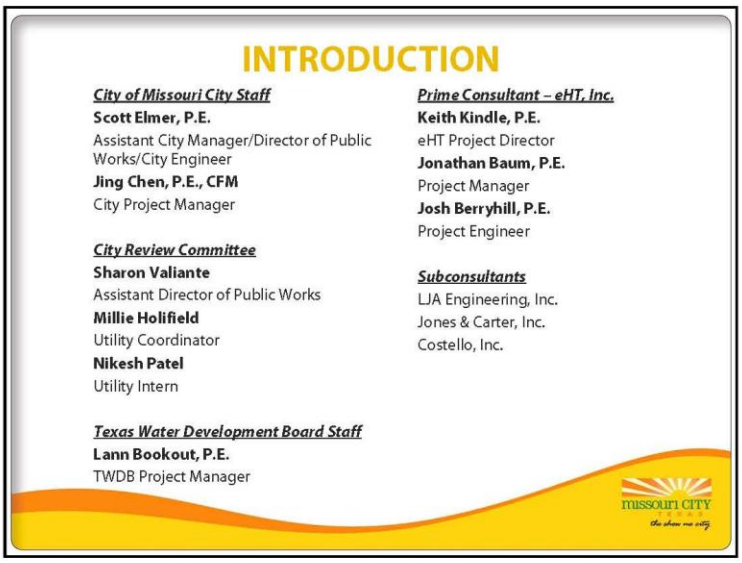
Enprotec / Hibbs & Todd

missouri CITY TEXAS
the show me city

Sign In Sheet
For
City of Missouri City, Texas
Regional Planning Study - Final Presentation
January 12, 2012

NAME	REPRESENTING	PHONE	E-MAIL
Lann Bookout	TWDB	(512) 936 4439	lann.bookout@TWDB.gov.
DAN SPAIN	CENTURY ENGINEERING FBMUD #46	(713) 780-8871 EXT. 234	DSPAIN@CENTURYENGINEERING.com
Nikesh Patel	COMC	281-403-8543	npatel@missouricitytx.gov
Philip Huseman	KSA	281.494.3252	phuseman@ksaeng.com
Sharon Valiante	COMC	281 403 8574	svaliante@missouricitytx.gov
Joe Taylor	QVJD	281 499 5539	jtaylor@quailvalleyud.org
Jing J. Chen	CoMC	281 403 8580	jchen@Missouricitytx.gov


City of Missouri City, Texas
REGIONAL
WATER AND WASTEWATER
PLANNING STUDY
FINAL PRESENTATION
Missouri City
Staff & Consultants
January 12, 2012
missouri CITY


INTRODUCTION
City of Missouri City Staff
Scott Elmer, P.E.
Assistant City Manager/Director of Public Works/City Engineer
Jing Chen, P.E., CFM
City Project Manager
City Review Committee
Sharon Valiante
Assistant Director of Public Works
Millie Holifield
Utility Coordinator
Nikesh Patel
Utility Intern
Texas Water Development Board Staff
Lann Bookout, P.E.
TWDB Project Manager
Prime Consultant – eHT, Inc.
Keith Kindle, P.E.
eHT Project Director
Jonathan Baum, P.E.
Project Manager
Josh Berryhill, P.E.
Project Engineer
Subconsultants
LJA Engineering, Inc.
Jones & Carter, Inc.
Costello, Inc.
missouri CITY

REGIONAL PLANNING PARTICIPANTS

- City of Missouri City
- Sienna Plantation Management District
- Sienna Plantation MUD 2
- Sienna Plantation MUD 3
- Sienna Plantation MUD 4
- Sienna Plantation MUD 5
- Sienna Plantation MUD 6
- Sienna Plantation MUD 7
- Sienna Plantation MUD 10
- Sienna Plantation MUD 12
- Sienna Plantation MUD 13
- Sienna Plantation MUD 149
- Fort Bend County MUD 129
- Fort Bend County MUD 49
- Fort Bend County MUD 47
- Fort Bend County MUD 48
- Fort Bend County MUD 26
- Fort Bend County MUD 46
- Fort Bend County MUD 115
- Fort Bend County MUD 42
- Palmer Plantation MUD 1
- Palmer Plantation MUD 2
- Quail Valley Utility District
- Thunderbird Utility District
- First Colony MUD 9
- Meadowcreek MUD
- Blue Ridge West MUD
- Harris County MUD 122
- Southwest Harris County MUD 1
- Fondren Road WC&ID

Fort Bend County MUD 23 and 24 are not included since they are out of City's ETJ.
WCID 2 is also excluded because its service area encompasses multiple cities.

missouri CITY
the show me city

OBJECTIVES

- Identify and Quantify Consolidation Opportunities for Water Distribution Facilities.
- Identify and Quantify Consolidation Opportunities for Wastewater Collection and Treatment Facilities.
- Determine Costs & Recommendations for Water & Wastewater Consolidation Opportunities.
- Develop an Implementation Schedule.
- Identify Funding Options and Alternative Consolidation Structures.
- Prepare a Report Summarizing the Findings.

missouri CITY
the show me city

EXISTING CONDITIONS

- Current Connections
- Projected Connections
- Current Population
- Projected Population
- Current & Projected Water Demands
- Current & Projected Wastewater Flows
- Current & Projected WTPs
- Current & Projected WWTPs
- Current Water & Wastewater Capacity Used
- Current MUD Billing Rates

CURRENT & PROJECTED CONNECTIONS

- Connection counts for this study were based on the Missouri City Joint Groundwater Reduction Plan (GRP).
- When current connection counts were provided by the utility districts, the up-to-date connection totals were used in place of the Joint GRP projections. However, the assumptions of build-out timing from the Joint GRP are used and extended to the year 2040.
- Current Connections for the Study Area:

  29,019
- Projected Connections for the Study Area in 2040:

  60,539
- Projected Connections for the Study Area at Build-Out:

  62,064

CURRENT & PROJECTED POPULATION

- The population of the planning Study Area was determined by the method used in the GRP.
- Current Population for the Study Area:

  29,019 connections x 3.07 persons per housing unit = **89,088 persons**
- Projected Population for the Study Area in 2040:

  60,539 connections x 3.07 persons per housing unit = **185,855 persons**
- Projected Population for the Study Area at Build-Out:

  62,064 connections x 3.07 persons per housing unit = **190,536 persons**

CURRENT & PROJECTED WATER DEMANDS

- In using the same process as the Joint GRP, the average water usage per connection per month was multiplied by the total number of connections. The monthly water usage for all districts was summed and multiplied by 12 months to obtain the annual water usage. The data for the average water usage per connection was obtained from the Joint GRP, or directly from the utility districts, if provided.
- Current Water Demand for the Study Area:

  12.4 MGD
- Projected Water Demand for the Study Area in 2040:

  26.7 MGD
- Projected Water Demand for the Study Area at Build-Out:

  27.3 MGD

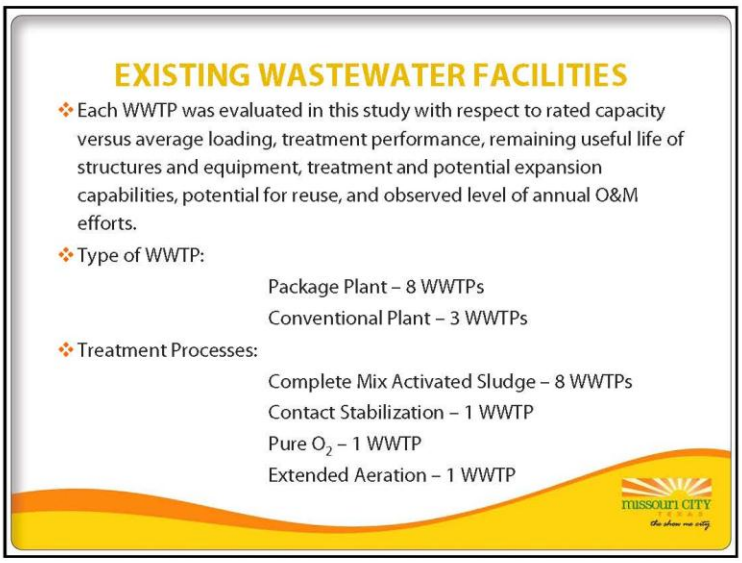
CURRENT & PROJECTED WASTEWATER DEMANDS

- Wastewater production was estimated as a percentage of the average water demand and was assumed to remain at a constant rate through the Study period.
- It was determined that the average wastewater usage per connection is approximately 60% of the water usage per connection.
- Current Wastewater Demand for the Study Area:
  7.5 MGD
- Projected Wastewater Demand for the Study Area in 2040:
  16.0 MGD
- Projected Wastewater Demand for the Study Area at Build-Out:
  16.4 MGD

EXISTING WATER FACILITIES

- Existing Water Wells:
  28 Public Water Wells within the Study Area
- Existing Water Treatment Plants (WTPs):
  24 WTPs within the Study Area
  Total Permitted Production Capacity = 49.5 MGD
- Existing Distribution System:
  Approximately 410 miles of water transmission and distribution piping

EXISTING WASTEWATER FACILITIES
Existing Wastewater Collection System:
Approximately 365 miles of gravity lines
87 wastewater lift stations
Approximately 35 miles of force mains
Existing Wastewater Treatment Plants (WWTPs):
11 WWTPs within the Study Area
Total Permitted Treatment Capacity = 13.75 MGD
missouri CITY

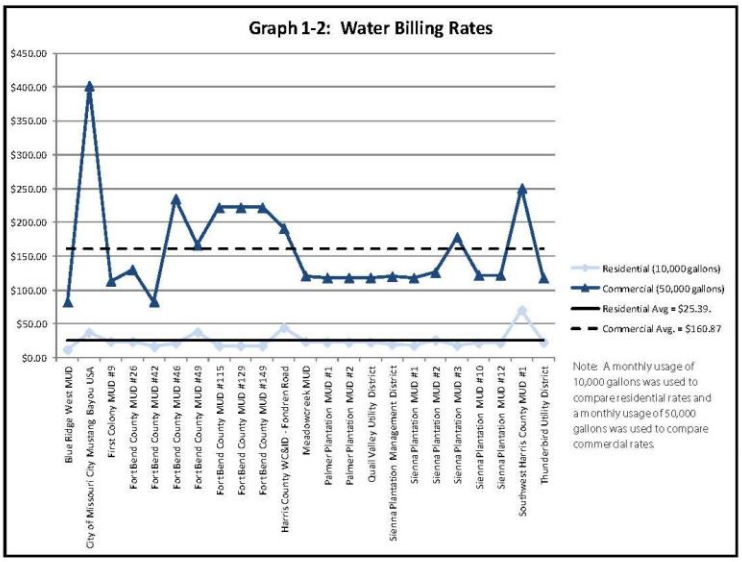

EXISTING WASTEWATER FACILITIES
Each WWTP was evaluated in this study with respect to rated capacity versus average loading, treatment performance, remaining useful life of structures and equipment, treatment and potential expansion capabilities, potential for reuse, and observed level of annual O&M efforts.
Type of WWTP:
Package Plant – 8 WWTPs
Conventional Plant – 3 WWTPs
Treatment Processes:
Complete Mix Activated Sludge – 8 WWTPs
Contact Stabilization – 1 WWTP
Pure O_2 – 1 WWTP
Extended Aeration – 1 WWTP
missouri CITY

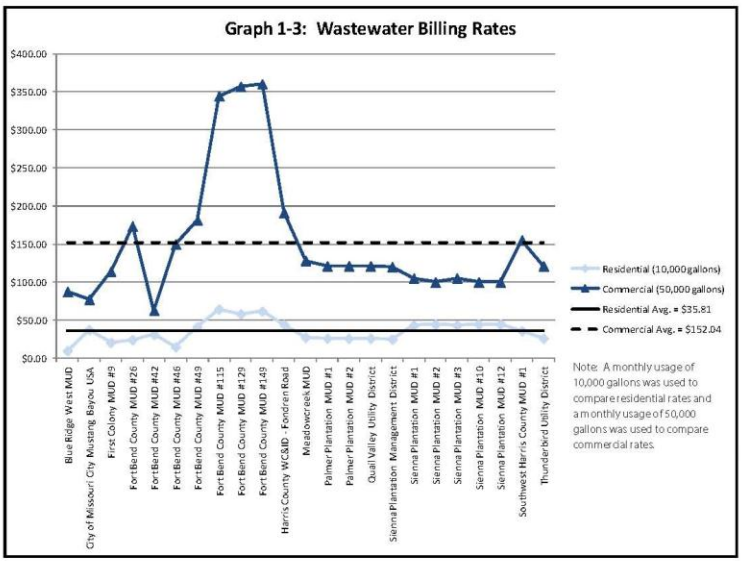
EXISTING WASTEWATER FACILITIES

- The majority of the WWTPs in the Study Area consist of package treatment plants. Package treatment plants typically have much shorter operating lives than more conventional or advanced treatment facilities.
- Age of WWTPs within the Study Area:
  - 0 - 10 Years Old – 2 WWTPs
  - 10 - 20 Years Old – 4 WWTPs
  - 20 - 30 Years Old – 4 WWTPs
  - 30+ Years Old – 1 WWTP

CURRENT MUD BILLING RATES

- The average monthly water and wastewater usage throughout the Study Area was calculated as 10,000 gallons per month for a residential connection and 50,000 gallons per month for a commercial connection.
- Using the current billing rates for each utility district, the monthly cost for the average usage was calculated to use as a comparison between individual districts.


Graph 1-2: Water Billing Rates
$450.00
$400.00
$350.00
$300.00
$250.00
$200.00
$150.00
$100.00
$50.00
$0.00
Blue Ridge West MUD
City of Missouri City Mustang Bayou USA
First Colony MUD #9
FortBend County MUD #26
FortBend County MUD #42
FortBend County MUD #46
FortBend County MUD #49
FortBend County MUD #115
FortBend County MUD #129
FortBend County MUD #149
Harris County WCID - Fondren Road
Meadowcreek MUD
Palmer Plantation MUD #1
Palmer Plantation MUD #2
Quail Valley Utility District
Sienna Plantation Management District
Sienna Plantation MUD #1
Sienna Plantation MUD #2
Sienna Plantation MUD #3
Sienna Plantation MUD #10
Sienna Plantation MUD #12
Southwest Harris County MUD #1
Thunderbird Utility District
Residential (10,000 gallons)
Commercial (50,000 gallons)
Residential Avg. = $25.39.
Commercial Avg. = $160.87
Note: A monthly usage of 10,000 gallons was used to compare residential rates and a monthly usage of 50,000 gallons was used to compare commercial rates.


Graph 1-3: Wastewater Billing Rates
$400.00
$350.00
$300.00
$250.00
$200.00
$150.00
$100.00
$50.00
$0.00
Blue Ridge West MUD
City of Missouri City Mustang Bayou USA
First Colony MUD #9
FortBend County MUD #26
FortBend County MUD #42
FortBend County MUD #46
FortBend County MUD #49
FortBend County MUD #115
FortBend County MUD #129
FortBend County MUD #149
Harris County WCID - Fondren Road
Meadowcreek MUD
Palmer Plantation MUD #1
Palmer Plantation MUD #2
Quail Valley Utility District
Sienna Plantation Management District
Sienna Plantation MUD #1
Sienna Plantation MUD #2
Sienna Plantation MUD #3
Sienna Plantation MUD #10
Sienna Plantation MUD #12
Southwest Harris County MUD #1
Thunderbird Utility District
Residential (10,000 gallons)
Commercial (50,000 gallons)
Residential Avg. = $35.81
Commercial Avg. = $152.04
Note: A monthly usage of 10,000 gallons was used to compare residential rates and a monthly usage of 50,000 gallons was used to compare commercial rates.

STUDY MAPS

- Water Service Area
  - Showing MUD boundaries, WTPs and Water Distribution Lines
- Sanitary Sewer Service Area
  - Showing MUD boundaries, WWTPs, Lift Stations, and Wastewater Collection Lines

WATER DISTRIBUTION AND WATER TREATMENT ALTERNATIVES

WATER TREATMENT ALTERNATIVES

City of Missouri City Regional Water Treatment Plant

- The City of Missouri City has joined together with a group of utility districts within the city limits and ETJ to form the Joint GRP.
- The goal of this group is to meet the groundwater reduction requirement set forth by the Fort Bend Subsidence District.
- The most cost effective way to meet the requirements of the Subsidence District is a complete conversion from groundwater to surface water for a portion of the City, while leaving the remaining areas on groundwater.
- The initial plant size is 10 MGD which will meet the City's demands until 2018.
- The full build out size of the plant is 33.3 MGD.
- The first phase of the plant is currently under construction and anticipated to be operational at the first of the year 2012.

WATER DISTRIBUTION RECOMMENDATIONS

- Interconnect First Colony MUD #9 with Fort Bend County MUD #115
- Mustang Bayou and Sienna Plantation Interconnect No. 2
- Mustang Bayou and Sienna Plantation Interconnect No. 3
- Sienna Plantation Internal Interconnect
- Sienna Plantation and Palmer Plantation Interconnect No. 1
- Silver Ridge Development and Sienna Plantation Interconnect No. 1
- Fort Bend County MUD #149 and Sienna Plantation Interconnect No. 1
- Permanently open the 12" interconnect between Fort Bend County MUD #26 and Blue Ridge West MUD
- Permanently open the interconnect between Fort Bend County WC&ID No. 2 and Blue Ridge West MUD
- Permanently open the interconnect between Fort Bend County MUD #47 and #48 and Mustang Bayou which will consolidate the operation of these two systems
- Permanently open the 24-inch Watts Plantation interconnect between the Mustang Bayou Service Area and Sienna Plantation.
- Mustang Bayou and Palmer Plantation Interconnect
- Mustang Bayou and Quail Valley Interconnect

10

WATER STORAGE RECOMMENDATIONS

- New EST at Sienna Plantation WTP No. 1
- New EST at Mustang Bayou WTP
- New EST at Fort Bend County MUD #149 WTP
- New EST at Palmer Plantation MUD No. 2 WTP
- New EST at Thunderbird Utility District System No. 1 WTP No. 2
- New EST at Harris County WC&ID – Fondren Road WTP No. 2

WASTEWATER COLLECTION AND TREATMENT ALTERNATIVES

DEVELOPMENT OF WWTP O&M COSTS

- WWTP Current Conditions

Name	Current Design Capacity (MGD)	Current Average Loading (MGD)	Site Buildout Capacity (MGD)	Estimated Useful Life Remaining (Years)
Southwest Harris County MUD #1 WWTP	0.4	0.1	0.4	5-10
Harris County WC&ID - Fondren Road WWTP	0.6	0.2	1.2	5-10
Harris County MUD #122 WWTP	0.25	0.1	0.25	5-10
Blue Ridge West MUD WWTP	1.3	0.75	2.6+	5-10
Fort Bend County MUD #26 WWTP	0.5	0.3	1.0	5-10
Quail Valley UD/Thunderbird UD WWTP	4.0	1.5	4.0-	5-10
Palmer Plantation WWTP	0.6	0.3	1.2+	5-10
Steep Bank/Flat Bank Regional WWTP	3.0	1.5	6.0+	25-30
Vicksburg Regional WWTP	0.95	0.4	2.0+	10-15
Sienna North WWTP	0.9	0.3	1.2	10-15
Sienna South WWTP	1.2	1.1+	1.2	5-10

DEVELOPMENT OF WWTP O&M COSTS

- Key WWTP Issues
  - The majority of the WWTPs are package plants, increasing difficulty (and cost) of O&M and rehabilitation.
  - Very few of the WWTPs have up-to-date SCADA systems and energy-reducing equipment such as VFD drives and automated DO control systems to reduce energy demand during low flow periods.
  - The majority of the WWTPs use onsite aerobic digestion of solids and either have liquid sludge hauled off-site, or hire a third-party company to dewater sludge on-site and haul the dewatered sludge off-site for ultimate disposal.
  - The majority of the WWTPs require upgrade or replacement of critical equipment and/or major rehabilitative work on the WWTP structures within the next 5 - 10 years.

DEVELOPMENT OF WWTP O&M COSTS

❖ Opinion of Current WWTP O&M Costs

Name	Base O&M Cost (per year)	Multiplier for Type of Plant	Multiplier for Flow Loading	Multiplier for Loss of Energy Savings	Multiplier for Age and Condition	Multiplier for Solids Digestion	Multiplier for 3rd Party Handling of Solids	Multiplier for Level of Automation and SCADA Support	Adjusted O&M Cost (per year)
Southwest Harris County MUD #1 WWTP	$180,000	1.25	0.25	1.2	1.4	1.25	1.25	1.2	$178,000
Harris County WCID - Fondren Road WWTP	$253,000	1.25	0.33	1.2	1.6	1.25	1.25	1.2	$380,000
Harris County MUD #122 WWTP	$130,000	1.25	0.4	1.2	1.4	1.25	1.25	1.2	$205,000
Blue Ridge West MUD WWTP	$435,000	1.25	0.58	1.1	1.4	1.25	1	1.1	$665,000
Fort Bend County MUD #26 WWTP	$220,000	1.25	0.6	1.2	1.6	1.25	1.25	1.2	$594,000
Quail Valley UD/Thunderbird UD WWTP	$780,000	1	0.375	1.75	1.7	1	1	1.2	$1,045,000
Palmer Plantation WWTP	$253,000	1	0.5	1.2	1.6	1.25	1.25	1.2	$456,000
Steep Bank/Flat Bank Regional WWTP	$652,000	1	0.5	1.1	1.1	1	1	1	$395,000
Vicksburg Regional WWTP	$400,000	1.25	0.4	1.2	1.1	1.25	1.25	1.2	$495,000
Sienna North WWTP	$360,000	1.25	0.33	1.2	1.2	1.25	1.25	1.2	$405,000
Sienna South WWTP	$422,000	1.25	0.92	1	1.4	1.25	1.25	1.2	$1,370,000
Total	-	-	-	-	-	-	-	-	**$6,038,000**

DEVELOPMENT OF WWTP ALTERNATIVES

❖ Consolidation Scenario Guidelines

- ❖ Existing WWTPs to remain online should be upgraded to reduce O&M cost.
- ❖ If an existing WWTP is to be consolidated, plan for construction of a new transfer pump station at the WWTP site (in some cases, it may be feasible to upgrade the existing influent PS instead of constructing a new pump station).
- ❖ WWTP transfer force mains should be designed to locate pipelines in irrigation and drainage canals wherever possible.
- ❖ Costs should be included for boring and encasement when approaching developed areas, even if open cut may ultimately be possible.
- ❖ WWTP expansions should be designed to maintain compliance w/ TCEQ 75/90 Rule requirements.

CONSOLIDATION PROJECTS

- Wastewater Treatment System Alternatives
  - Scenario 1 – Continue using all 11 existing WWTPs and construct new Hillwood Regional WWTP in the future (12 WWTPs in operation).
  - Scenario 2 – Consolidate existing WWTPs based on projects discussed at the 50% presentation (8 WWTPs in operation).
  - Scenario 3 – Consolidate existing WWTPs using Quail Valley UD WWTP as a regional WWTP (5 WWTPs in operation).
  - Scenario 4 – Consolidate existing WWTPs using Blue Ridge West MUD WWTP as a regional WWTP (5 WWTPs in operation).
  - Scenario 5 – Consolidate all existing WWTPs into new Super Regional WWTP (SB-FB WWTP) (1 WWTP in operation).

Additional scenarios developed from 95% Presentation comments, to be included as an appendix to the Final Report.

missouri CITY the show me city

CONSOLIDATION PROJECTS

- Wastewater Treatment System Alternatives

Scenario Description	WWTPs Online in This Scenario	Projected Total Capital Cost	Projected Annual O&M Cost	Projected 30-Year Life Cycle Cost
Rehab/Expand all existing WWTPs as needed and construct new South Regional WWTP to continue use for 30 years (11 existing WWTPs plus 1 new WWTP)	Southwest Harris County MUD #1, Harris County MUD #122, Harris County MUD-Fondren Road, Blue Ridge West MUD, Fort Bend County MUD #26, Palmer Plantation, Quail Valley UD, SB-FB, Mustang Bayou, Sienna North, Sienna South, New South Regional (Hillwood)	$113,603,000	$3,475,000	$181,722,000
Consolidate WWTPs based on MUD engineering firm recommendations (7 existing WWTPs plus 1 new WWTP)	Southwest Harris County MUD #1, Harris County MUD-Fondren Road, Blue Ridge West MUD, Quail Valley UD, SB-FB, Mustang Bayou, Sienna North, New South Regional (Hillwood)	$105,191,000	$2,662,100	$157,378,000
Consolidate WWTPs to reduce total number of WWTPs using Quail Valley UD as a regional facility (4 existing WWTPs plus 1 new WWTP)	Harris County MUD-Fondren Road, Quail Valley UD, SB-FB, Mustang Bayou, New South Regional (Hillwood)	$99,036,000	$1,896,900	$136,224,000
Consolidate WWTPs to reduce total number of WWTPs using Blue Ridge West MUD as a regional facility (4 existing WWTPs plus 1 new WWTP)	Blue Ridge West MUD, Quail Valley UD, SB-FB, Mustang Bayou, New South Regional (Hillwood)	$99,874,000	$2,280,700	$144,586,000
Consolidate WWTPs to reduce total number of WWTPs using SB-FB as the only regional WWTP facility (1 existing WWTP)	**SB-FB**	**$82,689,000**	**$1,331,400**	**$108,792,000**

missouri CITY the show me city

DEVELOPMENT OF WWTP O&M COSTS

- Super Regional WWTP Concept
  - Minimum build-out WWTP capacity required – 16.4 MGD.
  - Base O&M cost for a 16.4 MGD WWTP - $2,217,000 per year.
  - Adjusted O&M cost to operate a 16.4 MGD WWTP at current flows, if all plants consolidated - $1,029,000 per year.
  - Approximate annual cost to operate transfer pump stations to consolidate existing WWTPs - $250,000 per year.
  - Approximate annual savings to operate a single, super regional WWTP instead of the 11 existing WWTPs - $4,809,000 per year.
  - Approximate savings over a 30-year period - $144,270,000.

missouri CITY
the show me city

RECOMMENDED PROJECTS AND COSTS

missouri CITY
the show me city

CONSOLIDATION PROJECTS SUMMARY

- Water System Consolidation Projects
  - 17 Consolidation Projects Identified.
  - $121,517,000 Total Cost for all Projects.
- Wastewater Consolidation Projects
  - 16 Consolidation Projects Identified.
  - $82,689,000 Total Cost for all Project.
- The total cost for all of the projects identified in the Study is $204,206,000.

missouri CITY
the show me city

Table 7-1
Projected Cash Draw for Proposed Water Improvements

Year	Project 1	Project 2	Project 3	Project 4	Total Cost for Water Projects
2011-2015	Construct Phase I of the RWTP and Pipeline Improvements	Permanently open the Interconnect between the Mustang Bayou and Fort Bend County MUD #47 / #48 Water Systems	Construct EST at Sienna Plantation No. 1 WTP	Sienna Plantation Internal Interconnect	-
Project Cost [1]	-	-	$4,925,000	$490,000	**$5,415,000**
2016-2020	Construct Phase II of the RWTP and Pipeline Improvements	Permanently open the Interconnect between the Mustang Bayou and the Sienna Plantation Water Systems	Construct EST at Mustang Bayou WTP	Construct EST at Fort Bend County MUD #649 WTP	-
Project Cost [1]	$61,317,000	-	$2,425,000	$7,934,000	**$71,676,000**
2021-2025	Construct Phase III of the RWTP and Pipeline Improvements	Construct EST at Palmer Plantation MUD No. 2 WTP	Mustang Bayou and Sienna Plantation Interconnect No. 2	Fort Bend County MUD #649 and Sienna Plantation Interconnect No. 1	-
Project Cost [1]	$64,142,000	$5,279,000	$1,135,000	$823,000	**$71,379,000**
2026-2030	Construct EST at Thunderbird ID System 1 WTP NO. 2	Sienna Plantation and Palmer Plantation Interconnect	Mustang Bayou and Sienna Plantation Interconnect No. 3	Mustang Bayou and Palmer Plantation Interconnect	-
Project Cost [1]	$5,929,000	$1,480,000	$1,091,000	$476,000	**$8,976,000**
2031-2035	Construct EST at Harris County WCID-Fonlem Rd WTP No. 2	Mustang Bayou and Quail Valley Interconnect	First Colony MUD #9 and Fort Bend County MUD #615 Interconnect No. 1	Permanently open the Blue Ridge West MUD and Fort Bend County WCID No. 2 Interconnect	-
Project Cost [1]	$3,447,000	$512,000	$1,075,000	-	**$5,034,000**
2036-2040	Sienna Plantation and Silver Ridge Development Interconnect	Permanently open the Blue Ridge West MUD and Fort Bend County MUD #26 Interconnect	-	-	
Project Cost [1]	$300,000	-	-	-	**$301,000**
Total			**$162,780,000**		

Note :
1 - Please note that these costs are different from the costs discussed in Section 4 (i.e.in 2011 dollars), as these costs include a 3.5% annual costescalation factor to account for proposed delay in implementation from the time of this report. This cost is based on the timeline for projects discussed in Section 4 and 7 and assumes that projects will be funded toward the middle of each 5-year implementation period.

missouri CITY
the show me city

Table 7-2
Projected Cash Draw for Proposed Wastewater Improvements

Year	Project - Year 1	Project - Year 2	Project - Year 3	Project - Year 4	Project - Year 5	Total Cost for Wastewater Projects
2011-2015	-	Reroute Harris County MUD #6.22 WWTP to Harris County WCID-Fondren Rd WWTP	Construct new transfer PS at Palmer Plantation WWTP and transfer all plant flow to SB-FB WWTP	Construct new transfer PS at Sienna North WWTP and transfer all plant flow to SB-FB WWTP	-	-
Project Cost[1]	-	**$652,000**	**$1,679,000**	**$4,422,000**	-	**$6,753,000**
2016-2020	Construct 4.0 MGD expansion at SB-FB WWTP	Construct new transfer PS at Fort Bend County MUD #26 WWTP and transfer all plant flow to Palmer WWTP PS	Construct new transfer PS at Sienna South WWTP and transfer all plant flow to Sienna North WWTP PS	-	-	-
Project Cost[1]	**$17,470,000**	**$4,049,000**	**$6,986,000**	-	-	**$28,505,000**
2021-2025	Construct new transfer PS at Quail Valley UD WWTP and trans fer all plant flow to SB-FB WWTP	Construct 4.0 MGD expansion at SB-FB WWTP	Construct new transfer PS at Blue Ridge West WWTP and transfer all plant flow to Fort Bend County MUD #26 WWTP PS	Construct new transfer PS in Hillwood development and transfer all plant flow to Sienna South WWTP PS	-	-
Project Cost[1]	**$2,104,000**	**$20,093,000**	**$1,604,000**	**$3,478,000**	-	**$27,779,000**
2026-2030	Construct new transfer PS at Harris County WCID-Fondren Rd WWTP and transfer all plant flow to Blue Ridge West WWTP PS	Construct 4.0 MGD expansion at SB-FB WWTP	Construct new transfer PS at Southwest Harris County MUD #1 WWTP and transfer all plant flow to Harris County WCID-Fondren Rd WWTP PS	-	-	-
Project Cost[1]	**$2,296,000**	**$23,195,000**	**$396,000**	-	-	**$25,887,000**
2031-2035	Construct new transfer PS at Mustang Bayou WWTP and transfer all plant flow to Palmer Plantation WWTP PS	-	-	-	Construct 4.0 MGD expansion at SB-FB WWTP	-
Project Cost[1]	**$2,093,000**	-	-	-	**$27,388,000**	**$29,481,000**
2036-2040	-	-	-	-	-	-
Project Cost[1]	-	-	-	-	-	-
Total	**$110,378,000**					

Note:
1 - Please note that these costs are different from the costs discussed in Section 4 (shown in 2011 dollars), as these costs include a 3.5% annual cost escalation factor to account for proposed delay in implementation from the time of this report. This cost is based on the timeline for projects discussed in Section 4 and 7.

missouri CITY
the show me city

KEY POINTS

- GIS maps for existing water and wastewater infrastructure have been developed through this Study.
- Base maps and preliminary review of environmental impacts have been developed for individual environmental assessments of future projects.
- Interconnects should be utilized to eliminate redundant facilities and provide a secondary water source for service areas.
- ESTs are more cost-effective than HPT for the area given the current stage of development.
- A Super Regional WWTP at SB-FB is the most cost-effective alternative for future wastewater treatment.

missouri CITY
the show me city

KEY POINTS

- Bed & Banks Permit and Reuse should be implemented for the entire area.
- A Quasi- Governmental Entity is not recommended for implementation of regional projects – the GRP model works well for large, expensive regional projects.
- Funding for large regional projects should be done under the City due to better interest rates and the resultant cost savings.
- This Study is a guide map for consideration of future water and wastewater improvements – it establishes the foundation for identification of regional projects that result in cost savings. More detailed analysis will be needed before implementation.

STUDY SCHEDULE

- The Results of the Study were summarized in a Draft Report and distributed on October 16, 2011 for public review and comment in addition to TWDB review.
- TWDB issued written comments on December 6, 2011 and a response to the comments was submitted on December 13, 2011.
- A Final Report will be prepared incorporating review comments from the public, City, participants and TWDB after this Final Public Meeting and prior to January 31, 2012.

DISCUSSION
missouri CITY
the show me city

missouri CITY
TEXAS

October 30, 2008

JOINT GROUNDWATER REDUCTION PLAN

Sienna Plantation

Fort Bend MUD #129

Fort Bend MUD #149

Blue Ridge West MUD

First Colony MUD #9

Fort Bend County MUD #115

Fort Bend County MUD #26

Fort Bend County MUD #42

Fort Bend County MUD #46

Fort Bend County MUD #47

Fort Bend County MUD #48

Fort Bend County MUD #49

Meadow Creek MUD

Palmer Plantation MUD #1

Palmer Plantation MUD #2

Quail Valley Utility District

Thunderbird Utility District

Fort Bend MUD #23

Fort Bend MUD #24

City of Missouri City

Estates of Silver Ridge

Waterbrook Community Association

Silver Ridge HOA

Lake Shore Harbour

Manors of Silver Ridge POA

Riverstone

Sienna Point

Sienna Plantation RAI

Sienna Plantation POA

Lake Olympia

Coming together as a community to develop joint solutions...

Prepared by
Water Resources Management, LP
(512) 420-9841

Water Resources Management, L.P.

Table of Contents

Title		Page
Executive Summary		i
Section I.	Background	1
Section II.	Demand Projections	10
Section III.	Conversion Plan	27
Section IV.	Surface Water Supply	34
Section V.	Infrastructure Plan	37
Section VI.	Financial Plan	39
Section VII.	Other Considerations	40
Section VIII	Summary and Conclusions	42

Appendix A	Inter-local Agreements
Appendix B	Historical Building Permits
Appendix C	GCWA Raw Water Contract
Appendix D	SWTP Conceptual Design Report
Appendix E	Transmission System Conceptual Design Report
Appendix F	Detailed Project Development Cost Analysis

Executive Summary

The City of Missouri City has assembled a group of participants to form a Joint Ground Water Reduction Plant (Joint GRP). These participants include mostly entities lying within the city limits of Missouri City as well as some entities within the City's ETJ and outlying areas. Together, these entities have identified a plan for which as a whole, the participants will meet the groundwater reduction requirements set forth by the Fort Bend Subsidence District (Subsidence District). All wells of the stakeholders will be aggregated to expedite the administrative process of administering the plan.

Population projections and subsequent water demand projections were made for each individual stakeholder group based on current build-out density, City planning documents, and acreage estimates. Projected population and connection count are shown on the table below:

Participant	Build - Out	
	Connection Count	Population Served*
Sienna Plantation MUD #1, 4, 5, 6, 7	*10,000*	*30,400*
Sienna Plantation MUD #2	*2,157*	*6,557*
Sienna Plantation MUD #3	*2,806*	*8,530*
Sienna Plantation MUD #8, 10, 12	*2,680*	*8,147*
Sienna Plantation MUD #13	*730*	*2,220*
Fort Bend MUD #129	*1,550*	*4,712*
Fort Bend MUD #149	*1,700*	*5,168*
Blue Ridge West MUD	*2,509*	*7,627*
First Colony MUD #9	*3,300*	*10,032*
Fort Bend County MUD #115	*580*	*1,763*
Fort Bend County MUD #26	*2,145*	*6,521*
Fort Bend County MUD #42	*1,507*	*4,581*
Fort Bend County MUD #46	*1,073*	*3,262*
Fort Bend County MUD #47	*1,000*	*3,040*
Fort Bend County MUD #48	*1,370*	*4,164*
Fort Bend County MUD #49	*396*	*1,204*
Meadow Creek MUD	*985*	*2,994*
Palmer Plantation MUD #1	*798*	*2,426*
Palmer Plantation MUD #2	*1,000*	*3,040*
Quail Valley Utility District	*4,514*	*13,723*
Thunderbird Utility District	*1,986*	*6,039*
Fort Bend MUD #23/24	*6,000*	*18,240*
Mustang Bayou Phase 2	*9,095*	*27,649*
Mustang Bayou Phase 1	*3,178*	*9,661*
Total Connections	*63,059*	*191,700*

The Subsidence District requires that by 2013, groundwater production be limited to 70% of total water demand. The remaining demand must be met through alternative sources. By 2025, the Subsidence District requires that only 40% of total water demand be met by groundwater sources. Based on population projections, total demand and conversion requirements are presented below:

Participant	2013	2030
POTABLE DEMAND		
Sienna Plantation MUD #1, 4, 5, 6, 7	37,362,595	1,510,817,034
Sienna Plantation MUD #2	281,359,633	281,359,633
Sienna Plantation MUD #3	389,763,782	389,763,782
Sienna Plantation MUD #8, 10, 12	267,502,145	416,601,702
Sienna Plantation MUD #13	18,312,934	18,312,934
Fort Bend MUD #129	273,467,313	382,167,599
Fort Bend MUD #149	145,327,146	242,211,910
Blue Ridge West MUD	346,065,311	347,117,560
First Colony MUD #9	401,001,084	426,239,953
Fort Bend County MUD #115	147,231,315	153,041,415
Fort Bend County MUD #26	172,832,448	200,724,678
Fort Bend County MUD #42	216,001,465	228,744,552
Fort Bend County MUD #46	176,307,423	206,463,174
Fort Bend County MUD #47	108,600,456	144,432,472
Fort Bend County MUD #48	97,863,123	146,893,474
Fort Bend County MUD #49	111,717,421	119,048,976
Meadow Creek MUD	93,472,307	99,465,469
Palmer Plantation MUD #1	213,437,402	241,461,971
Palmer Plantation MUD #2	148,295,237	161,195,103
Quail Valley Utility District	519,365,838	567,910,878
Thunderbird Utility District	237,962,963	241,695,961
Fort Bend MUD #23/24	622,638,147	622,638,147
Mustang Bayou Phase 2	0	842,291,918
Mustang Bayou Phase 1	148,889,086	432,533,481
Total Potable Demand	***5,174,776,575***	***8,423,133,778***
REUSE DEMAND		
Quail Valley Reuse	208,295,722	208,295,722
Sienna Plantation Reuse	-	-
Riverstone Reuse	-	-
PRIVATE WELLS	442,937,000	442,937,000
TOTAL SYSTEM DEMAND	**5,826,009,297**	**9,074,366,500**
Required Alternative Water Supply	30%	60%
Total Required Alternative Water Supply	***1,747,802,789***	***5,444,619,900***

The Missouri City Joint GRP will meet these requirements through the conversion of some entities, largely those lying to the southern portion of the City and its ETJ entirely to surface water. While most entities lying to the northern portion of the City will remain on ground water supplies. The basic philosophy associated with this conversion plan is that those entities in the southern portion of the City are largely undeveloped, and thus, groundwater supplies in that area are also largely undeveloped. This should limit the cost impact associated with abandoning groundwater infrastructure upon conversion. Additionally, this plan considers that there are few interconnections within the built-out entities, thereby making it quite difficult to provide surface water to these entities without the construction of an entirely new transmission system throughout the City.

As the converting entities are not yet built-out, there is some risk associated with this plan, as the City is still required to meet the conversion percentages outlined by the Subsidence District, regardless of whether growth projections occur. As a contingency, the City has entered into inter-local agreements with every participant on the system requiring them to convert to surface water if and when directed by the City. The City would convert entities one by one beginning in the southern portion of the City, and working in a generally northerly direction.

Initial raw water supplies would be obtained through a pre-existing agreement the City of Missouri City has with the Gulf Coast Water Authority (GCWA). The City is currently identifying additional sources of raw water.

The City will own and operate the plant. Further, the City of Missouri City has been appointed the GRP administrator. As the GRP administrator, among other things, the City will see that the overall project is meeting conversion requirements, is providing required reporting to the Subsidence District and will also oversee the financial cost sharing program of the project. The cost share program involves an annual calculation of a pumpage fee to be assessed to each participant based on their respective groundwater pumpage. An end of the year "true-up" will be performed to assure that no single one entity would bear any more risk than the other participating entities.

Based on current demand projections the initial plant will have a design capacity of 10 MGD and employ membrane filtration technology. The plant will be located on the Briscoe canal in the southern portion of the Joint GRP service area near the Gulf Coast Water Authority existing intake structure on the Brazos River. From this point, treated water will be delivered to the converting entities existing ground storage facilities.

The table below summaries the total projected development cost for Phase 1 of this project. Appendix F provides the detailed project cost analysis.

ITEM	COST
Construction	
Surface Water Treatment Plant	$ 30,700,000
Transmission Pipeline	6,000,000
Contingencies	
Surface Water Treatment Plant	$4,605,000
Transmission Pipeline	900,000
Engineering	
Project Development/Design/Bid Phases	3,166,990
Construction/Post Construction Phases	1,092,000
Additional Engineering	266,500
Bond Issuance	540,000
Acquisition	3,495,000
Other	495,000
Total Project Development Cost	**$51,260,490**

I. Background

The City of Missouri City, in coordination with associated participants, has prepared this Joint Groundwater Reduction Plan (GRP) to comply with the Fort Bend County Subsidence District requirements for reduction of groundwater production.

A. The Fort Bend Subsidence District

The Fort Bend Subsidence District (Subsidence District) was created in 1989 during the 71st Legislative Session as a conservation and reclamation district. The Subsidence District was created "... to provide for the regulation of the withdrawal of groundwater within the District created by this Act to prevent subsidence that contributes to or precipitates flooding, inundation, or overflow of areas within the District, including rising waters resulting from storms or hurricanes."

Since that time, the Subsidence District has collected data and evaluated groundwater conditions in Fort Bend County. The Subsidence District prepared a Groundwater Management Plan in conformance with Senate Bill 1 that was certified by the Texas Water Development Board in August 1998. The Plan sets forth the following five goals:

- Provide for the efficient use of groundwater
- Control and prevent waste of groundwater
- Control and prevent subsidence
- Address conjunctive surface water management
- Address groundwater natural resource issues.

B. Groundwater Reduction Requirements

In meeting these goals, the Subsidence District adopted a Regulatory Plan on September 24, 2003. This Plan established a policy for the Subsidence District regarding groundwater regulation. These policies are designed to support the regulation of groundwater withdrawals to control subsidence on a regular basis. The Plan outlines specific permitting procedures and guidelines as well as fees for permits for groundwater withdrawal. Further, the Plan outlines groundwater reduction requirements that permittees are required to reach. Specifically, these requirements are outlined below:

- Beginning January 2008, a permittee, (or group of permittees) will be required to submit a Groundwater Reduction Plan (GRP) to the Subsidence District for certification.
- Beginning in January 2013 a permittee shall be required to reduce and maintain their groundwater withdrawals to comprise no more than 70% of the permittee's total water demand.
- Beginning in January 2025 and continuing thereafter, a permittee shall be required to reduce and maintain their groundwater withdrawals to comprise no more than 40% of the permittee's total water demand.

C. Groundwater Reduction Plans

The Subsidence District further specifies that the Groundwater Reduction Plan must include, at a minimum, details of strategies and steps necessary to achieve the groundwater reduction requirements. The permittees must have received certification of their GRP by the beginning date of their permit term in 2008.

Minimum requirements for an acceptable GRP include:

1) Identification of current and projected total water demand
   a) The data must be from a source agreed upon by the District and the permittee
   b) Projections must be for a time period consistent with the Plan's requirements through the year 2030
   c) Reasons detailing significant projected increases or decreases in groundwater total water demand

2) Plans for groundwater reduction
   a) Definition of infrastructure requirements to meet permittee's projected total water demand
   b) Timetable showing what infrastructure will be constructed by specific dates to meet projected requirements
   c) Explanation of how infrastructure costs will be financed
   d) Identification of source and amount of alternative water supply and water provider
   e) Evidence (executed contractual agreement and/or financial commitment) that the water supplier has sufficient water supplies and/or rights and is committed to meet the permittee's present and projected demands
   f) Preliminary engineering report of the proposed facilities to be constructed through year 2013 including a description of the proposed project and area maps
   g) Conceptual schematic plans of the proposed facilities to be constructed for the year 2025 requirements.
   h) Specific details of any conservation measures and/or efficient management practices to be implemented.
   i) Description of how over-conversion credits and/or water conservation credits would be used by the permittee.

D. Other information reasonably necessary for an adequate understanding of the project.

The plan allows for a group of permittees within the same regulatory area to submit a single GRP.

E. History of the Missouri City Joint GRP

Missouri City is unique in that the vast majority of utility customers within the City limits and surrounding areas are served by various utility districts, with a relatively small percentage of customers being served by the City. The City of Missouri City has 24 active Utility Districts operating in the City Limits/City Extra Territorial Jurisdiction (ETJ), 19 of which operate within the City limits. In addition, the City has 11 Utility Districts within the City Limits/ETJ that are not yet active, but will become active in the future.

Each Utility District is an established political subdivision of the State of Texas and is regulated by state law. Each District is a separate reporting entity and is not included in the City's budget. Each District has a separate elected board of directors. The City has little or no control over their operations and does not approve budgets, provide funding or maintain responsibility for the bonded indebtedness of the District.

As many of the above-mentioned Utility Districts are relatively small, the City became concerned that the large investment associated with conversion to surface water would be too burdensome for many of these smaller entities to bear independently. Additionally, the City felt that the identification of a reasonable solution was its fiduciary responsibility as it represents the constituency, in whole or in part, of the many Utility Districts. As a result, the City led an

effort to identify the most cost effective solution for the entire community in meeting the plan requirements. Missouri City brought together each of these entities and identified a mutually agreeable plan for meeting reduction requirements which involves the total conversion of certain systems to surface water and leaving other systems on groundwater supplies, as described in detail in Section III.

This document describes and presents the joint Plan identified by the City, and agreed to by each of the Participants.

F. Missouri City Joint GRP Participants

As previously described, the City of Missouri City has 24 active Utility Districts operating in the City Limits and ETJ. Some of these entities lie outside the Regulatory area, and are thus excluded from the Joint GRP. In addition to the Utility Districts within the City limits and ETJ, the City has been approached by other entities interested in participating in the Joint GRP. Where practical, some of these entities have been included. The Missouri City Joint GRP brings together 40 separate entities that collectively have permits for 57 wells with 2006 total pumpage of approximately 4.4 billion gallons of water. Table 1.1 and Map 1.1 illustrates participants of the Missouri City GRP.

G. Project Milestones

This GRP document outlines a plan for achieving required conversions. There are countless elements included in this plan that must be executed in order to achieve the required reduction percentages. Some of these elements are contingent upon actual growth and demand as well as other operating conditions in the future. For example, the actual amount of required future

raw water supplies will depend on actual development in the area, the effectiveness of water conservation strategies, and the actual contracts negotiated with water suppliers.

Many of these elements have already been achieved or are in process now, while other elements must be achieved into the future. The following project milestones have been proposed:

2009	- Conversion of GCWA Raw Water Option Agreement to Take-or-Pay Contract for 15 MGD
	- Coordinate with the Subsidence District to identify amount of Quail Valley historical reuse water that qualifies for credits
	- Aggregate all wells within the Missouri City GRP
2010	- Transmission System Phase 1 (to Sienna Water Plants 1 and 2) construction complete
2011	- Water Treatment Plant (10 MGD) construction complete
2014	- Transmission System Phase 2 (to Sienna Water Plants 4 and 5) construction complete
2015	- Transmission System Phase 3 (to MUD 46, 149, and Vicksburg Joint Powers) construction complete
2017	- Transmission System Phase 4 (to Missouri City Water Plant 3) construction complete

The City has an option agreement with GCWA that is in effect through 2009, reserving 15 MGD of raw water. Currently, the City of Missouri City is in final negotiations with GCWA and drafting the agreement. The City has also identified other potential sources of raw water to meet its ultimate 33 MGD peak day demands, and is currently working to secure agreements for additional water supplies. There are many factors, which could influence the ultimate required water supplies. These include actual development, the effectiveness of water conservation programs, the definition of whether the current 15 MGD is to be for average daily demand or peak day demand, are just a few influencing factors that must be considered. As a result, it must be noted that it is not fiscally responsible for the GRP Administrator to enter into

a contract for future raw water supplies on a take-or-pay contract for supplies that the City may or may not need. Therefore, as an additional proposed milestone, the GRP Administrator will identify and officially enter into executed contracts for raw water supplies to meet 2030 demands by a milestone date of 2018.

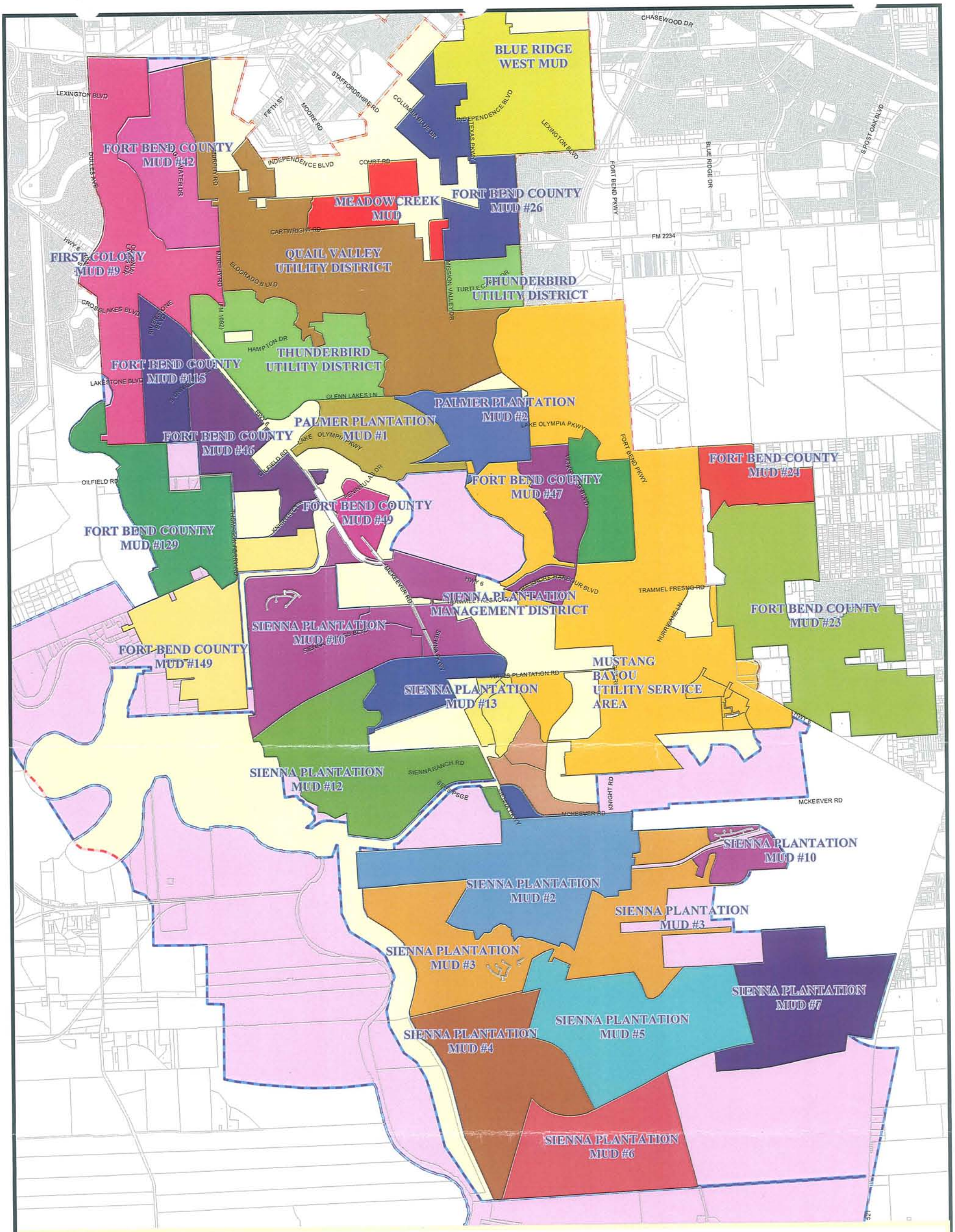
Table 1.1 MC Joint GRP Participants

Participant	District Well No.	Permit No.	Aggregate # of Wells	Current Connection Count	2006 Pumpage
Sienna Plantation MUD #1, 4, 5, 6, 7	1258, 1078, 1194, 811, 812 & 958	13700, 13701, 13702, 13703, 13704 & 13705	6	13	753,815,000
Sienna Plantation MUD #2	Service received from Sienna MUD #1			1,780	
Sienna Plantation MUD #3	Service received from Sienna MUD #1			2,185	
Sienna Plantation MUD #8, 10, 12	Service received from Sienna MUD #1			962	
Sienna Plantation MUD #13	Service received from Sienna MUD #1			108	
Fort Bend MUD #129	Service received from MUD #115			521	
Fort Bend MUD #149	MUD not yet active				
Blue Ridge West MUD	105 & 106	13377 & 13378	2	2,490	310,833,000
First Colony MUD #9	279	13399	1	2,651	415,970,000
Fort Bend County MUD #115	1025	13401	1	535	210,350,000
Fort Bend County MUD #26	253 & 1228	13390 & 13418	2	1,477	150,443,000
Fort Bend County MUD #42	234	13422	1	1,300	211,968,000
Fort Bend County MUD #46	170	13423	1	695	145,771,000
Fort Bend County MUD #47	149	13424	1	416	171,467,000
Fort Bend County MUD #48	Service received from MUD #47			631	
Fort Bend County MUD #49	Service received from Palmer MUD #1			341	
Meadow Creek MUD	944	13464	1	847	90,355,000
Palmer Plantation MUD #1	264 & 867	13483 & 13484	2	580	155,250,000
Palmer Plantation MUD #2	Service received from Palmer MUD #1			812	134,920,000
Quail Valley Utility District	257, 258, 259 & 260	13487, 13488, 13489 & 13490	4	3,607	567,436,000
Thunderbird Utility District	261, 262 & 263	13538, 13539 & 13540	3	1,917	239,472,000
Fort Bend MUD #23/24	1156, 1283, 169 & 770	13411, 13412, 13413 & 13414	4	3,153	345,199,000
Mustang Bayou Phase 2 (Missouri City)	To be served through the Mustang Bayou Phase 1				
Mustang Bayou Phase 1 (Missouri City)	1203	13469	1	334	

*

Participant	District Well No.	Permit No.	Aggregate Number of Wells	Current Connection Count	2006 Pumpage
Community Wells					
Estates of Silver Ridge	1087 & 1297	13508 & 13572	2	1	8,906,000
Waterbrook Community Assoc, Inc.	745	13727	1	1	32,750,000
Silver Ridge HOA	945	13711	1	1	36,086,000
Lake Shore Harbour	1102 & 1133	13461 & 13462	2	1	164,820,000
Manors of Silver Ridge POA	1317, 1318	13851, 13952	2	1	-
Riverstone	1009, 1229, 1289,1290	13491, 13492, 13568 & 13569	4	1	14,943,000
Sienna Point	891, 892, 862, 863	13504, 13505, 13506, 13507	4	1	44,297,000
Sienna Plantation RAI	908, 909, 1036, 1164, 1246, 1256, 1327		7	1	106,581,000
Sienna Plantation POA	847, 857		2	1	14,392,000
Lake Olympia	357, 358	14148, 14149	2	1	20,162,000
Total			***57***	***27,023***	***4,386,153,000***

MUD23/24 provided by MUD engineer
Sienna MUD 1 serves all Sienna MUDs. Data provided is for all the MUDs combined.
MUD 115 also serves MUD 129. Data presented is for both MUDs combined.
MUD 49 receives water from Palmer Plantation
MUD 149 is not yet active.
Community well pumpage was provided by the Subsidence District.



Legend

- ETJ
- City Limits
- Silver Ridge
- Waterbrook
- Blue Ridge West MUD
- First Colony MUD #9
- Fort Bend County MUD #115
- Fort Bend County MUD #129
- Fort Bend County MUD #149
- Fort Bend County MUD #23
- Fort Bend County MUD #24
- Fort Bend County MUD #26
- Fort Bend County MUD #42
- Fort Bend County MUD #46
- Fort Bend County MUD #47
- Fort Bend County MUD #48
- Fort Bend County MUD #49
- Meadowcreek MUD
- Palmer Plantation MUD #1
- Palmer Plantation MUD #2
- Quail Valley Utility District
- Sienna Plantation MUD #10
- Sienna Plantation MUD #12
- Sienna Plantation MUD #13
- Sienna Plantation MUD #2
- Sienna Plantation MUD #3
- Sienna Plantation MUD #4
- Sienna Plantation MUD #5
- Sienna Plantation MUD #6
- Sienna Plantation MUD #7
- Sienna Plantation Management District
- Thunderbird Utility District
- Mustang Bayou Utility Service Area

MISSOURI CITY TEXAS

GRP Participants

1 inch = 0.8 miles

This map has been produced from various sources. Every effort has been made to ensure the accuracy of this map. However, Missouri City assumes no liabilities or damages due to errors or omissions. If any errors are detected, please contact Public Works, Engineering Division so that they may be corrected.

Map By:
GIS/Engineering
October 2008

II. Missouri City Joint GRP Demand Projections

A. Methodology

In making projections for the Missouri City Joint GRP future water use, connection count and population data were first projected. Once a future connection count was projected, it was then possible to make projections of future water use. Future projections were evaluated and determined by current service providers (e.g. specific Utility District, City, private well, etc). Projections were made in this manner, as it was the most accurate way to evaluate the data and allowed for specific considerations to be given for land use, current demand, and ultimate build-out, as most of the current service providers are Municipal Utility Districts (MUDs) which usually represent a specific development. In making all projections, it was assumed that future development density, population, and per capita water consumption would follow trends consistent with available historical data.

Projection of Future Connection Count and Population

City planning data was heavily relied upon for the determination of the future connection count for all current service provider areas, or platted future service providers. The process that was utilized is outlined below.

Step 1: Acreage Analysis

1. For each independent service area, total acreage within the area was determined utilizing City maps and GIS information;
2. Using City planning data, and currently filed plats with the City, the platted acreage was then determined; and
3. The balance between the total acreage and platted acreage was determined as the vacant, not-platted acreage.

Table 2.1 outlines the results of the acreage analysis for each service area.

Table 2.1 Acreage Analysis

Participant	Total Acreage	Platted Acreage	Non-Platted Acreage
Sienna Plantation MUD #1, 4, 5, 6, 7	4,005.00	4,005.00	0.00
Sienna Plantation MUD #2	1,059.07	954.98	104.09
Sienna Plantation MUD #3	1,219.93	1,219.93	0.00
Sienna Plantation MUD #8, 10, 12	1,999.91	789.52	1,210.39
Sienna Plantation MUD #13	325.24	97.12	228.12
Fort Bend MUD #129	638.12	638.12	0.00
Fort Bend MUD #149	658.21	658.21	0.00
Blue Ridge West MUD	857.26	857.26	0.00
First Colony MUD #9	1,085.09	1,085.09	0.00
Fort Bend County MUD #115	309.78	309.78	0.00
Fort Bend County MUD #26	517.17	446.77	70.40
Fort Bend County MUD #42	536.02	536.02	0.00
Fort Bend County MUD #46	471.70	471.70	0.00
Fort Bend County MUD #47	628.95	628.95	0.00
Fort Bend County MUD #48	294.16	138.52	155.64
Fort Bend County MUD #49	131.47	120.51	10.96
Meadow Creek MUD	254.21	240.27	13.94
Palmer Plantation MUD #1	432.29	414.41	17.88
Palmer Plantation MUD #2	341.69	325.63	16.06
Quail Valley Utility District	1,731.23	1,651.07	80.16
Thunderbird Utility District	964.03	930.35	33.68
Fort Bend MUD #23/24	1,501.51	1,501.51	0.00
Mustang Bayou Phase 2	not applicable	not applicable	not applicable
Mustang Bayou Phase 1	not applicable	not applicable	not applicable

Mustang Bayou growth projections were taken from the City's adopted Impact Fee analysis.

Step 2: Customer Density Analysis

1. The platted connection/lots for each service area was determined utilizing City planning data and currently filed plats with the City; and
2. Platted acreage as determined in Step 1 was then divided by platted lots to determine the current lots per acre.

Table 2.2 outlines the results of the customer density analysis for each service area.

Table 2.2 Customer Density Analysis

Participant	Total Platted Lots	Total Platted Acreage	Platted Lots per Acre
Sienna Plantation MUD #1, 4, 5, 6, 7	10,000	4,005.00	2.50
Sienna Plantation MUD #2	1,945	954.98	2.04
Sienna Plantation MUD #3	2,806	1,219.93	2.30
Sienna Plantation MUD #8, 10, 12	1,058	789.52	1.34
Sienna Plantation MUD #13	108	97.12	Not Available
Fort Bend MUD #129	1,550	638.12	Not Available
Fort Bend MUD #149	1,700	658.21	Not Available
Blue Ridge West MUD	2,509	857.26	2.93
First Colony MUD #9	3,300	1,085.09	3.04
Fort Bend County MUD #115	580	309.78	1.87
Fort Bend County MUD #26	1,853	446.77	4.15
Fort Bend County MUD #42	1,507	536.02	2.81
Fort Bend County MUD #46	1,073	471.70	2.27
Fort Bend County MUD #47	1,000	628.95	1.59
Fort Bend County MUD #48	645	138.52	4.66
Fort Bend County MUD #49	363	120.51	3.01
Meadow Creek MUD	931	240.27	3.87
Palmer Plantation MUD #1	765	414.41	1.85
Palmer Plantation MUD #2	953	325.63	2.93
Quail Valley Utility District	4,305	1,651.07	2.61
Thunderbird Utility District	1,917	930.35	2.06
Fort Bend MUD #23/24	6,000	1,501.51	4.00
Mustang Bayou Phase 2	not applicable	not applicable	not applicable
Mustang Bayou Phase 1	not applicable	not applicable	not applicable
Average			***2.73***

* Community Wells and Reuse demand have been excluded from this analysis and will be included in the final demand projections.

Step 3: Projection of Non-Platted Lots

1. The vacant, non-platted acreage as determined in Step 1 was multiplied by the current lots per acre to make a projection of future, non-platted lots within each service area. The assumption in this instance is that future lots will be developed in a pattern similar to that of the currently platted areas within the service area.

Table 2.3 Projection of Non-Platted Lots

Participant	Non-Platted Acreage	Platted Lots per Acre	Projected Non-Platted Lots
Sienna Plantation MUD #1, 4, 5, 6, 7	0.00	2.50	0
Sienna Plantation MUD #2	104.09	2.04	212
Sienna Plantation MUD #3	0.00	2.30	0
Sienna Plantation MUD #8, 10, 12	1,210.39	1.34	1,622
Sienna Plantation MUD #13*	228.12	2.73	622
Fort Bend MUD #129*	0.00	2.73	0
Fort Bend MUD #149*	0.00	2.73	0
Blue Ridge West MUD	0.00	2.93	0
First Colony MUD #9	0.00	3.04	0
Fort Bend County MUD #115	0.00	1.87	0
Fort Bend County MUD #26	70.40	4.15	292
Fort Bend County MUD #42	0.00	2.81	0
Fort Bend County MUD #46	0.00	2.27	0
Fort Bend County MUD #47	0.00	1.59	0
Fort Bend County MUD #48	155.64	4.66	725
Fort Bend County MUD #49	10.96	3.01	33
Meadow Creek MUD	13.94	3.87	54
Palmer Plantation MUD #1	17.88	1.85	33
Palmer Plantation MUD #2	16.06	2.93	47
Quail Valley Utility District	80.16	2.61	209
Thunderbird Utility District	33.68	2.06	69
Fort Bend MUD #23/24	0.00	4.00	0
Mustang Bayou Phase 2	not applicable	not applicable	not applicable
Mustang Bayou Phase 1	not applicable	not applicable	not applicable

*Sienna MUD #13 & Fort Bend #149, were both assumed to have a build-out density equal to the system average.

* Community Wells and Reuse demand have been excluded from this analysis and will be included in the final demand projections.

Step 4: Projection of Build-out Connections

1. Total platted lots as determined in Step # 2 was added to the projection of non-platted lots (Step #3) to determine a projection of build-out connections within each service area.

Table 2.4 Projection of Build-out Connections

Participant	Total Platted Lots	Projected Non-Platted Lots	Total Projected Built-Out (Lots)
Sienna Plantation MUD #1, 4, 5, 6, 7	10,000	0	10,000
Sienna Plantation MUD #2	1,945	212	2,157
Sienna Plantation MUD #3	2,806	0	2,806
Sienna Plantation MUD #8, 10, 12	1,058	1,622	2,680
Sienna Plantation MUD #13	108	622	730
Fort Bend MUD #129	1,550	0	1,550
Fort Bend MUD #149	1,700	0	1,700
Blue Ridge West MUD	2,509	0	2,509
First Colony MUD #9	3,300	0	3,300
Fort Bend County MUD #115	580	0	580
Fort Bend County MUD #26	1,853	292	2,145
Fort Bend County MUD #42	1,507	0	1,507
Fort Bend County MUD #46	1,073	0	1,073
Fort Bend County MUD #47	1,000	0	1,000
Fort Bend County MUD #48	645	725	1,370
Fort Bend County MUD #49	363	33	396
Meadow Creek MUD	931	54	985
Palmer Plantation MUD #1	765	33	798
Palmer Plantation MUD #2	953	47	1,000
Quail Valley Utility District	4,305	209	4,514
Thunderbird Utility District	1,917	69	1,986
Fort Bend MUD #23/24	6,000	0	6,000
Mustang Bayou Phase 2	not applicable	not applicable	9,095
Mustang Bayou Phase 1	not applicable	not applicable	3,178
Total			63,059

MUD23/24 provided by MUD engineer
Mustang Bayou Phase 1 and Phase 2 according to the Impact Fee Analysis.

* Community Wells and Reuse demand have been excluded from this analysis and will be included in the final demand projections.

The above-described methodology was used for existing developments, both residential and commercial as they are currently platted. It must be noted that most of the areas listed above are residential developments, with some commercial. Most of the undeveloped commercial areas within Missouri City lie within the "Mustang Bayou Service Area." Projections for the Mustang Bayou Service area were made utilizing the City's Land Use Assumptions, for the Mustang Bayou Service Area Impact Fees. The connections as listed in the above table for the Mustang Bayou Service Area are listed as living unit equivalents, taking into consideration the possible increased usage associated with providing service to commercial development.

Step 5: Population Projection

1. The current population within the service area was thoroughly analyzed as some of the participants within the Missouri City Joint GRP lie outside of the city limits. Additionally, part of Missouri City actually lies within Harris County, meaning some of the service providers within the City are not participants in the plan. As a result, it is necessary to assume that the service area population per housing unit is similar to population per service unit for the City of Missouri City, as sited in the 2000 census. The 2000 Census stated a population of 52,913 with a total of 17,481 housing units, yielding 3.04 persons per housing unit. It was assumed that the current and future population would develop in much the same fashion.

Step 6: Projection of Build-Out Timing

1. In projecting the timing associated with the service area development and growth, the following assumptions were made:
   - Platted, vacant lots were assumed to develop in 10 years at a Levelized growth rate;
   - Non-Platted lots were assumed to begin development in 10 years at a Levelized growth rate for 30 years;
   - Sienna Plantation MUDs 1, 4, 5, 6, and 7 were assumed to remain at current connection count through 2012, then grow at a rate of 200 connections per year through 2015, 400 connections per year through 2020, and then at 600 connections per year thereafter. These assumptions were based on indications provided by the developer and the MUD engineer.
   - Sienna MUD 2 was provided by the engineer, and was assumed levelizing at 1604 connections even though potential build-out was 2157.
   - Sienna MUD 3 was provided by the engineer through 2012, and was assumed to grow at a rate of 50 connections per year thereafter.
   - Sienna MUD 13 was assumed to remain at constant connection count of 104, even though potential build-out was 730.
   - Mustang Bayou Phase 1 was assumed to develop at a Levelized growth rate over 20 years;
   - Mustang Bayou Phase 2 was assumed to begin development in 10 years at a Levelized growth rate over 30 years;
   - First Colony MUD #9 was assumed to grow at a rate of 10 homes per year through build-out;
   - Fort Bend County MUD#23, and Fort Bend County MUD #24 anticipated growth rate was provided by the system engineer; and It is important to note that growth projections can be highly sensitive to a variety of factors such as global and local economic conditions as well as developer interests. Many of these factors are outside the control of the City of Missouri City. In projecting growth for the City, each individual Utility District, its current connection count, plats, etc have been examined. The City has closely monitored historical growth, and has used data

provided by engineers in many of the Utility Districts in making these projections. Further, the City has compared these projections to historical growth as a means of assessing the reasonableness of the projections in the future. Appendix B presents historical building permits, and Table 2.8 presents historical growth in connection count, as a means of comparison.

Table 2.6: Projected Build-Out Timing (Connection Count)

Participant	Current Connection Count	Vacant Platted Lots	Projected Non-Platted Lots	Build-Out Connection Count	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Sienna Plantation MUD #1, 4, 5, 6, 7	13	9,987	0	10,000	13	13	13	13	13	213	413	613	1,013	1,413	1,813	2,213	2,613	3,213	3,813	4,413	5,013	5,613	6,213	6,813	7,413	8,013	8,613
Sienna Plantation MUD #2	1,592	353	212	2,157	1,592	1,596	1,602	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604
Sienna Plantation MUD #3	2,052	754	0	2,806	2,052	2,107	2,214	2,218	2,222	2,222	2,222	2,222	2,222	2,222	2,222	2,222	2,222	2,222	2,222	2,222	2,222	2,222	2,222	2,222	2,222	2,222	2,222
Sienna Plantation MUD #8, 10, 12	945	113	1,622	2,680	945	993	1,245	1,408	1,475	1,525	1,575	1,625	1,675	1,725	1,775	1,825	1,875	1,925	1,975	2,025	2,075	2,125	2,175	2,225	2,275	2,325	2,375
Sienna Plantation MUD #13	104	4	622	730	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104
Fort Bend MUD #129	521	1,029	0	1,550	521	624	727	830	933	1,036	1,138	1,241	1,344	1,447	1,447	1,447	1,447	1,447	1,447	1,447	1,447	1,447	1,447	1,447	1,447	1,447	1,447
Fort Bend MUD #149	0	1,700	0	1,700	170	340	510	680	850	1,020	1,190	1,360	1,530	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700
Blue Ridge West MUD	2,490	19	0	2,509	2,490	2,492	2,494	2,496	2,498	2,500	2,501	2,503	2,505	2,507	2,507	2,507	2,507	2,507	2,507	2,507	2,507	2,507	2,507	2,507	2,507	2,507	2,507
First Colony MUD #9	2,651	649	0	3,300	2,651	2,661	2,671	2,681	2,691	2,701	2,711	2,721	2,731	2,741	2,751	2,761	2,771	2,781	2,791	2,801	2,811	2,821	2,831	2,841	2,851	2,861	2,871
Fort Bend County MUD #115	535	45	0	580	535	540	544	549	553	558	562	567	571	576	580	580	580	580	580	580	580	580	580	580	580	580	580
Fort Bend County MUD #26	1,477	376	292	2,145	1,528	1,566	1,603	1,641	1,678	1,716	1,754	1,791	1,829	1,866	1,876	1,886	1,896	1,905	1,915	1,925	1,935	1,944	1,954	1,964	1,973	1,983	1,993
Fort Bend County MUD #42	1,300	207	0	1,507	1,300	1,321	1,341	1,362	1,383	1,404	1,424	1,445	1,466	1,486	1,486	1,486	1,486	1,486	1,486	1,486	1,486	1,486	1,486	1,486	1,486	1,486	1,486
Fort Bend County MUD #46	695	378	0	1,073	695	733	771	808	846	884	922	960	997	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035
Fort Bend County MUD #47	416	584	0	1,000	416	474	533	591	650	708	766	825	883	942	942	942	942	942	942	942	942	942	942	942	942	942	942
Fort Bend County MUD #48	631	14	725	1,370	631	632	634	635	637	638	639	641	642	644	668	692	716	740	764	789	813	837	861	885	909	933	958
Fort Bend County MUD #49	341	22	33	396	341	343	345	348	350	352	354	356	359	361	362	363	364	365	366	367	369	370	371	372	373	374	375
Meadow Creek MUD	847	84	54	985	847	855	864	872	881	889	897	906	914	923	924	926	928	930	932	933	935	937	939	941	942	944	946
Palmer Plantation MUD #1	580	185	33	798	580	599	617	636	654	673	691	710	728	747	748	749	750	751	752	753	754	755	756	758	759	760	761
Palmer Plantation MUD #2	812	141	47	1,000	812	826	840	854	868	883	897	911	925	939	940	942	944	945	947	948	950	951	953	955	956	958	959
Quail Valley Utility District	3,607	698	209	4,514	3,607	3,677	3,747	3,816	3,886	3,956	4,026	4,096	4,165	4,235	4,242	4,249	4,256	4,263	4,270	4,277	4,284	4,291	4,298	4,305	4,312	4,319	4,326
Thunderbird Utility District	1,917	0	69	1,986	1,917	1,917	1,917	1,917	1,917	1,917	1,917	1,917	1,917	1,917	1,919	1,922	1,924	1,926	1,929	1,931	1,933	1,936	1,938	1,940	1,942	1,945	1,947
Fort Bend MUD #23/24	3,153	2,847	0	6,000	4,100	4,600	5,000	5,400	5,700	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
Mustang Bayou Phase 2	0	9,095	0	9,095	0	-	-	-	-	-	-	-	-	-	455	910	1,364	1,819	2,274	2,729	3,183	3,638	4,093	4,548	5,002	5,457	5,912
Mustang Bayou Phase 1	334	2,844	0	3,178	334	476	618	761	903	1,045	1,187	1,329	1,472	1,614	1,756	1,898	2,040	2,183	2,325	2,467	2,609	2,751	2,894	3,036	3,036	3,036	3,036
																											.
Total Connections	*27,013*	*32,128*	*3,918*	*63,059*	*28,181*	*29,489*	*30,954*	*32,224*	*33,295*	*34,545*	*35,496*	*36,446*	*37,597*	*38,747*	*39,857*	*40,962*	*42,068*	*43,374*	*44,679*	*45,985*	*47,291*	*48,596*	*49,902*	*51,208*	*52,371*	*53,535*	*54,698*

* Community Wells and Reuse demand have been excluded from this analysis and will be included in the final demand projections.

Table 2.7 Projected Build-Out Timing (Population)

Participant	Current Population	Build-Out Population	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Sienna Plantation MUD #1, 4, 5, 6, 7	40	30,400	40	40	40	40	40	648	1,256	1,864	3,080	4,296	5,512	6,728	7,944	9,768	11,592	13,416	15,240	17,064	18,888	20,712	22,536	24,360	26,184
Sienna Plantation MUD #2	4,840	6,557	4,840	4,852	4,870	4,876	4,876	4,876	4,876	4,876	4,876	4,876	4,876	4,876	4,876	4,876	4,876	4,876	4,876	4,876	4,876	4,876	4,876	4,876	4,876
Sienna Plantation MUD #3	6,238	8,530	6,238	6,405	6,731	6,743	6,755	6,755	6,755	6,755	6,755	6,755	6,755	6,755	6,755	6,755	6,755	6,755	6,755	6,755	6,755	6,755	6,755	6,755	6,755
Sienna Plantation MUD #8, 10, 12	2,873	8,147	2,873	3,019	3,785	4,280	4,484	4,636	4,788	4,940	5,092	5,244	5,396	5,548	5,700	5,852	6,004	6,156	6,308	6,460	6,612	6,764	6,916	7,068	7,220
Sienna Plantation MUD #13	316	2,220	316	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317
Fort Bend MUD #129	1,584	4,712	1,584	1,897	2,209	2,522	2,835	3,148	3,461	3,774	4,086	4,399	4,399	4,399	4,399	4,399	4,399	4,399	4,399	4,399	4,399	4,399	4,399	4,399	4,399
Fort Bend MUD #149	0	5,168	517	1,034	1,550	2,067	2,584	3,101	3,618	4,134	4,651	5,168	5,168	5,168	5,168	5,168	5,168	5,168	5,168	5,168	5,168	5,168	5,168	5,168	5,168
Blue Ridge West MUD	7,570	7,627	7,570	7,575	7,581	7,587	7,593	7,598	7,604	7,610	7,616	7,622	7,622	7,622	7,622	7,622	7,622	7,622	7,622	7,622	7,622	7,622	7,622	7,622	7,622
First Colony MUD #9	8,059	10,032	8,059	8,089	8,120	8,150	8,181	8,211	8,241	8,272	8,302	8,333	8,363	8,393	8,424	8,454	8,485	8,515	8,545	8,576	8,606	8,637	8,667	8,697	8,728
Fort Bend County MUD #115	1,626	1,763	1,626	1,640	1,654	1,667	1,681	1,695	1,708	1,722	1,736	1,750	1,762	1,762	1,762	1,762	1,762	1,762	1,762	1,762	1,762	1,762	1,762	1,762	1,762
Fort Bend County MUD #26	4,490	6,521	4,645	4,759	4,874	4,988	5,102	5,217	5,331	5,445	5,560	5,674	5,703	5,733	5,763	5,792	5,822	5,851	5,881	5,911	5,940	5,970	5,999	6,029	6,059
Fort Bend County MUD #42	3,952	4,581	3,952	4,015	4,078	4,141	4,204	4,267	4,330	4,392	4,455	4,518	4,518	4,518	4,518	4,518	4,518	4,518	4,518	4,518	4,518	4,518	4,518	4,518	4,518
Fort Bend County MUD #46	2,113	3,262	2,113	2,228	2,343	2,458	2,572	2,687	2,802	2,917	3,032	3,147	3,147	3,147	3,147	3,147	3,147	3,147	3,147	3,147	3,147	3,147	3,147	3,147	3,147
Fort Bend County MUD #47	1,265	3,040	1,265	1,442	1,620	1,797	1,975	2,152	2,330	2,507	2,685	2,862	2,862	2,862	2,862	2,862	2,862	2,862	2,862	2,862	2,862	2,862	2,862	2,862	2,862
Fort Bend County MUD #48	1,918	4,164	1,918	1,922	1,927	1,931	1,935	1,940	1,944	1,948	1,952	1,957	2,030	2,103	2,177	2,250	2,324	2,397	2,471	2,544	2,617	2,691	2,764	2,838	2,911
Fort Bend County MUD #49	1,037	1,204	1,037	1,043	1,050	1,057	1,063	1,070	1,077	1,083	1,090	1,097	1,100	1,104	1,107	1,110	1,114	1,117	1,120	1,124	1,127	1,130	1,134	1,137	1,140
Meadow Creek MUD	2,575	2,994	2,575	2,600	2,626	2,651	2,677	2,703	2,728	2,754	2,779	2,805	2,810	2,816	2,821	2,827	2,832	2,838	2,843	2,848	2,854	2,859	2,865	2,870	2,876
Palmer Plantation MUD #1	1,763	2,426	1,763	1,819	1,876	1,932	1,988	2,044	2,101	2,157	2,213	2,269	2,273	2,276	2,279	2,283	2,286	2,289	2,293	2,296	2,299	2,303	2,306	2,309	2,313
Palmer Plantation MUD #2	2,468	3,040	2,468	2,511	2,554	2,597	2,640	2,683	2,726	2,769	2,811	2,854	2,859	2,864	2,869	2,873	2,878	2,883	2,888	2,892	2,897	2,902	2,907	2,911	2,916
Quail Valley Utility District	10,965	13,723	10,965	11,177	11,390	11,602	11,814	12,026	12,238	12,451	12,663	12,875	12,896	12,917	12,939	12,960	12,981	13,002	13,023	13,044	13,066	13,087	13,108	13,129	13,150
Thunderbird Utility District	5,828	6,039	5,828	5,828	5,828	5,828	5,828	5,828	5,828	5,828	5,828	5,828	5,835	5,842	5,849	5,856	5,863	5,870	5,877	5,884	5,891	5,898	5,905	5,912	5,919
Fort Bend MUD #23/24	9,585	18,240	12,464	13,984	15,200	16,416	17,328	18,240	18,240	18,240	18,240	18,240	18,240	18,240	18,240	18,240	18,240	18,240	18,240	18,240	18,240	18,240	18,240	18,240	18,240
Mustang Bayou Phase 2	0	27,649	0	0	0	0	0	0	0	0	0	0	1,382	2,765	4,147	5,530	6,912	8,295	9,677	11,060	12,442	13,824	15,207	16,589	17,972
Mustang Bayou Phase 1	1,015	9,661	1,015	1,448	1,880	2,312	2,745	3,177	3,609	4,041	4,474	4,906	5,338	5,771	6,203	6,635	7,067	7,500	7,932	8,364	8,797	9,229	9,229	9,229	9,229
Total Connections	*82,120*	*191,700*	*85,670*	*89,646*	*94,101*	*97,960*	*101,217*	*105,018*	*107,907*	*110,796*	*114,294*	*117,791*	*121,164*	*124,526*	*127,887*	*131,856*	*135,825*	*139,795*	*143,764*	*147,733*	*151,703*	*155,672*	*159,209*	*162,746*	*166,283*

Assumed 3.04 persons per connection

* Community Wells and Reuse demand have been excluded from this analysis and will be included in the final demand projections.

Projection of Future Water Demand

It was generally assumed that future water demand would follow closely with trends of historical water demand on a per connection and per capita basis. Thus, historical pumpage and billing data of each service provider was relied upon in making these projections.

Step 1: Average Use Analysis

1. Historical Pumpage and Connection Count data was obtained through annual pumpage reports and billing data provided by each service provider for 2005, 2006 and 2007. An annual average usage per connection, per month was determined by dividing the annual pumpage by the average connection count times 12 months. The same methodology was utilized to determine the average usage per capita per month for the same historical period.
2. Average Usage per Connection (or per capita) per month was then determined using a three year average of data.

Table 2.8 Annual Historical Connection and Population Count

Participant	Connections			Population		
	2005	2006	2007	2005	2006	2007
Sienna Plantation MUD #1, 4, 5, 6, 7	3,353	4,138	4,764	10,193	12,580	14,483
Sienna Plantation MUD #2				-	-	-
Sienna Plantation MUD #3				-	-	-
Sienna Plantation MUD #8, 10, 12				-	-	-
Sienna Plantation MUD #13				-	-	-
Fort Bend MUD #129				-	-	-
Fort Bend MUD #149				-	-	-
Blue Ridge West MUD	2,490	2,490	2,490	7,570	7,570	7,570
First Colony MUD #9	2,600	2,610	2,651	7,904	7,934	8,059
Fort Bend County MUD #115	609	769	1,056	1,851	2,338	3,210
Fort Bend County MUD #26	1,471	1,489	1,477	4,472	4,527	4,490
Fort Bend County MUD #42	1,286	1,306	1,300	3,909	3,970	3,952
Fort Bend County MUD #46	673	685	695	2,046	2,082	2,113
Fort Bend County MUD #47	962	1,032	1,047	2,924	3,137	3,183
Fort Bend County MUD #48				-	-	-
Fort Bend County MUD #49	342	341	341	1,040	1,037	1,037
Meadow Creek MUD	837	893	847	2,544	2,715	2,575
Palmer Plantation MUD #1	581	582	580	1,766	1,769	1,763
Palmer Plantation MUD #2	810	812	812	2,462	2,468	2,468
Quail Valley Utility District	4,378	4,394	3,607	13,309	13,358	10,965
Thunderbird Utility District	1,911	1,905	1,917	5,809	5,791	5,828
Fort Bend MUD #23/24	3,049	3,632	3,153	9,269	11,041	9,585
Mustang Bayou Phase 2				-	-	-
Mustang Bayou Phase 1			334	-	-	1,015
Total	***25,352***	***27,078***	***27,071***	***77,070***	***82,317***	***82,296***

MUD23/24 provided by MUD engineer
Sienna MUD 1 serves all Sienna MUDs. Data provided is for all the MUDs combined.
MUD 115 also serves MUD 129. Data presented is for both MUDs combined.
MUD 49 receives water from Palmer Plantation
MUD 149 is not yet active.
MUD 47 and 48 are served by the same system, data presented is combined.
* Community Wells and Reuse demand have been excluded from this analysis and will be included in the final demand projections.

Table 2.9 Annual Historical Pumpage

Participant	2005	2006	2007
Sienna Plantation MUD #1, 4, 5, 6, 7	660,317,000	753,815,000	700,935,000
Sienna Plantation MUD #2			
Sienna Plantation MUD #3			
Sienna Plantation MUD #8, 10, 12			
Sienna Plantation MUD #13			
Fort Bend MUD #129			
Fort Bend MUD #149			
Blue Ridge West MUD	390,007,000	350,800,000	293,443,000
First Colony MUD #9	409,947,000	415,970,000	340,241,000
Fort Bend County MUD #115	197,818,000	210,350,000	204,774,000
Fort Bend County MUD #26	168,141,000	150,443,000	128,225,000
Fort Bend County MUD #42	225,660,000	211,968,000	161,107,000
Fort Bend County MUD #46	142,834,000	145,771,000	120,436,000
Fort Bend County MUD #47	142,571,000	171,467,000	152,672,000
Fort Bend County MUD #48			
Fort Bend County MUD #49			
Meadow Creek MUD	98,366,000	90,355,000	81,927,000
Palmer Plantation MUD #1	163,245,000	155,250,000	234,559,000
Palmer Plantation MUD #2	137,637,000	134,920,000	
Quail Valley Utility District	562,600,000	567,436,000	491,316,000
Thunderbird Utility District	258,114,000	239,472,000	213,984,000
Fort Bend MUD #23/24	318,181,000	345,199,000	352,882,000
Mustang Bayou Phase 2			
Mustang Bayou Phase 1			14,122,000
Total Pumpage	***3,875,438,000***	***3,943,216,000***	***3,490,623,000***

MUD23/24 provided by MUD engineer
Sienna MUD 1 serves all Sienna MUDs. Data provided is for all the MUDs combined.
MUD 115 also serves MUD 129. Data presented is for both MUDs combined.
MUD 49 receives water from Palmer Plantation
MUD 149 is not yet active.
* Community Wells and Reuse demand have been excluded from this analysis and will be included in the final demand projections.

Table 2.10 Average Usage Analysis

Participant	Average Usage per Connection per Month				Average Usage per Capita per Day			
	2005	2006	2007*	3-Year Average	2005	2006	2007	3-Year Average
Sienna Plantation MUD #1, 4, 5, 6, 7	16,411	15,181	12,261	14,618	177	164	133	158
Sienna Plantation MUD #2								
Sienna Plantation MUD #3								
Sienna Plantation MUD #8, 10, 12								
Sienna Plantation MUD #13								
Fort Bend MUD #129								
Fort Bend MUD #149								
Blue Ridge West MUD	13,052	11,740	9,821	11,538	141	127	136	135
First Colony MUD #9	13,139	13,281	10,695	12,372	142	144	116	134
Fort Bend County MUD #115	27,069	22,795	16,160	22,008	293	247	350	296
Fort Bend County MUD #26	9,525	8,420	7,235	8,393	103	91	78	91
Fort Bend County MUD #42	14,623	13,525	10,327	12,825	158	146	223	176
Fort Bend County MUD #46	17,686	17,734	14,441	16,620	191	192	156	180
Fort Bend County MUD #47	12,350	13,846	12,152	12,783	134	150	131	138
Fort Bend County MUD #48								
Fort Bend County MUD #49	0	0	0	0	-	-	-	-
Meadow Creek MUD	9,794	8,432	8,061	8,762	106	91	116	104
Palmer Plantation MUD #1	23,414	22,229	33,701	26,448	253	240	486	326
Palmer Plantation MUD #2	14,160	13,846		14,003	153	150	-	101
Quail Valley Utility District	10,709	10,762	11,351	10,940	116	116	164	132
Thunderbird Utility District	11,256	10,476	9,302	10,344	122	113	134	123
Fort Bend MUD #23/24	8,696	7,920	9,327	8,648	94	86	110	97
Mustang Bayou Phase 2								
Mustang Bayou Phase 1			3,523	3,523			38	38
System Average	***12,739***	***12,135***	***10,745***	***11,873***	***138***	***131***	***116***	***128***

Step 2: Future Demand Projections

1. Future demand was assumed to follow similar patterns to historical demand on a per connection or per capita basis. Thus, the three year average usage per connection per month, as determined on Table 2.10 for each system provider was multiplied by the projected connections for each year time 12 months to make annual water demand projections.
2. Small privately held community wells with permitted pumpage above 10 million gallons per year were assumed to have annual pumpage equal to their actual 2006 pumpage.

Table 2.12 Projected Water Demand

Participant	Average Usage per Connection per Month	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Sienna Plantation MUD #1, 4, 5, 6, 7	14,618	2,280,346	2,280,346	2,280,346	2,280,346	2,280,346	37,362,595	72,444,843	107,527,092	177,691,589	247,856,086	318,020,583	388,185,080	458,349,577	563,596,323	668,843,069	774,089,815	879,336,560	984,583,306	1,089,830,052	1,195,076,797	1,300,323,543	1,405,570,289	1,510,817,034
Sienna Plantation MUD #2	14,618	279,254,699	279,956,344	281,008,811	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633
Sienna Plantation MUD #3	14,618	359,943,870	369,591,489	388,360,492	389,062,137	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782
Sienna Plantation MUD #8, 10, 12	14,618	165,763,624	174,183,364	218,386,997	246,979,030	258,731,583	267,502,145	276,272,707	285,043,270	293,813,832	302,584,394	311,354,956	320,125,518	328,896,080	337,666,642	346,437,205	355,207,767	363,978,329	372,748,891	381,519,453	390,290,015	399,060,577	407,831,140	416,601,702
Sienna Plantation MUD #13	14,618	18,242,769	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934
Fort Bend MUD #129	22,008	137,591,956	164,767,027	191,942,099	219,117,170	246,292,241	273,467,313	300,642,384	327,817,456	354,992,527	382,167,599	382,167,599	382,167,599	382,167,599	382,167,599	382,167,599	382,167,599	382,167,599	382,167,599	382,167,599	382,167,599	382,167,599	382,167,599	382,167,599
Fort Bend MUD #149	11,873	24,221,191	48,442,382	72,663,573	96,884,764	121,105,955	145,327,146	169,548,337	193,769,528	217,990,719	242,211,910	242,211,910	242,211,910	242,211,910	242,211,910	242,211,910	242,211,910	242,211,910	242,211,910	242,211,910	242,211,910	242,211,910	242,211,910	242,211,910
Blue Ridge West MUD	11,538	344,750,000	345,013,062	345,276,124	345,539,187	345,802,249	346,065,311	346,328,373	346,591,436	346,854,498	347,117,560	347,117,560	347,117,560	347,117,560	347,117,560	347,117,560	347,117,560	347,117,560	347,117,560	347,117,560	347,117,560	347,117,560	347,117,560	347,117,560
First Colony MUD #9	12,372	393,577,888	395,062,527	396,547,166	398,031,806	399,516,445	401,001,084	402,485,724	403,970,363	405,455,002	406,939,642	408,424,281	409,908,920	411,393,560	412,878,199	414,362,838	415,847,478	417,332,117	418,816,756	420,301,396	421,786,035	423,270,674	424,755,314	426,239,953
Fort Bend County MUD #115	22,008	141,289,244	142,477,658	143,666,073	144,854,487	146,042,901	147,231,315	148,419,729	149,608,144	150,796,558	151,984,972	153,041,340	153,041,347	153,041,353	153,041,359	153,041,365	153,041,372	153,041,378	153,041,384	153,041,390	153,041,397	153,041,403	153,041,409	153,041,415
Fort Bend County MUD #26	8,393	153,897,425	157,684,429	161,471,434	165,258,439	169,045,443	172,832,448	176,619,453	180,406,458	184,193,462	187,980,467	188,960,791	189,941,115	190,921,439	191,901,763	192,882,087	193,862,411	194,842,735	195,823,058	196,803,382	197,783,706	198,764,030	199,744,354	200,724,678
Fort Bend County MUD #42	12,825	200,072,607	203,258,379	206,444,150	209,629,922	212,815,693	216,001,465	219,187,236	222,373,008	225,558,779	228,744,551	228,744,551	228,744,551	228,744,551	228,744,551	228,744,551	228,744,551	228,744,552	228,744,552	228,744,552	228,744,552	228,744,552	228,744,552	228,744,552
Fort Bend County MUD #46	16,620	138,612,736	146,151,674	153,690,611	161,229,548	168,768,485	176,307,423	183,846,360	191,385,297	198,924,235	206,463,172	206,463,172	206,463,172	206,463,173	206,463,173	206,463,173	206,463,173	206,463,173	206,463,174	206,463,174	206,463,174	206,463,174	206,463,174	206,463,174
Fort Bend County MUD #47	12,783	63,810,438	72,768,441	81,726,445	90,684,449	99,642,453	108,600,456	117,558,460	126,516,464	135,474,468	144,432,471	144,432,471	144,432,472	144,432,472	144,432,472	144,432,472	144,432,472	144,432,472	144,432,472	144,432,472	144,432,472	144,432,472	144,432,472	144,432,472
Fort Bend County MUD #48	12,783	96,789,390	97,004,137	97,218,883	97,433,630	97,648,377	97,863,123	98,077,870	98,292,617	98,507,363	98,722,110	102,427,599	106,133,089	109,838,578	113,544,068	117,249,558	120,955,047	124,660,537	128,366,026	132,071,516	135,777,005	139,482,495	143,187,984	146,893,474
Fort Bend County MUD #49	26,448	108,226,251	108,924,485	109,622,719	110,320,953	111,019,187	111,717,421	112,415,654	113,113,888	113,812,122	114,510,356	114,859,481	115,208,605	115,557,730	115,906,855	116,255,979	116,605,104	116,954,229	117,303,353	117,652,478	118,001,602	118,350,727	118,699,852	119,048,976
Meadow Creek MUD	8,762	89,056,292	89,939,495	90,822,698	91,705,901	92,589,104	93,472,307	94,355,509	95,238,712	96,121,915	97,005,118	97,194,376	97,383,634	97,572,891	97,762,149	97,951,407	98,140,665	98,329,922	98,519,180	98,708,438	98,897,696	99,086,954	99,276,211	99,465,469
Palmer Plantation MUD #1	26,448	184,079,841	189,951,353	195,822,865	201,694,377	207,565,889	213,437,402	219,308,914	225,180,426	231,051,938	236,923,450	237,272,567	237,621,684	237,970,801	238,319,918	238,669,035	239,018,152	239,367,269	239,716,386	240,065,503	240,414,620	240,763,737	241,112,854	241,461,971
Palmer Plantation MUD #2	14,003	136,448,422	138,817,785	141,187,148	143,556,511	145,925,874	148,295,237	150,664,600	153,033,963	155,403,326	157,772,689	158,035,952	158,299,214	158,562,477	158,825,740	159,089,002	159,352,265	159,615,527	159,878,790	160,142,052	160,405,315	160,668,578	160,931,840	161,195,103
Quail Valley Utility District	10,940	473,547,163	482,710,898	491,874,633	501,038,368	510,202,103	519,365,838	528,529,573	537,693,308	546,857,043	556,020,778	556,935,401	557,850,024	558,764,647	559,679,270	560,593,893	561,508,516	562,423,139	563,337,762	564,252,385	565,167,008	566,081,631	566,996,254	567,910,878
Thunderbird Utility District	10,344	237,962,963	237,962,963	237,962,963	237,962,963	237,962,963	237,962,963	237,962,963	237,962,963	237,962,963	237,962,963	238,250,117	238,537,271	238,824,424	239,111,578	239,398,732	239,685,886	239,973,039	240,260,193	240,547,347	240,834,500	241,121,654	241,408,808	241,695,961
Fort Bend MUD #23/24	8,648	425,469,401	477,355,913	518,865,123	560,374,333	591,506,240	622,638,147	622,638,147	622,638,147	622,638,147	622,638,147	622,638,147	622,638,147	622,638,147	622,638,147	622,638,147	622,638,147	622,638,147	622,638,147	622,638,147	622,638,147	622,638,147	622,638,147	622,638,147
Mustang Bayou Phase 2	11,873	0	0	0	0	0	0	0	0	0	0	0	64,791,686	129,583,372	194,375,058	259,166,744	323,958,430	388,750,116	453,541,802	518,333,488	583,125,174	647,916,860	712,708,546	777,500,232
Mustang Bayou Phase 1	11,873	47,587,517	67,847,830	88,108,144	108,368,458	128,628,772	148,889,086	169,149,400	189,409,714	209,670,028	229,930,342	250,190,656	270,450,970	290,711,284	310,971,597	331,231,911	351,492,225	371,752,539	392,012,853	412,273,167	432,533,481	432,533,481	432,533,481	432,533,481
Community Wells		442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000
Total Demand		***4,665,413,033***	***4,853,401,916***	***5,076,199,432***	***5,264,616,345***	***5,425,465,654***	***5,617,713,575***	***5,778,829,588***	***5,939,945,602***	***6,136,143,865***	***6,332,342,127***	***6,505,908,546***	***6,678,418,603***	***6,850,928,661***	***7,058,520,967***	***7,266,113,272***	***7,473,705,578***	***7,681,297,884***	***7,888,890,190***	***8,096,482,496***	***8,304,074,802***	***8,491,406,794***	***8,678,738,786***	***8,866,070,778***

All Sienna MUDs were assumed to have the same average usage as Sienna MUD #1
Assumed MUD #149 had the same average usage as MUD #115, as it is served by MUD #115.
MUD #149 assumed system average usage as #149 is not yet active.
MUD #48 assumed same average usage as MUD #47 as it is served by MUD #47.
MUD #49 assumed same average usage as Palmer MUD #1 as it is served by Palmer MUD #1

III. Missouri City Joint GRP Conversion Plan

The participants of the Missouri City Joint GRP have determined that the most cost effective means of meeting the requirements set forth by the Subsidence District is a complete conversion from groundwater to surface water of a portion of the service area, while leaving the remaining service area on ground water supplies. Converting entities would largely consist as those lying in the southern portion of the City and its ETJ for the initial conversion required by 2013. As the 60% reduction requirement is approached in 2025, additional entities would be converted to surface water, generally moving northward on the system.

Initial Conversion Area

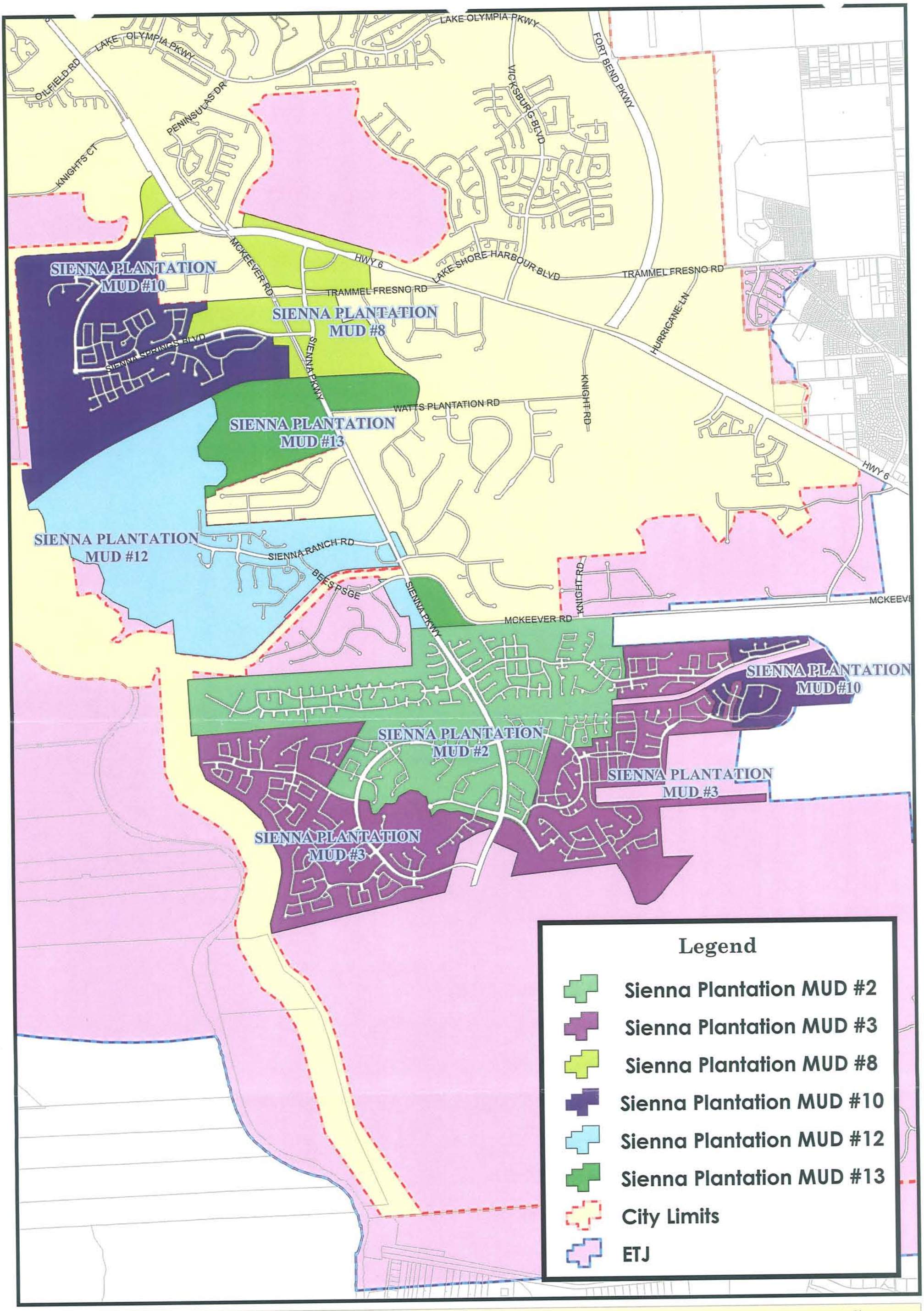
Map 3.1 and Table 3.1 identify the initial converting entities, which generally consist of Sienna Plantation MUDs . As illustrated on Table 3.1, each entity is only partially built-out. As a result, it is thought that the amount of groundwater infrastructure that may be abandoned or underutilized would be significantly less than a conversion of entities that are more fully built-out, thereby adding to the cost-effectiveness of this conversion strategy.

Table 3.1 Initial Converting Entities

Participant	Connection Count		Demand	
	Current	Build-Out	2008 Projected	2030 Projected Demand
Sienna Plantation MUD #2	1,592	2,157	279,254,699	281,359,633
Sienna Plantation MUD #3	2,052	2,806	359,943,870	389,763,782
Sienna Plantation MUD #8, 10, 12	945	2,680	165,763,624	416,601,702
Sienna Plantation MUD #13	104	730	18,242,769	18,312,934
Total	***4,693***	***8,373***	***823,204,963***	***1,106,038,050***

Ultimate Conversion Area

As the customers on the system grow, and thereby the amount of surface water to be supplied increases; as well as the increased conversion requirements in 2025 are realized, it may become necessary to convert additional entities to surface water. The City anticipates two additional conversion phases. Phase 2 would consist of Sienna MUDs 1, 4, 5, 6 and 7, Fort Bend County MUDs 46, 47, 48, and 149, and the Mustang Bayou Service Area. Phase 3 would consist of converting Fort Bend County MUDs #129 and 115. Map 3.2 and Table 3.2 identify the planned ultimate converting entities. Each participating entity in the Missouri City Joint GRP has agreed to convert to surface water when the GRP administrator deems the conversion necessary. The terms and conditions of this arrangement are detailed in the Inter local Agreements. (Appendix A).



missouri CITY TEXAS

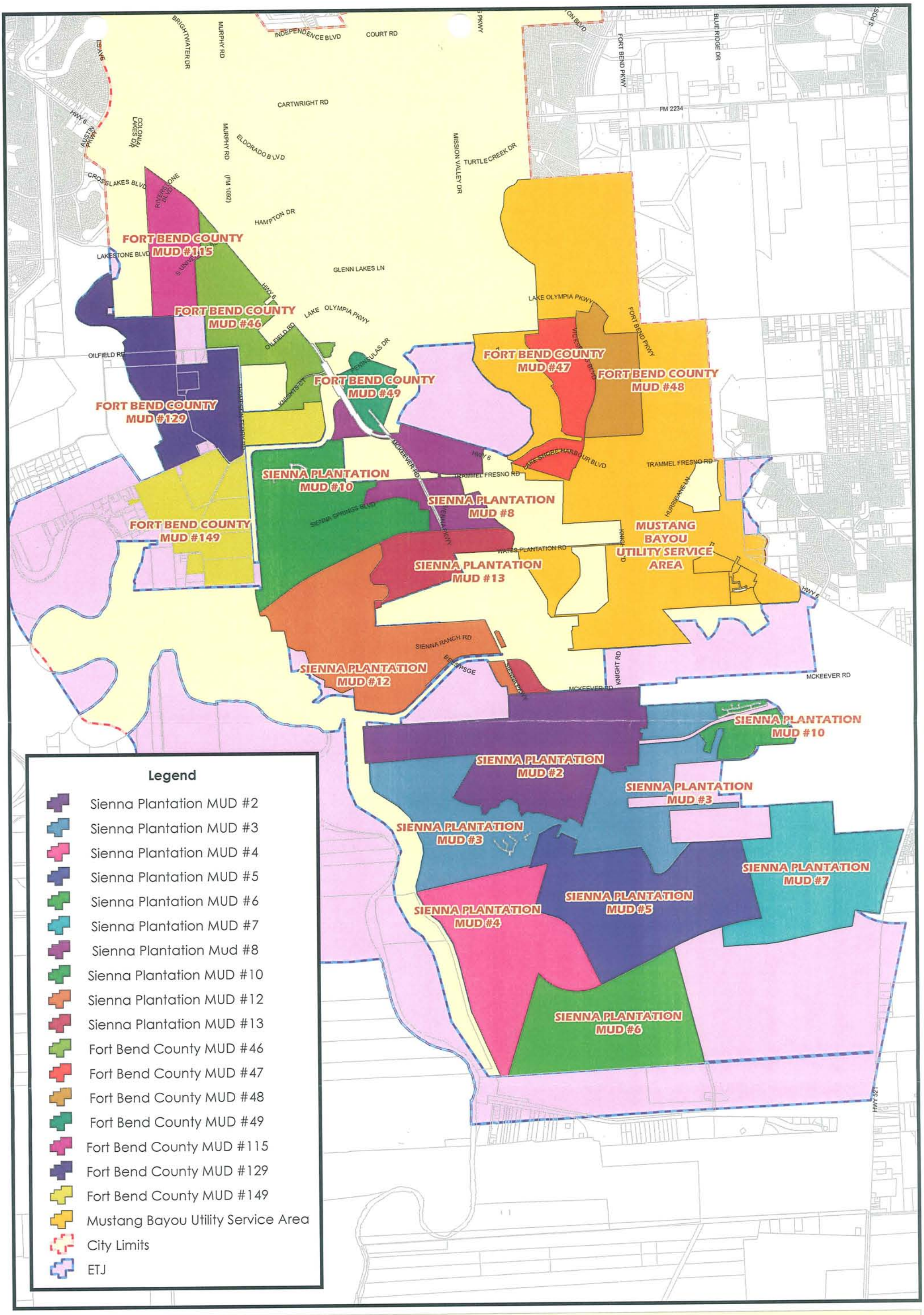
Initial Converting Entities

1 inch = 0.5 miles

This map has been produced from various sources. Every effort has been made to ensure the accuracy of this map. However, Missouri City assumes no liabilities or damages due to errors or omissions. If any errors are detected, please contact Public Works, Engineering Division so that they may be corrected.

N W E S

Map By:
GIS/Engineering
October 2008



MISSOURI CITY TEXAS

Ultimate Converting Entities

1 inch = 0.75 miles

This map has been produced from various sources. Every effort has been made to ensure the accuracy of this map. However, Missouri City assumes no liabilities or damages due to errors or omissions. If any errors are detected, please contact Public Works, Engineering Division so that they may be corrected.

N W E S

Map By:
GIS/Engineering
October 2008

Table 3.2 Ultimate Converting Entities

Participant	Connection Count		Demand	
	Current	Build-Out Projection	2008 Projected Demand	2030 Projected Demand
Sienna Plantation MUD #1, 4, 5, 6, 7	13	10,000	2,280,346	1,510,817,034
Sienna Plantation MUD #2	1,592	2,157	279,254,699	281,359,633
Sienna Plantation MUD #3	2,052	2,806	359,943,870	389,763,782
Sienna Plantation MUD #8, 10, 12	945	2,680	165,763,624	416,601,702
Sienna Plantation MUD #13	104	730	18,242,769	18,312,934
Fort Bend County MUD #46	695	1,073	138,612,736	206,463,174
Fort Bend County MUD #47	416	1,000	63,810,438	144,432,472
Fort Bend County MUD #48	631	1,370	96,789,390	146,893,474
Fort Bend MUD #129	521	1,550	137,591,956	382,167,599
Fort Bend MUD #149	0	1,700	24,221,191	242,211,910
Fort Bend County MUD #115	535	580	141,289,244	153,041,415
Mustang Bayou Phase 2	0	9,095	0	842,291,918
Mustang Bayou Phase 1	334	3,178	47,587,517	432,533,481
Total	***7,838***	***37,919***	***1,475,387,780***	***5,166,890,529***

Conversion Timing

A portion of the initial converting entities will require additional water supplies immediately. Therefore, rather than continuing to develop groundwater supplies, the project anticipates the new water treatment facility will be online in 2011. The initial converting entities will begin utilizing surface water supplies at that time. Through this early conversion, the Missouri City Joint GRP will be able to take advantage of the early conversion credits offered by the Subsidence District, thereby enabling the initial plant to be sized slightly smaller. Table 3.3 illustrates the planned conversion timing for each converting entity, based on currently available demand and growth projections.

Table 3.3 Planned Conversion Timing

Participant	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Sienna Plantation MUD #1,4,5,6,7	-	-	-	-	-	-	-	177,691,589	247,856,086	318,020,583	388,185,080	458,349,577	563,596,323	668,843,069	774,089,815	879,336,560	984,583,306	1,089,830,052	1,195,076,797	1,300,323,543	1,405,570,289	1,510,817,034
Sienna Plantation MUD #2	-	-	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633
Sienna Plantation MUD #3	-	-	389,062,137	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782
Sienna Plantation MUD #8, 10, 12	-	-	246,979,030	258,731,583	267,502,145	276,272,707	285,043,270	293,813,832	302,584,394	311,354,956	320,125,518	328,896,080	337,666,642	346,437,205	355,207,767	363,978,329	372,748,891	381,519,453	390,290,015	399,060,577	407,831,140	416,601,702
Sienna Plantation MUD #13	-	-	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934
Fort Bend County MUD #46	-	-	-	-	-	-	-	198,924,235	206,463,172	206,463,172	206,463,172	206,463,173	206,463,173	206,463,173	206,463,173	206,463,173	206,463,174	206,463,174	206,463,174	206,463,174	206,463,174	206,463,174
Fort Bend County MUD #47	-	-	-	-	-	-	-	135,474,468	144,432,471	144,432,471	144,432,472	144,432,472	144,432,472	144,432,472	144,432,472	144,432,472	144,432,472	144,432,472	144,432,472	144,432,472	144,432,472	144,432,472
Fort Bend County MUD #48	-	-	-	-	-	-	-	98,507,363	98,722,110	102,427,599	106,133,089	109,838,578	113,544,068	117,249,558	120,955,047	124,660,537	128,366,026	132,071,516	135,777,005	139,482,495	143,187,984	146,893,474
Fort Bend MUD #129	-	-	-	-	-	-	-	113,812,122	114,510,356	114,859,481	115,208,605	115,557,730	115,906,855	116,255,979	116,605,104	116,954,229	117,303,353	117,652,478	118,001,602	118,350,727	118,699,852	119,048,976
Fort Bend MUD #149	-	-	-	-	-	-	-	-	-	64,791,686	129,583,372	194,375,058	259,166,744	323,958,430	388,750,116	453,541,802	518,333,488	583,125,174	647,916,860	712,708,546	777,500,232	842,291,918
Fort Bend County MUD #115	-	-	-	-	-	-	-	209,670,028	229,930,342	250,190,656	270,450,970	290,711,284	310,971,597	331,231,911	351,492,225	371,752,539	392,012,853	412,273,167	432,533,481	432,533,481	432,533,481	432,533,481
Mustang Bayou Phase 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	382,167,599
Mustang Bayou Phase 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	242,211,910
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	153,041,415
Total Demand	***0***	***0***	***935,713,734***	***948,167,932***	***956,938,494***	***965,709,056***	***974,479,618***	***1,917,329,985***	***2,033,935,280***	***2,201,976,954***	***2,370,018,627***	***2,538,060,301***	***2,741,184,223***	***2,944,308,145***	***3,147,432,067***	***3,350,555,989***	***3,553,679,912***	***3,756,803,834***	***3,959,927,756***	***4,142,791,364***	***4,325,654,973***	***5,285,939,505***

The Missouri City Joint GRP will take advantage of available credits for water reuse, as well as over-conversion credits described above. Table 3.4 illustrates the conversion plan, the associated timing of groundwater versus surface water supplies and the anticipated "credit bank" associated with this plan.

Table 3.4 GRP Conversion Plan and Credit Bank

Total System Demand	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Potable Demand	4,410,464,916	4,633,262,432	4,821,679,345	4,982,528,654	5,174,776,575	5,335,892,588	5,497,008,602	5,693,206,865	5,889,405,127	6,062,971,546	6,235,481,603	6,407,991,661	6,615,583,967	6,823,176,272	7,030,768,578	7,238,360,884	7,445,953,190	7,653,545,496	7,861,137,802	8,048,469,794	8,235,801,786	8,423,133,778
Private Wells	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000	442,937,000
Reuse Demand	208,295,701	208,295,702	208,295,703	208,295,704	208,295,705	208,295,706	208,295,707	208,295,708	208,295,709	208,295,710	208,295,711	208,295,712	208,295,713	208,295,714	208,295,715	208,295,716	208,295,717	208,295,718	208,295,719	208,295,720	208,295,721	208,295,722
Total System Demand	***5,061,697,617***	***5,284,495,134***	***5,472,912,048***	***5,633,761,358***	***5,826,009,280***	***5,987,125,294***	***6,148,241,309***	***6,344,439,573***	***6,540,637,836***	***6,714,204,256***	***6,886,714,314***	***7,059,224,373***	***7,266,816,680***	***7,474,408,986***	***7,682,001,293***	***7,889,593,600***	***8,097,185,907***	***8,304,778,214***	***8,512,370,521***	***8,699,702,514***	***8,887,034,507***	***9,074,366,500***

*Potable Demand = Total System Demand from Table 2.12 less Private Wells

Surface Water Conversion	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Sienna Plantation MUD #1, 4, 5, 6, 7								177,691,589	247,856,086	318,020,583	388,185,080	458,349,577	563,596,323	668,843,069	774,089,815	879,336,560	984,583,306	1,089,830,052	1,195,076,797	1,300,323,543	1,405,570,289	1,510,817,034
Sienna Plantation MUD #2			281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633	281,359,633
Sienna Plantation MUD #3			389,062,137	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782	389,763,782
Sienna Plantation MUD #8, 10, 12			246,979,030	258,731,583	267,502,145	276,272,707	285,043,270	293,813,832	302,584,394	311,354,956	320,125,518	328,896,080	337,666,642	346,437,205	355,207,767	363,978,329	372,748,891	381,519,453	390,290,015	399,060,577	407,831,140	416,601,702
Sienna Plantation MUD #13			18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934	18,312,934
Fort Bend County MUD #46								198,924,235	206,463,172	206,463,172	206,463,172	206,463,173	206,463,173	206,463,173	206,463,173	206,463,173	206,463,174	206,463,174	206,463,174	206,463,174	206,463,174	206,463,174
Fort Bend County MUD #47								135,474,468	144,432,471	144,432,471	144,432,472	144,432,472	144,432,472	144,432,472	144,432,472	144,432,472	144,432,472	144,432,472	144,432,472	144,432,472	144,432,472	144,432,472
Fort Bend County MUD #48								98,507,363	98,722,110	102,427,599	106,133,089	109,838,578	113,544,068	117,249,558	120,955,047	124,660,537	128,366,026	132,071,516	135,777,005	139,482,495	143,187,984	146,893,474
Fort Bend County MUD #49								113,812,122	114,510,356	114,859,481	115,208,605	115,557,730	115,906,855	116,255,979	116,605,104	116,954,229	117,303,353	117,652,478	118,001,602	118,350,727	118,699,852	119,048,976
Mustang Phase 1								-	-	64,791,686	129,583,372	194,375,058	259,166,744	323,958,430	388,750,116	453,541,802	518,333,488	583,125,174	647,916,860	712,708,546	777,500,232	842,291,918
Mustang Phase 2								209,670,028	229,930,342	250,190,656	270,450,970	290,711,284	310,971,597	331,231,911	351,492,225	371,752,539	392,012,853	412,273,167	432,533,481	432,533,481	432,533,481	432,533,481
Fort Bend MUD #129																						382,167,599
Fort Bend MUD #149																						242,211,910
Fort Bend County MUD #115																						153,041,415
Total Surface Water Usage	-	-	***935,713,734***	***948,167,932***	***956,938,494***	***965,709,056***	***974,479,618***	***1,917,329,985***	***2,033,935,280***	***2,201,976,954***	***2,370,018,627***	***2,538,060,301***	***2,741,184,223***	***2,944,308,145***	***3,147,432,067***	***3,350,555,989***	***3,553,679,912***	***3,756,803,834***	***3,959,927,756***	***4,142,791,364***	***4,325,654,973***	***5,285,939,505***

Reuse Pumpage	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Quail Valley Reuse	208,295,701	208,295,702	208,295,703	208,295,704	208,295,705	208,295,706	208,295,707	208,295,708	208,295,709	208,295,710	208,295,711	208,295,712	208,295,713	208,295,714	208,295,715	208,295,716	208,295,717	208,295,718	208,295,719	208,295,720	208,295,721	208,295,722
Sienna Reuse	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riverstone Reuse		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Annual Reuse	***208,295,701***	***208,295,702***	***208,295,703***	***208,295,704***	***208,295,705***	***208,295,706***	***208,295,707***	***208,295,708***	***208,295,709***	***208,295,710***	***208,295,711***	***208,295,712***	***208,295,713***	***208,295,714***	***208,295,715***	***208,295,716***	***208,295,717***	***208,295,718***	***208,295,719***	***208,295,720***	***208,295,721***	***208,295,722***

Total Alternative Water Supply	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Surface Water Usage	-	-	935,713,734	948,167,932	956,938,494	965,709,056	974,479,618	1,917,329,985	2,033,935,280	2,201,976,954	2,370,018,627	2,538,060,301	2,741,184,223	2,944,308,145	3,147,432,067	3,350,555,989	3,553,679,912	3,756,803,834	3,959,927,756	4,142,791,364	4,325,654,973	5,285,939,505
Reuse Demand	208,295,701	208,295,702	208,295,703	208,295,704	208,295,705	208,295,706	208,295,707	208,295,708	208,295,709	208,295,710	208,295,711	208,295,712	208,295,713	208,295,714	208,295,715	208,295,716	208,295,717	208,295,718	208,295,719	208,295,720	208,295,721	208,295,722
Total Alternative Water Supply	***208,295,701***	***208,295,702***	***1,144,009,437***	***1,156,463,636***	***1,165,234,199***	***1,174,004,762***	***1,182,775,325***	***2,125,625,693***	***2,242,230,989***	***2,410,272,664***	***2,578,314,338***	***2,746,356,013***	***2,949,479,936***	***3,152,603,859***	***3,355,727,782***	***3,558,851,705***	***3,761,975,629***	***3,965,099,552***	***4,168,223,475***	***4,351,087,084***	***4,533,950,694***	***5,494,235,227***

Required Alternative Water Supply	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Required Alternative Supply (%)	0%	0%	0%	0%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	60%	60%	60%	60%	60%	60%
Total System Demand	5,061,697,617	5,284,495,134	5,472,912,048	5,633,761,358	5,826,009,280	5,987,125,294	6,148,241,309	6,344,439,573	6,540,637,836	6,714,204,256	6,886,714,314	7,059,224,373	7,266,816,680	7,474,408,986	7,682,001,293	7,889,593,600	8,097,185,907	8,304,778,214	8,512,370,521	8,699,702,514	8,887,034,507	9,074,366,500
Required Alternative Supply (Gallons)	-	-	-	-	***1,747,802,784***	***1,796,137,588***	***1,844,472,393***	***1,903,331,872***	***1,962,191,351***	***2,014,261,277***	***2,066,014,294***	***2,117,767,312***	***2,180,045,004***	***2,242,322,696***	***2,304,600,388***	***2,366,878,080***	***4,858,311,544***	***4,982,866,928***	***5,107,422,313***	***5,219,821,508***	***5,332,220,704***	***5,444,619,900***

Credit Bank Calculation	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Over Conversion from Reuse	208,295,701	208,295,702	208,295,703	208,295,704	-	-	-	208,295,708	208,295,709	208,295,710	208,295,711	208,295,712	208,295,713	208,295,714	208,295,715	208,295,716	-	-	-	-	-	49,615,328
Over Conversion from Surface Water	-	-	935,713,734	948,167,932	-	-	-	13,998,113	71,743,929	187,715,677	304,004,333	420,292,989	561,139,219	701,985,449	842,831,679	983,677,909	-	-	-	-	-	-
Under Conversion	-	-	-	-	(582,568,585)	(622,132,826)	(661,697,067)	-	-	-	-	-	-	-	-	-	(1,096,335,916)	(1,017,767,377)	(939,198,837)	(868,734,424)	(798,270,011)	-
Total Over/Under Conversion	***208,295,701***	***208,295,702***	***1,144,009,437***	***1,156,463,636***	***(582,568,585)***	***(622,132,826)***	***(661,697,067)***	***222,293,821***	***280,039,638***	***396,011,387***	***512,300,044***	***628,588,701***	***769,434,932***	***910,281,163***	***1,051,127,394***	***1,191,973,625***	***(1,096,335,916)***	***(1,017,767,377)***	***(939,198,837)***	***(868,734,424)***	***(798,270,011)***	***49,615,328***
Reuse Over Conversion Multiplier	1.5																					
Reuse Over Conversion Credits	312,443,552	312,443,553	312,443,555	312,443,556	-	-	-	312,443,562	312,443,564	312,443,565	312,443,567	312,443,568	312,443,570	312,443,571	312,443,573	312,443,574	-	-	-	-	-	74,422,991
Surface Water Over Conversion Credits	-	-	935,713,734	948,167,932	-	-	-	13,998,113	71,743,929	187,715,677	304,004,333	420,292,989	561,139,219	701,985,449	842,831,679	983,677,909	-	-	-	-	-	-
Under Conversion	-	-	-	-	(582,568,585)	(622,132,826)	(661,697,067)	-	-	-	-	-	-	-	-	-	(1,096,335,916)	(1,017,767,377)	(939,198,837)	(868,734,424)	(798,270,011)	-
Annual Credit Contribution	***312,443,552***	***312,443,553***	***1,248,157,288***	***1,260,611,488***	***(582,568,585)***	***(622,132,826)***	***(661,697,067)***	***326,441,675***	***384,187,493***	***500,159,242***	***616,447,899***	***732,736,557***	***873,582,789***	***1,014,429,020***	***1,155,275,252***	***1,296,121,483***	***(1,096,335,915)***	***(1,017,767,377)***	***(939,198,837)***	***(868,734,424)***	***(798,270,011)***	***74,422,991***
Credit "Bank" Balance	***312,443,552***	***624,887,105***	***1,873,044,393***	***3,133,655,881***	***2,551,087,296***	***1,928,954,469***	***1,267,257,402***	***1,593,699,077***	***1,977,886,570***	***2,478,045,812***	***3,094,493,711***	***3,827,230,268***	***4,700,813,057***	***5,715,242,077***	***6,870,517,329***	***8,166,638,812***	***7,070,302,897***	***6,052,535,520***	***5,113,336,683***	***4,244,602,259***	***3,446,332,248***	***3,520,755,240***

Contingency Planning

As any GRP is a "plan" based on certain assumptions and projections into the future, the Missouri City GRP must remain somewhat dynamic in nature. The Missouri City Joint GRP was developed utilizing certain assumptions pertaining to system growth and future demands, and to some extent the ability of this plan to meet conversion requirements does hinge on the actual system demands, it was determined necessary to develop a contingency plan. In general, all participants of the Missouri City Joint GRP have agreed to convert to surface water if and when it is determined necessary by the GRP administrator. Therefore, if at any point in time, the conversion of the above outlined entities does not allow the Joint GRP to meet conversion requirements, additional entities may be required to convert to surface water. As the GRP administrator, the City of Missouri City will closely monitor actual development, actual demands and compliance with Subsidence District guidelines annually. In the event that the actual conversion percentage falls below that projected by the plan in a material manner, the City will begin to evaluate the situation and take actions to adjust the GRP as necessary.

Table 3.3 has outlined conversion timing and the planned converting entities. In the event that the projected growth and subsequent water demands deviate from those projected, the City may accelerate or decelerate the conversion of the Phase 2 or Phase 3 entities, depending on the situation.

IV. Surface Water Supply

The Missouri City Joint GRP will rely entirely upon surface water that will be treated by a new surface water treatment plant to be owned and operated by the City. The City of Missouri City will provide the raw surface through a contact with the Gulf Coast Water Authority.

Initial Surface Water Supply

In 1997, the City of Missouri City entered into an option water agreement with the Gulf Coast Water Authority (GCWA). This agreement allowed the City the "option" to eventually purchase raw water from the GCWA in an amount up to 15 MGD. The agreement further required the City to "convert" to a "take-of-pay" contract by 2009. The City will exercise its option to take the entire 15 MGD. Please see Appendix C for a copy of this agreement.

As illustrated on Table 4.1, based on current projected demands this water will allow the City to meet the Subsidence District's conversion requirements through 2023.

Table 4.1– Required Water Supply and Plant Capacity

Participant	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Build-Out
Sienna Plantation MUD #1, 4, 5, 6, 7								1,013	1,413	1,813	2,213	2,613	3,213	3,813	4,413	5,013	5,613	6,213	6,813	7,413	8,013	8,613	10,000
Sienna Plantation MUD #2			1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	2,157
Sienna Plantation MUD #3			2,218	2,222	2,222	2,222	2,222	2,222	2,222	2,222	2,222	2,222	2,222	2,222	2,222	2,222	2,222	2,222	2,222	2,222	2,222	2,222	2,806
Sienna Plantation MUD #8, 10, 12			1,408	1,475	1,525	1,575	1,625	1,675	1,725	1,775	1,825	1,875	1,925	1,975	2,025	2,075	2,125	2,175	2,225	2,275	2,325	2,375	2,680
Sienna Plantation MUD #13			104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	730
Fort Bend County MUD #46								997	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,073
Fort Bend County MUD #47								883	942	942	942	942	942	942	942	942	942	942	942	942	942	942	1,000
Fort Bend County MUD #48								642	644	668	692	716	740	764	789	813	837	861	885	909	933	958	1,370
Fort Bend County MUD #49								359	361	362	363	364	365	366	367	369	370	371	372	373	374	375	396
Mustang Bayou Phase 2								-	-	455	910	1,364	1,819	2,274	2,729	3,183	3,638	4,093	4,548	5,002	5,457	5,912	9,095
Mustang Bayou Phase 1								1,472	1,614	1,756	1,898	2,040	2,183	2,325	2,467	2,609	2,751	2,894	3,036	3,036	3,036	3,036	3,178
Fort Bend MUD #129																						1,447	1,550
Fort Bend MUD #149																						1,700	1,700
Fort Bend County MUD #115																						580	580
																						-	
Total Connection Count	0	0	5,334	5,405	5,455	5,505	5,555	10,971	11,663	12,736	13,808	14,880	16,152	17,424	18,697	19,969	21,241	22,513	23,785	24,915	26,045	30,902	38,315
Required gpm per connection	0.6																						
Total Required MAX DAY Water Supply/Plant Capacity (gpd)	-	-	4,608,922	4,670,266	4,713,466	4,756,666	4,799,866	9,479,290	10,077,178	11,003,565	11,929,952	12,856,339	13,955,526	15,054,713	16,153,900	17,253,087	18,352,274	19,451,461	20,550,648	21,526,975	22,503,301	26,699,410	33,104,029

Additional Surface Water Supply

As illustrated on Table 4.1, the 15 MGD of raw water supplies obtained from the GCWA will meet the Missouri City Joint GRP's peak day needs through 2023. Beyond 2023, the City may need to obtain additional supplies; pending final negotiations of the GCWA water supply contract and actual growth and demands into the future. Unfortunately, the GCWA does not have any additional water that can be acquired; therefore, alternative sources are being sought. The City has identified several options for this additional water, including, but not limited to, the City of Houston and the Brazos River Authority. The City is continuing to explore other options and will secure additional water supplies as necessary to meet GRP requirements. The City will identify and execute a contract for the additional required raw water supplies, as necessary by the project milestone date of 2018.

Surface Water Treatment

The City of Missouri City will construct and operate a surface water treatment plant. The City of Missouri City will retain ownership of the raw water to be treated by the plant. The treated surface water will be distributed to the converting entities in accordance with the Missouri City Joint GRP, as directed by the City of Missouri City. The initial plant size will be 10 MGD, which is projected to meet the City's required maximum demand through 2018, at which time the plant will be expanded to its ultimate capacity.

V. Infrastructure Plan

Introduction

As discussed in a previous section, the participating entities situated in the northern half of the City (north of SH6) are generally built out and currently operate groundwater production and distribution systems independent of each other. Conversion of these existing systems independently or as a combined system would be, a complex endeavor given the age, size and operating pressures of the respective systems.

To the south of SH6, the largely undeveloped Sienna Plantation provides a mechanism for the creation and expansion of a surface water system with a limited amount of actual conversion from groundwater. Conversion of existing Sienna Plantation customers and expansion of a surface water system based on projected growth in this area results in a significant amount of surface water usage.

Definition of Infrastructure Requirements

The plant will be located near the Gulf Coast Water Authority's intake structure for the Brisco Canal on the Brazos River approximately 1.8 miles due west of Sienna Parkway. The site consists of approximately 40 acres

The conceptual design report included in Appendix D illustrates the schematic plan and associated infrastructure design through 2018. Based on the demand projections presented earlier, the plant will initially be designed for a capacity of 10 MGD. It has been determined that a Membrane Filtration Technology will be employed in the design of the plant. The plant

will provide for approximately 100 acres of off-channel storage. The current schedule brings the plant on line in 2011.

It is anticipated that treated water will be transmitted to the converting entities by a low-pressure system that will deliver water through an air gap into the respective ground water storage tanks. The location, size, and length of transmission piping proposed for the initial conversion are illustrated in the conceptual design report included in Appendix E.

As noted, the plant will require an expansion to an approximate ultimate capacity of 33 MGD. Details related to that expansion and associated transmission lines are provided in the engineering report included in Appendix E.

Infrastructure Timetable

Design has begun for the first phase of the water treatment plant and associated infrastructure. Appendix D and E also illustrate projected milestones for the construction of the initial plant as well as future expansions.

VI. Missouri City Joint GRP Financial Plan

The City of Missouri City will issue bonds backed by the City's general fund revenues. The City will establish a separate enterprise fund that will provide for separate accounting of the surface water treatment plant and GRP related costs. The costs of annual debt service and operation and maintenance of the plant will be reimbursed by annual user fees.

The City has also entered into inter-local agreements (Appendix A) with each individual stakeholder for payment of GRP participation/pumpage fees (described below).

Cost Sharing Program

A pumpage fee and water use fee will be assessed to each participant and will be collected by the GRP administrator. These fees are determined through projected costs and pumpage; however, an end of the year "true-up" will be performed as a means of assuring that no single one entity will bear greater risk than the other entities. The mechanism for calculation of these fees is outlined in the Interlocal Agreements contained in Appendix A.

Cash Flow

Participants are required to make payments to assist in the cash-flow requirements associated with plant design and construction. These payments will be used to offset engineering fees, consulting, raw water purchase, as well as historical costs incurred to develop this GRP.

VII. Other Considerations

Reclaimed Water Reuse

The use of reclaimed water for irrigation of golf courses and landscaped areas is a desirable means of not only meeting the guidelines set forth by the Subsidence District, but also an effective means of utilizing limited water resources more effectively. Fortunately, some significant water reuse projects are already operational and have established track records for usage, and new projects have been planned.

Quail Valley Utility District has an established track record of reuse demands. As a result, it was assumed that their usage would continue into the future in an amount equal to their last years' usage. Quail Valley Utility District has been using reuse water prior to the 2003 adoption of the Subsidence District's regulatory plan. While Quail Valley Utility District has not yet received official credits for their historical reuse, the Missouri City GRP Administrator intends to apply for these credits in 2009. These credits would transfer to the Missouri City GRP upon well aggregation. In the interest of being conservative, these additional credits have not been included in the credit bank calculations outlined on Table 3.4.

The Riverstone Development has a proposed reuse project that may become active within the planning period. Currently, this development is in negotiations with the City for the acquisition of reuse water in the amount of 1.5 MGD. However, as this project is in the planning stages, in the interest of being conservative, this reuse has not been included in the plan.

Sienna Plantation also has a proposed reuse project; however, it is unknown at this time if or when this project will become active. As a result, in the interest of being conservative, usage for this reclaimed water has not yet been included in the Joint GRP. In the event that this usage occurs, and thus a smaller plant and/or surface water supplies will suffice, the City will simply post-pone plant expansions and the acquisition of additional water supplies until such time as they are necessary.

Water Conservation and Best Management Practices

It is a well-established fact that water conservation is one of the most cost-effective means of obtaining water supplies to meet future water demands. Each participant in the Missouri City Joint GRP is encouraged to implement water conservation strategies and best management practices. However, as the effectiveness of various strategies may not be reliably quantifiable, this current plan assumes that future consumption patterns will follow closely to historical consumption on a per capita basis.

Early/Over Conversion

The Missouri City Joint GRP is actively pursuing financing in order to begin the immediate construction of the treatment plant. The new plant is projected to be operational by the second quarter of 2011. As a result, certain early conversion credits will be accumulated. Table 3.4 illustrates the planned usage of these credits, which would allow for a smaller initial plant size.

VIII. Summary and Conclusions

The Missouri City Joint Ground Water Reduction Plant will bring together 39 entities to provide surface water and meet the groundwater reduction requirements set forth by the Fort Bend Subsidence District. The participants in the Missouri City Joint GRP include mostly entities lying within the city limits of Missouri City as well as some entities within the City's ETJ and outlying areas. Together, these entities have identified a plan for which as a whole, the participants will meet the groundwater reduction requirements set forth by the Subsidence District.

Population projections and subsequent water demand projections were made for each individual stakeholder group based on current build-out density, City planning documents, and acreage estimates. The participants will meet the groundwater reduction requirements through the conversion of some entities, largely those lying to the southern portion of the City and its ETJ entirely to surface water. While most entities lying to the northern portion of the City will remain on ground water supplies. The basic philosophy associated with this conversion plan is that those entities in the southern portion of the City are largely undeveloped, and thus, groundwater supplies in that area are also largely undeveloped in that area. This should limit the cost impact associated with the abandonment of groundwater infrastructure upon conversion. Additionally, this plan considers that there are few interconnections within the built-out entities, thereby making it quite difficult to provide surface water to these entities without the construction of an entirely new transmission system throughout the City.

Initial raw water supplies would be obtained through a pre-existing agreement the City of Missouri City has with the Gulf Coast Water Authority (GCWA). The City is currently identifying additional sources of raw water.

The City has entered into a contract with the Sienna Plantation MUD #1, in which Sienna will initially own and operate the plant, while the City has oversight authority and the ability to eventually take-over the plant.

The City of Missouri City has been appointed the GRP administrator. As the GRP administrator, among other things, the City will see that the overall project is meeting conversion requirements, is providing required reporting to the Subsidence District and will also oversee the financial cost sharing program of the project. The cost share program involves an annual calculation of a pumpage fee to be assessed to participants based on their respective groundwater pumpage. An end of the year "true-up" will be performed to assure that no single one entity would bear any more risk than the other participating entity.

Based on current demand projections the initial plant will have a design capacity of 10 MGD and employ membrane filtration technology. The plant will be located on the Briscoe canal in the southern portion of the Joint GRP service area near the Gulf Coast Water Authority existing intake structure on the Brazos River. From this point, treated water will be delivered to the converting entities existing ground storage facilities.

Appendix B

B.1 Planning Participant Descriptions

The Missouri City Regional Planning Study will look at a group of 30 participating entities within the incorporated limits and extra territorial jurisdiction of the City of Missouri City. These entities range in age and size, however they are each responsible for providing water and sewer service to the residents and businesses located within their service area.

B.1.1 City of Missouri City (PWS ID# 0790207)

The majority of the residents living in the City of Missouri City are provided water and sewer service by independent municipal utility districts. However, the City provides these services in the Mustang Bayou Service Area and the Northeast Oyster Creek Service Area.

In the Mustang Bayou Utility Service Area the City owns the water distribution system, the water plant, the wastewater collection system and the wastewater treatment plant.

In the Northeast Oyster Creek Utility Service Area the City only owns the water distribution system. Water is provided by Quail Valley Utility District. Wastewater collection and treatment are also provided by Quail Valley Utility District. For use in this planning study connections within the Northeast Oyster Creek Utility Service Area have been included in the Quail Valley connection counts.

Current Service Connections	
Mustang Bayou Utility Service Area 630 - Single Family 18 - Commercial 1 - Other 649 - Total	*Northeast Oyster Creek Utility Service Area* 409 - ESCFs (Included in Quail Valley)
Number of Water Plants	
1 - Mustang Bayou Water Treatment Plant	
Water Sources	
Primary - Groundwater Wells (1) Secondary - None	
Supplies Water to Other Districts	
Sienna Plantation MUD #1 (Agreement for the City to supply water for up to 1,000 connections)	
Receives Water from Other Districts	
None	
Emergency Interconnects	
Sienna Plantation MUD #1 (1) Fort Bend County MUD #47/#48 (1)	

Number of Wastewater Plants
2 - Steep Bank-Flat Bank Regional WWTP Vicksburg Regional WWTP
Treats Wastewater from Other Districts
Steep Bank-Flat Bank Regional WWTP First Colony MUD #9 Fort Bend County MUD #42 Fort Bend County MUD #46 Fort Bend County MUD #115 Fort Bend County MUD #129 Fort Bend County MUD #149 *Vicksburg Regional WWTP* Fort Bend County MUD #47 Fort Bend County MUD #48

B.1.2 Sienna Plantation MUD #1 (PWS ID# 0790373)

Sienna Plantation MUD #1 was created by the TCEQ on August 12, 1978. The District is the "Master MUD" for the Sienna Plantation development and supplies water and wastewater services to all other Sienna MUD districts.

Current Service Connections
1 - Home Owner's Association 1 - Vacant Single Family 2 - Commercial 5 - Non-Residential Irrigation 9 - District Meters 18 Total
Number of Water Plants
2 - Sienna Water Treatment Plant #1 Sienna Water Treatment Plant #2
Water Sources
Primary - Groundwater Wells (5) Secondary - None
Supplies Water to Other Districts
Sienna Management District Sienna Plantation MUD #2 Sienna Plantation MUD #3 Sienna Plantation MUD #4 Sienna Plantation MUD #5 Sienna Plantation MUD #6 Sienna Plantation MUD #7 Sienna Plantation MUD #10 Sienna Plantation MUD #12 Sienna Plantation MUD #13
Receives Water from Other Districts
None
Emergency Interconnects
Mustang Bayou (1)

Number of Wastewater Plants
2 - Sienna North WWTP Sienna South WWTP
Treats Wastewater from Other Districts
Sienna Management District Sienna Plantation MUD #2 Sienna Plantation MUD #3 Sienna Plantation MUD #4 Sienna Plantation MUD #5 Sienna Plantation MUD #6 Sienna Plantation MUD #7 Sienna Plantation MUD #10 Sienna Plantation MUD #12 Sienna Plantation MUD #13

B.1.3 Sienna Plantation Management District (PWS ID# 0790493)

The Sienna Plantation Management District was created by the TCEQ, on June 20, 2003. The District contains approximately 310 acres of land. This area contains the commercial and multi-family property at the Sienna Plantation entrance located at Highway 6 and Sienna Parkway.

Current Service Connections
15 - Multi-Family 28 - Commercial 15 - Non-Residential Irrigation 11 - District Meters 69 Total
Number of Water Plants
None
Water Sources
Sienna Plantation MUD #1
Supplies Water to Other Districts
None
Receives Water from Other Districts
None
Emergency Interconnects
Sienna Plantation
Number of Wastewater Plants
None
Treats Wastewater from Other Districts
None

B.1.4 Sienna Plantation MUD #2 (PWS ID# 0790345)

The Sienna Plantation Municipal Utility District #2 was created by the TCEQ on March 10, 1997. The District contains approximately 1,056 acres of land. The land use in the District consists of predominately residential homes with a few commercial areas.

Current Service Connections
1,574 - Occupied Single Family 17 - Vacant Single Family 4 - Commercial 1 - Builder 4 - Home Owner's Association 169 - Non-Residential Irrigation 9 - Residential Irrigation 2 - Rental Meters 4 - District Meters 1,784 Total
Number of Water Plants
None
Water Sources
Sienna Plantation MUD #1
Supplies Water to Other Districts
None
Receives Water from Other Districts
None
Emergency Interconnects
Sienna Plantation
Number of Wastewater Plants
None
Treats Wastewater from Other Districts
None

B.1.5 Sienna Plantation MUD #3 (PWS ID# 0790376)

The Sienna Plantation Municipal Utility District #3 was created by the TCEQ on March 10, 1997. The District encompasses approximately 1,229 acres of land within Sienna Plantation. The land use in the District consists of predominately residential homes with a few commercial areas.

Current Service Connections
2,242 - Occupied Single Family 24 - Vacant Single Family 5 - Commercial 26 - Builder 155 - Non-Residential Irrigation 3 - Residential Irrigation 2,455 Total
Number of Water Plants
None
Water Sources
Sienna Plantation MUD #1
Supplies Water to Other Districts
None
Receives Water from Other Districts
None

Emergency Interconnects
Sienna Plantation
Number of Wastewater Plants
None
Treats Wastewater from Other Districts
None

B.1.6 Sienna Plantation MUD #4 (PWS ID# 0790489)

The Sienna Plantation Municipal Utility District #4 was created by the TCEQ on March 10, 1997. The District encompasses approximately 1,063 acres of land within Sienna Plantation. Sienna Plantation MUD #4 is not yet active.

B.1.7 Sienna Plantation MUD #5 (PWS ID# 0790490)

The Sienna Plantation Municipal Utility District #5 was created by the TCEQ on March 3, 1997. The District encompasses approximately 32 acres of land within Sienna Plantation. Sienna Plantation MUD #5 is not yet active.

B.1.8 Sienna Plantation MUD #6 (PWS ID# 0790491)

Sienna Plantation Municipal Utility District #6 was created by the TCEQ on March 3, 1997. The District encompasses approximately 1,300 acres of land within Sienna Plantation. Sienna Plantation MUD #6 is not yet active.

B.1.9 Sienna Plantation MUD #7 (PWS ID# 0790492)

Sienna Plantation Municipal Utility District #7 was created by the TCEQ on October 17, 1979. The District encompasses approximately 1,028 acres of land within Sienna Plantation. Sienna Plantation MUD #7 is not yet active.

B.1.10 Sienna Plantation MUD #8

Sienna Plantation MUD #8 has been converted into the Sienna Plantation Management District. This district was created to have additional powers to maintain the streets and pedestrian facilities within the main Sienna Plantation commercial area. See Section B.1.3 for information on the Sienna Plantation Management District utilities.

B.1.11 Sienna Plantation MUD #10 (PWS ID# 0790452)

The Sienna Plantation Municipal Utility District #10 was created by the TCEQ on September 26, 2002. The District encompasses approximately 944 acres of land within Sienna Plantation. The land use in the District consists of predominately residential homes with a few commercial areas.

Current Service Connections
1,188 - Occupied Single Family 14 - Vacant Single Family 1 - Commercial 112 - Builder 1 - Home Owner's Association 58 - Non-Residential Irrigation 1 - Residential Irrigation 1 - Rental Meters 1,376 Total
Number of Water Plants
None
Water Sources
Sienna Plantation MUD #1
Supplies Water to Other Districts
None
Receives Water from Other Districts
None
Emergency Interconnects
Sienna Plantation
Number of Wastewater Plants
None
Treats Wastewater from Other Districts
None

B.1.12 Sienna Plantation MUD #12 (PWS ID# 0790494)

The Sienna Plantation Municipal Utility District #12 was created by the TCEQ on September 26, 2002. The District encompasses approximately 911 acres of land within Sienna Plantation. The land use in the District consists of predominately residential homes with a few commercial areas.

Current Service Connections
89 - Occupied Single Family 4 - Vacant Single Family 10 - Commercial 8 - Builder 34 - Non-Residential Irrigation 1 - Residential Irrigation 4 - Rental Meters 1 - District Meters 151 Total
Number of Water Plants
None
Water Sources
Sienna Plantation MUD #1
Supplies Water to Other Districts
None
Receives Water from Other Districts
None

Emergency Interconnects
Sienna Plantation
Number of Wastewater Plants
None
Treats Wastewater from Other Districts
None

B.1.13 Sienna Plantation MUD #13

Sienna Plantation Municipal Utility District #13 was created by the TCEQ on September 26, 2002. The District encompasses approximately 324 acres of land within Sienna Plantation. Sienna Plantation MUD #13 is not yet active.

B.1.14 Fort Bend County MUD #149 (PWS ID# 0790517)

The Fort Bend County Municipal Utility District #149 was created on August 21, 2007. The District encompasses approximately 658 acres of land, and is located entirely within the extraterritorial jurisdiction of the City of Missouri City.

Current Service Connections
58 - Occupied Single Family 62 - Builder 4 - Irrigation 1 - Rental Meters 125 Total
Number of Water Plants
1 - Fort Bend County MUD #149 Water Treatment Plant
Water Sources
Primary - Groundwater Wells (1) Secondary - None
Supplies Water to Other Districts
None
Receives Water from Other Districts
Fort Bend County MUD #129 (All water in FBC MUD #129 is from FBC MUD #115)
Emergency Interconnects
Fort Bend County MUD #129 (2)
Number of Wastewater Plants
None
Treats Wastewater from Other Districts
None

B.1.15 Fort Bend County MUD #129 (PWS ID# 0790437)

The Fort Bend County Municipal Utility District #129 was created on October 24, 2003. The District encompasses approximately 606 acres of land, and is located entirely within the extraterritorial jurisdiction of the City of Missouri City. Land use within Fort Bend County MUD #129 is predominately residential.

Current Service Connections
894 - Occupied Single Family 9 - Vacant Single Family 2 - Commercial 45 - Builder 64 - Irrigation 1 - Rental Meters 1,015 Total
Number of Water Plants
None
Water Sources
Primary - Fort Bend County MUD #115 Secondary - None
Supplies Water to Other Districts
None
Receives Water from Other Districts
Fort Bend County MUD #115
Emergency Interconnects
Fort Bend County MUD #149 (1)
Number of Wastewater Plants
None
Treats Wastewater from Other Districts
None

B.1.16 Fort Bend County MUD #115 (PWS ID# 0790403)

The Fort Bend County Municipal Utility District #115 was created on July 31, 1998. The District encompasses approximately 306 acres of land and is located within the corporate limits of the City of Missouri City.

Current Service Connections
438 - Occupied Single Family 37 - Commercial 71 - Irrigation 2 - Rental Meters 548 Total
Number of Water Plants
1 - Fort Bend County MUD #115 Water Treatment Plant
Water Sources
Primary - Groundwater Wells (1) Secondary - None
Supplies Water to Other Districts
Fort Bend County MUD #129
Receives Water from Other Districts
None
Emergency Interconnects
Fort Bend County MUD #46 (1) First Colony MUD #9 (1)

Number of Wastewater Plants
None
Treats Wastewater from Other Districts
None

B.1.17 Fort Bend County MUD #49 (PWS ID# 0790256)

The Fort Bend County Municipal Utility District #49 was created on July 13, 1983. The District encompasses approximately 187 acres of land and is located within the corporate limits of the City of Missouri City.

Current Service Connections
336 - Single Family 4 - Commercial 340 Total
Number of Water Plants
None
Water Sources
Primary - Palmer Plantation Secondary - None
Supplies Water to Other Districts
None
Receives Water from Other Districts
Palmer Plantation
Emergency Interconnects
None
Number of Wastewater Plants
None
Treats Wastewater from Other Districts
None

B.1.18 Fort Bend County MUD #48 (PWS ID# 0790267)

The Fort Bend County Municipal Utility District #48 was created on March 8, 1983. The District encompasses approximately 521 acres of land and is located within the corporate limits of the City of Missouri City.

Current Service Connections
634 Total Connections
Number of Water Plants
1 - Vicksburg Joint Powers (Ownership shared with Fort Bend County MUD #47)
Water Sources
Primary - Groundwater Wells (1) Secondary - None
Supplies Water to Other Districts
None

Receives Water from Other Districts
None
Emergency Interconnects
Mustang Bayou (1)
Number of Wastewater Plants
None
Treats Wastewater from Other Districts
None

B.1.19 Fort Bend County MUD #47 (PWS ID# 0790220)

The Fort Bend County Municipal Utility District #47 was created on March 8, 1983. The District encompasses approximately 354 acres of land and is located within the corporate limits of the City of Missouri City.

Current Service Connections
633 Total Connections
Number of Water Plants
1 - Vicksburg Joint Powers WTP (Ownership shared with Fort Bend County MUD #48)
Water Sources
Primary - Groundwater Wells (1) Secondary - None
Supplies Water to Other Districts
None
Receives Water from Other Districts
None
Emergency Interconnects
Mustang Bayou (1)
Number of Wastewater Plants
None
Treats Wastewater from Other Districts
None

B.1.20 Fort Bend County MUD #46 (PWS ID# 0790315)

The Fort Bend County Municipal Utility District #46 was created on January 25, 1984. The District encompasses approximately 490 acres of land and is located within the corporate limits of the City of Missouri City.

Current Service Connections
771 Total Connections
Number of Water Plants
1 - Fort Bend County MUD #46 Water Treatment Plant
Water Sources
Primary - Groundwater Wells (1) Secondary - None
Supplies Water to Other Districts
None

Receives Water from Other Districts
None
Emergency Interconnects
Fort Bend County MUD #115 (1) Palmer Plantation (1)
Number of Wastewater Plants
None
Treats Wastewater from Other Districts
None

B.1.21 Fort Bend County MUD #42 (PWS ID# 0790254)

The Fort Bend County Municipal Utility District #42 was created on July 31, 1981. The District encompasses approximately 529 acres of land and is located within the corporate limits of the City of Missouri City.

Current Service Connections
1,275 - Single Family 25 - Commercial 3 - Other 1,303 Total
Number of Water Plants
1 - Fort Bend County MUD #42 Water Treatment Plant
Water Sources
Primary - Groundwater Wells (1) Secondary - None
Supplies Water to Other Districts
None
Receives Water from Other Districts
None
Emergency Interconnects
Quail Valley Utility District (3) First Colony MUD #9 (2)
Number of Wastewater Plants
None
Treats Wastewater from Other Districts
None

B.1.22 Fort Bend County MUD #26 (PWS ID# 0790137)

The Fort Bend County Municipal Utility District #26 was created on June 28, 1978. The District encompasses approximately 553 acres of land and is located within the corporate limits of the City of Missouri City.

Current Service Connections
1,432 - Single Family 50 - Commercial 2 - Other 1,484 Total
Number of Water Plants
1 - Fort Bend County MUD #26 Water Treatment Plant
Water Sources
Primary - Groundwater Wells (1) Secondary - None
Supplies Water to Other Districts
None
Receives Water from Other Districts
None
Emergency Interconnects
Meadowcreek MUD (1) Blue Ridge West MUD (2) Thunderbird Utility District - System #2 (1)
Number of Wastewater Plants
1 - Fort Bend County MUD #26 WWTP
Treats Wastewater from Other Districts
None

B.1.23 Palmer Plantation MUD #1 (PWS ID# 0790199)

The Palmer Plantation Municipal Utility District #1 was created on December 21, 1982. The District encompasses approximately 416 acres of land and is located within the corporate limits of the City of Missouri City. Palmer Plantation MUD #1, Palmer Plantation MUD #2, and Fort Bend County MUD #49 operate as one combined water and one combined wastewater system.

Current Service Connections
590 - Single Family 6 - Commercial 3 - Other 599 Total
Number of Water Plants
1 - Palmer Plantation MUD #1 Water Treatment Plant
Water Sources
Primary - Groundwater Wells (1) Secondary - None
Supplies Water to Other Districts
Palmer Plantation MUD #2 Fort Bend County MUD #49
Receives Water from Other Districts
Palmer Plantation MUD #2

Emergency Interconnects
Quail Valley Utility District (1) Fort Bend County MUD #46 (1) Thunderbird Utility District - System #1 (2)
Permanent Interconnects
Palmer Plantation MUD #2 (1) Fort Bend County MUD #49 (2)
Number of Wastewater Plants
1 - Palmer Plantation WWTP (Ownership shared with Palmer Plantation MUD #2)
Treats Wastewater from Other Districts
Palmer Plantation MUD #2 Fort Bend County MUD #49

B.1.24 Palmer Plantation MUD #2 (PWS ID# 0790323)

The Palmer Plantation Municipal Utility District #2 was created on December 21, 1982. The District encompasses approximately 333 acres of land and is located within the corporate limits of the City of Missouri City. Palmer Plantation MUD #1, Palmer Plantation MUD #2, and Fort Bend County MUD #49 operate as one combined water and one combined wastewater system.

Current Service Connections
802 - Single Family 10 - Commercial 1 - Other 813 Total
Number of Water Plants
1 - Palmer Plantation MUD #2 Water Treatment Plant
Water Sources
Primary - Groundwater Wells (1) Secondary - None
Supplies Water to Other Districts
Palmer Plantation MUD #1 Fort Bend County MUD #49
Receives Water from Other Districts
Palmer Plantation MUD #1
Emergency Interconnects
Quail Valley Utility District (2)
Permanent Interconnects
Palmer Plantation MUD #1 (1) Fort Bend County MUD #49 (1)
Number of Wastewater Plants
1 - Palmer Plantation WWTP (Ownership shared with Palmer Plantation MUD #1)
Treats Wastewater from Other Districts
Palmer Plantation MUD #1 Fort Bend County MUD #49

B.1.25 Quail Valley Utility District (PWS ID# 0790028)

The Quail Valley Utility District was created on May 29, 1969. The District encompasses approximately 1,572 acres of land, and is located within the corporate limits of the City of Missouri City.

Current Service Connections
3,442 - Single Family 164 - Commercial 810 - Multi-Family 7 - Other 4,423 Total
Number of Water Plants
3 - Quail Valley Utility District Water Treatment Plant #1 Quail Valley Utility District Water Treatment Plant #2 Quail Valley Utility District Water Treatment Plant #3
Water Sources
Primary - Groundwater Wells (4) Secondary - None
Supplies Water to Other Districts
None
Receives Water from Other Districts
None
Emergency Interconnects
Fort Bend County MUD #42 (3) Thunderbird Utility District - System #1 (3) Thunderbird Utility District - System #2 (3) Meadowcreek MUD (3) Palmer Plantation MUD #2 (2) Fort Bend County WC&ID No. 2 (1)
Number of Wastewater Plants
1 - Quail Valley Utility District/Thunderbird Utility District WWTP
Treats Wastewater from Other Districts
Thunderbird Utility District Meadowcreek MUD

B.1.26 Thunderbird Utility District System #1(PWS ID# 0790033)

The Thunderbird Utility District #1 was created on May 26, 1971. The District encompasses approximately 965 acres of land and is located within the corporate limits of the City of Missouri City.

Current Service Connections
1,242 - Single Family 83 - Commercial 2 - Other 1,325 Total
Number of Water Plants
2 - Thunderbird Utility District Water Treatment Plant #1 Thunderbird Utility District Water Treatment Plant #2
Water Sources
Primary - Groundwater Wells (2) Secondary - None
Supplies Water to Other Districts
None
Receives Water from Other Districts
None
Emergency Interconnects
Quail Valley Utility District (3) Palmer Plantation MUD #1 (1) Fort Bend County MUD #46 (1)
Number of Wastewater Plants
None
Treats Wastewater from Other Districts
None

B.1.27 Thunderbird Utility District - System #2 (PWS ID# 0790050)

The Thunderbird Utility District - System #2 is a separate system from Thunderbird Utility District #1. For planning purposes connection counts for both systems have been included together.

Current Service Connections
575 - Single Family 13 - Commercial 1 - Other 589 Total
Number of Water Plants
1 - Thunderbird Utility District Water Treatment Plant #3
Water Sources
Primary - Groundwater Wells (1) Secondary - None
Supplies Water to Other Districts
None
Receives Water from Other Districts
None
Emergency Interconnects
Quail Valley Utility District (3) Fort Bend County MUD #26 (1)
Number of Wastewater Plants
None

Treats Wastewater from Other Districts
None

B.1.28 First Colony MUD #9 (PWS ID# 0790230)

The First Colony Municipal Utility District #9 was created on May 30, 1984. The District encompasses approximately 940 acres of land and is located within the corporate limits of the City of Missouri City.

Current Service Connections
2,546 - Single Family 131 - Commercial 2,677 Total
Number of Water Plants
1 - First Colony MUD #9 Water Treatment Plant
Water Sources
Primary - Groundwater Wells (1) Secondary - None
Supplies Water to Other Districts
None
Receives Water from Other Districts
None
Emergency Interconnects
Fort Bend County MUD #42 (2) Fort Bend County MUD #115 (1) City of Sugar Land
Number of Wastewater Plants
None
Treats Wastewater from Other Districts
None

B.1.29 Meadowcreek MUD (PWS ID# 0790049)

The Meadowcreek Municipal Utility District was created on August 21, 1973. The District encompasses approximately 213 acres of land, and is located within the corporate limits of the City of Missouri City.

Current Service Connections
839 - Single Family 8 - Commercial 41 - Multi-Family 888 Total
Number of Water Plants
1 - Meadowcreek MUD Water Treatment Plant
Water Sources
Primary - Groundwater Wells (1) Secondary - None

Supplies Water to Other Districts
None
Receives Water from Other Districts
None
Emergency Interconnects
Fort Bend County MUD #26 (2) Quail Valley Utility District (3)
Number of Wastewater Plants
None
Treats Wastewater from Other Districts
None

B.1.30 Blue Ridge West MUD (PWS ID# 0790051)

The Blue Ridge West Municipal Utility District was created on June 16, 1967. The District encompasses approximately 862 acres of land, and is located within the corporate limits of the City of Missouri City.

Current Service Connections
2,494 Total Connections
Number of Water Plants
2 - Blue Ridge West MUD Water Treatment Plant #1 Blue Ridge West MUD Water Treatment Plant #2
Water Sources
Primary - Groundwater Wells (2) Secondary - None
Supplies Water to Other Districts
None
Receives Water from Other Districts
None
Emergency Interconnects
Fort Bend County MUD #26 (2) Fort Bend County WC&ID No. 2 (1)
Number of Wastewater Plants
1 - Blue Ridge West MUD WWTP
Treats Wastewater from Other Districts
None

B.1.31 Harris County MUD #122 (PWS ID# 1012391)

The Harris County Municipal Utility District #122 was created on March 6, 1979. The District encompasses approximately 230 acres of land, and is located within the corporate limits of the City of Missouri City.

Current Service Connections
410 Total Connections
Number of Water Plants
None

Water Sources
Primary - Fort Bend County WC&ID No.2 Secondary - Surface Water from City of Houston
Supplies Water to Other Districts
None
Receives Water from Other Districts
Fort Bend County WC&ID No.2
Emergency Interconnects
City of Houston (1)
Permanent Interconnects
Fort Bend County WC&ID No. 2
Number of Wastewater Plants
1 - Harris County MUD #122 WWTP
Treats Wastewater from Other Districts
None

B.1.32 Southwest Harris County MUD #1 (PWS ID# 1011911)

The Southwest Harris County Municipal Utility District #1 was created on February 19, 1975. The District encompasses approximately 153 acres of land, and is located within the corporate limits of the City of Missouri City.

Current Service Connections
527 Total Connections
Number of Water Plants
1 - Southwest Harris County MUD #1 Water Treatment Plant
Water Sources
Primary - Groundwater Wells (1) Secondary - Surface Water from City of Houston
Supplies Water to Other Districts
None
Receives Water from Other Districts
None
Emergency Interconnects
Harris County WC&ID - Fondren Rd. (2)
Permanent Interconnects
City of Houston
Number of Wastewater Plants
1 - Southwest Harris County MUD #1 WWTP
Treats Wastewater from Other Districts
None

B.1.33 Harris County WC&ID - Fondren Road (PWS ID# 1010249)

The Harris County Water Control & Improvement District - Fondren Road was created on August 23, 1963. The District encompasses approximately 353 acres of land, and is located within the corporate limits of the City of Missouri City.

Current Service Connections
1,017 Total Connections
Number of Water Plants
2 - Harris County WC&ID - Fondren Rd. Water Treatment Plant #1 Harris County WC&ID - Fondren Rd. Water Treatment Plant #2
Water Sources
Primary - Groundwater Wells (2) Secondary - Surface Water from City of Houston
Supplies Water to Other Districts
None
Receives Water from Other Districts
None
Emergency Interconnects
Southwest Harris County MUD #1 (2)
Permanent Interconnects
City of Houston
Number of Wastewater Plants
1 - Harris County WC&ID - Fondren Rd. WWTP
Treats Wastewater from Other Districts
None

CITY OF MISSOURI CITY

WATER CONSERVATION
AND
DROUGHT CONTINGENCY PLAN

PWSID 0790207

September, 2011

Prepared by:

Enprotec / Hibbs & Todd
402 Cedar, Abilene, Texas 79604
Phone: (325) 698-5560 / Fax: (325) 691-0058
Website: e-ht.com
PE Firm Registration No. 1151
PG Firm Registration No. 50103

TABLE OF CONTENTS

WATER CONSERVATION PLAN

Section I Declaration of Policy, Purpose and Intent 1

Section II Utility Profile Summary 1

Section III Water Conservation Goals 4

Section IV Metering Devices 4

Section V Universal Metering 4

Section VI Measures to Determine and Control Unaccounted-For Uses of Water 4

Section VII Leak Detection and Repair 5

Section VIII Water Rate Structure 5

Section IX Means of Implementation and Enforcement 5

Section X Additional Wholesale Water Contract Requirements 5

Section XI Coordination with Region H Water Planning Group 5

Section XII Reservoir Operations Plan 6

Section XIII Revisions to the Water Conservation Plan 6

Section XIV Severability 6

DROUGHT CONTINGENCY PLAN

Section I Declaration of Policy, Purpose and Intent 7

Section II Public Involvement 7

Section III Wholesale Water Customer Education 7

Section IV Coordination with Regional Water Planning Group 7

Section V Authorization 7

Section VI Application 7

TABLE OF CONTENTS (continued)

Section VII Criteria for Initiation and Termination of Drought Response Stages 8

Section VIII Drought Response Stages 11

Section IX Pro Rata Allocation 14

Section X Enforcement 14

Section XI Variances 15

Section XII Severability 16

APPENDICES

Appendix A Service Area Maps

Appendix B Resolution Adopting the Water Conservation Plan

Appendix C Notification to Wholesale Purchasers

Appendix D City of Missouri City Water Rate Structure

CITY OF MISSOURI CITY, TEXAS
WATER CONSERVATION PLAN

Section I Declaration of Policy, Purpose and Intent

The purpose of the Water Conservation Plan (Plan) is to: promote the wise and responsible use of water by implementing structural programs that result in quantifiable water conservation results; develop, maintain, and enforce water conservation policies and ordinances; and support public education programs that educate customers about water and wastewater facilities operations, water quantity and quality, water conservation and non-point source protection.

Section II Utility Profile Summary

The City of Missouri City (City) supplies treated potable water on a wholesale basis to the Sienna Plantation MUD #1 who in turn delivers treated potable water to the following public water systems:

- Sienna Management District
- Sienna Plantation MUD #2
- Sienna Plantation MUD #3
- Sienna Plantation MUD #4
- Sienna Plantation MUD #10
- Sienna Plantation MUD #12

The service area for these public water systems encompasses an area of approximately 15 square miles and is depicted in the service area map in Appendix A.

A. Population

The population of the wholesale service area served by the City's Regional Water Treatment Plant (MCWTP) in the year 2011 when the plant goes into service will be approximately 14,164 water users as determined by information available via the Texas Water Utility Database. Two factors in the coming years will increase the number of wholesale water users supplied by the MCWTP. Population growth in the current service area of the MCWTP and tying additional public water systems onto by the system will expand the number of wholesale water users supplied by the plant. The City is undertaking a regional water and wastewater planning study to better assess the potential population of the service area in the coming years. More detailed population figures will be available as the plant goes on line and users are added.

B. Customer Data and Water Use Data

At the time this Water Conservation Plan was prepared the plant has not yet begun providing water to wholesale users. As such, detailed water use data for wholesale water users is not yet available. However, the Region H Water Planning Group makes population and water use data available for the service area to be supplied by the MCWTP. Additionally, TCEQ's Texas Water Utility Database also provides information on the number of water users in each of the public water systems slated for conversion to service from the MCWTP. Table 1 presents a summary of the customer base served by the public water systems slated for conversion to service from the MCWTP in the fall of 2011. It should be noted that the MCWTP provides treated water to Sienna Plantation MUD#1 who in turn wholesales that water to adjoin MUDs depicted in Table 1. Not all of Sienna Plantation MUD#1's customers depicted in Table 1 will be supplied water from the MCWTP.

Table 1-Customers Served by the MCWTP		
Water User Group	Retail Customers	Wholesale Customers
Sienna Plantation MUD#1	210	17,544
Sienna Plantation MUD#2	5,352	0
Sienna Plantation MUD#3	7,299	0
Sienna Plantation MUD#10	25	0
Sienna Plantation MUD#12	411	0
Sienna Plantation Management District	867	0
Total	14,164	
Source-Texas Water Utility Database		

Table 2 presents water use and population figures obtained from the Region H Water Planning Group for the City of Missouri City from the period spanning 2010-2060.

Table 2-Population and Water Use Projections for the City of Missouri City (2010-2060)			
Year	Population (persons)	Water Use (acre feet)	Per Capita Use (gpcd)
2010	83,645	14,556	155
2020	104,844	18,049	154
2030	125,194	21,563	154
2040	145,816	25,191	154
2050	160,523	27,892	155
2060	193,025	33,912	157

It is anticipated that wholesale water users served by the MCWTP will use similar amounts of water as projected by Region H for Missouri City citizens. With 14,164 expected wholesale water users and per capita use of 155 gpcd it is anticipated that average daily water production at the MCWTP for municipal water uses will initially range from 2.2-3.0 MGD or about 2,500-3,400 acre-feet per year.

C. Water Supply System

1. Water Sources

Water from the Brazos River is supplied to the MCWTP by way of the off-channel reservoirs via contract with the GCWA. Missouri City's contract with GCWA is for annual purchase of up to 15,000,000 gallons per day.

2. Water Treatment

A pump station operated by the GCWA located on the eastern bank of the Brazos River pumps water from the river into the Briscoe Canal. A diversion structure for the MCWTP is situated in the Briscoe Canal and serves to divert water from the canal into the MCWTP (rated for a treatment capacity of 10 MGD) where it undergoes pretreatment consisting of screening, coagulation, and flocculation. Pretreated water is then filtered using membrane microfiltration and is disinfected prior to being supplied to four separate storage tanks operated by Sienna Plantation MUD#1.

3. Water Distribution

As a wholesale water provider the distribution system affiliated with the MCWTP is minimal. The high service pump station at the MCWTP is used to transfer treated potable water produced at the plant to the storage tanks operated by the Sienna Plantation MUD#1. Sienna Plantation MUD#1 in turn transfers the majority of water obtained from the MCWTP to wholesale water users. Total storage operated by Sienna MUD#1 amounts to 2.320 million gallons with 78,000 gallons of that being pressure tank storage.

D. Wastewater System

1. Wastewater Collection

The existing wastewater collection system throughout the City consists of approximately 360 miles of gravity lines and 35 miles of force mains, of various sizes, types, and ages. Each utility district is responsible for construction and maintenance of its collection system. Because some of the utility districts share capacity in regional WWTPs, several systems are interconnected. Some of the interconnections are direct gravity lines to a WWTP and some are force mains that transfer wastewater flows from one utility district's lift station into another utility district's collection system to ultimately travel to a regional WWTP.

2. Wastewater Treatment

Sienna MUD #1 owns two wastewater treatment plants within the service area. Sienna North Wastewater Treatment Plant has a permitted capacity of 0.902 MGD and treats wastewater from Sienna Plantation MUD #10 & #12. Sienna South Wastewater Treatment Plant has a permitted capacity of 1.2 MGD and treats wastewater from Sienna Plantation MUD #2, #3, Sienna Plantation Management District and also a portion of Sienna Plantation MUD #10. The City of Missouri City also owns two wastewater treatment plants. The Flat Bank/Steep Bank Regional Wastewater Treatment Plant with a permitted capacity of 3.0 MGD and the Vicksburg Regional Wastewater Treatment Plant with a permitted capacity of 0.95 MGD. The two wastewater treatment plants owned by the City of Missouri City will become part of the MCSTWP service area in Phase II.

Section III Water Conservation Goals

A. Wholesale Use Goals

The 5 and 10-year goals for wholesale users supplied by the City of Missouri City is to maintain per capita use at 155 gpcd and 154 gpcd respectively. The 5 and 10-year per capita water loss goals are to maintain per capita loss at or below 23 gpcd. These goals are set in accordance with Region H Water Planning Group projections.

Section IV Metering Devices

It is Missouri City's policy to purchase meters that meet at least the minimum standards developed by the American Water Works Association. All metering devices used to meter water diverted from the source of supply are accurate to within plus or minus 5% to measure and account for water diverted from the source of supply. Meters at the MCWTP that are used to measure water diverted from the source of supply and water discharged from the plant are calibrated annually and replaced as needed. The wholesale water purchasers are responsible for metering device installation, maintenance and calibration for meters located within their service areas.

Section V Universal Metering

It is Missouri City's policy to meter all water diverted from the source of supply and discharged to the wholesale users.

Section VI Measures to Determine and Control Unaccounted-For Uses of Water

The City of Missouri City will utilize a record management system designed to account for water use from point of diversion to point of discharge into the wholesale users' systems. Through detailed record keeping and onsite inspection of the treatment and transmission systems Missouri City will be able to account for water delivery to customers. This

information is used to evaluate the integrity of the water delivery system from source to end user to control and minimize unaccounted-for uses of water.

Section VII Leak Detection and Repair

Operations personnel at the MCWTP will practice a leak detection and repair program involving visual inspections of the transmission systems associated with the MCWTP. A record management system will also be used to detect unusual water delivery rates. MCWTP personnel will visually inspect suspected leaks and make quick and timely repairs to those leaks when detected. Leaking pipelines or pipeline sections are repaired or replaced as they are detected.

Section VIII Water Rate Structure

The water rate structure utilized in contracts made by the City with wholesale users promotes conservation and shifts the cost of supplying water to those consumers using it most.

Section IX Means of Implementation and Enforcement

This Water Conservation Plan has been adopted by the City. A copy of the resolution adopting this Plan is included in Appendix B. Wholesale customers will receive written notification of Plan adoption and any subsequent Amendments. Adoption of this Plan by the City of Missouri City per 30 Texas Administrative Code (TAC) Rule §288.5 obligates wholesale customers as defined in 30 TAC Rule §288.1 to implement water conservation measures. A copy of the notification letter to wholesale users has been included in Appendix C.

Section X Additional Wholesale Water Contract Requirements

It is Missouri City's policy to include in every wholesale water supply contract entered into or renewed after official adoption of the Plan, including any contract extension, that each successive wholesale customer develop and implement a water conservation plan or water conservation measures using applicable elements in 30 TAC 288. If the wholesale customer intends to resell the water, then the contract between Missouri City and the wholesale customer must provide that the contract for the resale of the water must have water conservation requirements so that each successive customer in the resale of the water will be required to implement water conservation measures in accordance with 30 TAC 288.

Section XI Coordination with Region H Water Planning Group

All of the customers served by the City of Missouri City are located within the Brazos G Regional Water Planning Area. Missouri City has provided a copy of this Plan to the Brazos G Regional Water Planning Group.

Section XII Reservoir Operations Plan

There are two raw water storage reservoirs associated with the MCWTP which are used to store raw water prior to the treatment processes at the plant. The City maintains an up to date *Plan of Operations* for the MCWTP which provides a detailed operating plan for the raw water storage reservoirs. The *Plan of Operations* is available for review at the MCWTP.

Section XIII Revisions to the Water Conservation Plan

The City of Missouri City will review and update this water conservation plan, as appropriate, based on new or updated information, such as the adoption or revision of the regional water plan. As a minimum the Plan will be updated every five (5) years.

Section XIV Severability

It is hereby to be the intention of Missouri City that the sections, paragraphs, sentences, clauses, and phrases of this Plan are severable and if, any phrase, clause, sentence, paragraph or section shall be declared unconstitutional by the valid judgment or decree of any court of competent jurisdiction, such unconstitutionality shall not affect any of the remaining phrases, clauses, sentences, paragraphs or sections of this Plan, since the same would not have been enacted by Missouri City without the incorporation into this Plan of any such unconstitutional phrase, clause, sentence, paragraph or section.

DROUGHT CONTINGENCY PLAN

Section I Declaration of Policy, Purpose and Intent

In order to conserve the available water supply and/or to protect the integrity of water supply facilities, with particular regard for domestic water use, sanitation, and fire protection, and to protect and preserve public health, welfare, and safety and minimize the adverse impacts of water supply shortage or other water supply emergency conditions, the City of Missouri City, Texas (City) adopts the following Drought Contingency Plan (Plan).

Section II Public Involvement

Opportunity for the public and wholesale water customers to provide input into the preparation of the Plan was provided by the City by means of regular City Council meetings.

Section III Wholesale Water Customer Education

The City will periodically provide wholesale water customers with information about the Plan, including information about the conditions under which each stage of the Plan is to be initiated or terminated and the drought response measures to be implemented in each stage. A copy of the Plan will be provided to the wholesale customers initially after adoption of the Plan and thereafter when the Plan is revised or resubmitted to the State and to Region H Water Planning Group.

Section IV Coordination with Regional Water Planning Group

The wholesale and retail water service area of the City of Missouri City is located within the Region H Water Planning Group and the City has provided a copy of the Plan to the Region H Water Planning Group.

Section V Authorization

The City Manager for the City of Missouri City, or his/her designee, is hereby authorized and directed to implement the applicable provisions of this Plan upon determination that such implementation is necessary to protect public health, safety, and welfare. The City Manager, or his/her designee, shall have the authority to initiate or terminate drought or other water supply emergency response measures as described in this Plan.

Section VI Application

The provisions of this Plan shall apply to all customers utilizing water provided by the City of Missouri City. The terms “person” and “customer” as used in the Plan include individuals, corporations, partnerships, associations, and all other legal entities.

Section VII Criteria for Initiation and Termination of Drought Response Stages

The City Manager, or his/her designee, shall monitor water supply and/or demand conditions on a weekly basis and shall determine when conditions warrant initiation or termination of each stage of the Plan. Customer notification of the initiation or termination of drought response stages will be made by email, mail or telephone. The news media will also be informed.

The triggering criteria described below are based on a combination of two factors.

1. The City receives raw water on a wholesale basis from the Gulf Coast Water Authority (GCWA) which maintains a water conservation and drought contingency plan. Pursuant to pro rata measures described in section §11.039 of the Texas Water Code if a shortage of water in a water supply covered by a water conservation plan prepared in compliance with applicable State Rules results from drought, accident, or other cause, the person, association of persons, or corporation owning or controlling the water shall divide the water to be distributed among all customers pro rata, according to:

    a. The amount of water to which each customer may be entitled; or
    b. The amount of water to which each customer may be entitled, less the amount of water the customer would have saved if the customer had operated its water system in compliance with the water conservation plan.

    As such the City of Missouri City recognizes the need to implement drought-related water use restrictions for wholesale customers receiving treated surface water based on the same triggering criteria recognized by the GCWA. One set of triggering criteria defined by the City of Missouri City in its Plan will be the same as the triggering criteria defined in the GCWA's Drought Contingency Plan.

2. The City also recognizes that conditions in its wholesale and/or retail delivery system may require the City to implement drought contingency measures exclusive of conditions in the GCWA delivery system. A second set of triggering conditions are therefore defined in the City's Plan based on water usage of its wholesale purchasers and the City's production and delivery systems.

A. Stage 1 Triggers -- Mild Water Shortage Conditions

1. <u>Requirements for Initiation:</u>
    a. The City of Missouri City will recognize that a mild water shortage condition exists for wholesale customers receiving treated surface water when the GCWA declares Stage 1 of its Plan to be in effect,

and supplemental groundwater supplies are not sufficient to meet demand when combined with available treated surface water, or

b. For wholesale treated surface water customers when the pumpage from the Missouri City Regional Water Treatment Plant (MCRWTP) exceeds 90% of rated treatment plant capacity for three (3) consecutive days or

c. Continually falling water storage facility levels in either wholesale or retail storage tanks do not refill above the 50% level overnight.

2. Requirements for Termination:

a. Stage 1 of the Plan may be rescinded when GCWA rescinds its Stage 1 or when all of the other conditions listed as triggering events have ceased to exist for a period of three (3) consecutive days.

b. The City of Missouri City will notify its wholesale and/or retail customers and the media of the termination of Stage 1 in the same manner as the notification of initiation of Stage 1 of the Plan.

B. Stage 2 Triggers -- Moderate Water Shortage Conditions

1. Requirements for Initiation:

a. The City of Missouri City will recognize that a moderate water shortage condition exists for wholesale customers receiving treated surface water when the GCWA declares Stage 2 of its Plan to be in effect, and supplemental groundwater supplies are not sufficient to meet demand when combined with available treated surface water, or

b. For wholesale treated surface water customers when the pumpage from the MCRWTP exceeds 95% of rated treatment plant capacity for three (3) consecutive days, and supplemental groundwater supplies are not sufficient to meet demand when combined with available treated surface water, or

c. When continually falling water storage facility levels in either wholesale or treated water storage tanks do not refill above the 50% level overnight for three (3) consecutive days.

2. Requirements for Termination:

a. Stage 2 of the Plan may be rescinded when GCWA rescinds its Stage 2 or when all of the other conditions listed as triggering events have ceased to exist for a period of three (3) consecutive days.

b. The City of Missouri City will notify its wholesale and/or retail customers and the media of the termination of Stage 2 in the

same manner as the notification of initiation of Stage 2 of the Plan.

c. Stage 1 may be implemented upon rescinding Stage 2.

C. Stage 3 Triggers -- Severe Water Shortage Conditions

1. Requirements for Initiation:

a. The City of Missouri City will recognize that a severe water shortage condition exists for wholesale customers receiving treated surface water when the GCWA declares Stage 3 of its Plan to be in effect, and supplemental groundwater supplies are not sufficient to meet demand when combined with available treated surface water, or

b. For wholesale treated surface water customers when the pumpage from the MCRWTP exceeds 90% of rated treatment plant capacity for three (3) consecutive days, or

c. When continually falling water storage facility levels either wholesale or treated water storage tanks do not refill above the 50% level overnight for five (5) consecutive days.

2. Requirements for Termination:

a. Stage 3 of the Plan may be rescinded when GCWA rescinds its Stage 3 or when all of the other conditions listed as triggering events have ceased to exist for a period of three (3) consecutive days.

b. The City of Missouri City will notify its wholesale and/or retail customers and the media of the termination of Stage 3 in the same manner as the notification of initiation of Stage 3 of the Plan.

c. Stage 1 or 2 may be implemented upon rescinding Stage 3.

D. Stage 4 Triggers -- Emergency Water Shortage Conditions

1. Requirements for Initiation:

a. The City of Missouri City will recognize that an emergency water shortage condition for wholesale customers receiving treated surface water when the GCWA declares Stage 4 of its Plan to be in effect, and supplemental groundwater supplies are not sufficient to meet demand when combined with available treated surface water, or

b. For wholesale treated surface water customers when the pumpage from the MCRWTP is above 98% of rated treatment plant capacity for three (3) consecutive days, or

c. When continually falling water storage facility levels either wholesale or treated water storage tanks do not refill above the 50% level overnight for seven (7) consecutive days, or

d. When major line breaks, pump system failures, treatment system failures, water supply contamination or other unforeseen conditions occur that cause the City Manager to recommend implementation of Stage 4 of the Plan.

2. Requirements for Termination:

a. Stage 4 of the Plan may be rescinded when GCWA rescinds its Stage 4 or when all of the other conditions listed as triggering events have ceased to exist for a period of three (3) consecutive days, or

b. When at the discretion of the City Manager or his/her designee service has been restored to the point where Stage 4 conditions may be rescinded.

c. The City of Missouri City will notify its wholesale and/or retail customers and the media of the termination of Stage 4 in the same manner as the notification of initiation of Stage 4 of the Plan.

d. Stages 1, 2 or 3 may be implemented upon rescinding Stage 4.

Section VIII: Drought Response Stages

The City Manager or his/her designee, shall monitor water supply and/or demand conditions and, in accordance with the triggering criteria set forth in Section VII, shall determine that mild, moderate, or severe water shortage conditions exist or that an emergency condition exists and shall implement the following actions:

A. Stage 1 Response -- Mild Water Shortage Conditions

1. Target:

a. Achieve voluntary reduction in total water use by wholesale and/or retail system users as applicable.

2. Best Management Practices for Supply Management:

a. Wholesale customers may utilize wells to supplement surface water production when necessary during periods when drought restrictions corresponding to GCWA stages are in place.

3. Water Use Restrictions for Reducing Demand:

a. The City Manager, or his/her designee, will contact wholesale and/or retail water customers to discuss water supply and/or demand conditions, and will request that wholesale and/or retail

water customers initiate voluntary measures to reduce water use (e.g., implement Stage 1 of the wholesale customer's drought contingency plan).

b. The City Manager, or his/her designee, will provide a weekly report to news media with information regarding current water supply and/or demand conditions, projected water supply and demand conditions if drought conditions persist, and consumer information on water conservation measures and practices.

B. Stage 2 Response -- Moderate Water Shortage Conditions

1. Target:

   a. Achieve reduction in total water use by wholesale and/or retail system users, as applicable, to a point where water use drops below Stage 2 trigger conditions.

2. Best Management Practices for Supply Management:

   a. Wholesale customers may utilize wells to supplement surface water production when necessary during periods when drought restrictions corresponding to GCWA stages are in place.

3. Water Use Restrictions for Reducing Demand:

   a. The City Manager, or his/her designee, will initiate weekly contact with wholesale water customers to discuss water supply and/or demand conditions and the possibility of pro rata curtailment of water diversions and/or deliveries.

   b. The City Manager, or his/her designee, will request wholesale water customers to initiate mandatory measures to reduce non-essential water use (e.g., implement Stage 2 of the customer's drought contingency plan). Mandatory reductions will not be required if a wholesale customer can supplement reduced surface water deliveries with groundwater supplies adequate to meet demands.

   c. The City Manager, or his/her designee, will initiate preparations for the implementation of pro rata curtailment of treated surface water deliveries by preparing a monthly water usage allocation baseline for each wholesale customer according to the procedures specified in Section IX of the Plan.

   d. The City Manager, or his/her designee, will provide a weekly report to news media with information regarding current water supply and/or demand conditions, projected water supply and demand conditions if drought conditions persist, and consumer information on water conservation measures and practices.

C. Stage 3 Response -- Severe Water Shortage Conditions

1. Target:
   a. Achieve reduction in total water use by wholesale and/or retail users to a point where water use drops below Stage 3 trigger conditions.

2. Best Management Practices for Supply Management:
   a. Wholesale customers may utilize wells to supplement surface water production when necessary during periods when drought restrictions corresponding to GCWA stages are in place.

3. Water Use Restrictions for Reducing Demand:
   a. The City Manager, or his/her designee, will contact wholesale and retail water customers to discuss water supply and/or demand conditions and will request that wholesale water customers initiate additional mandatory measures to reduce non-essential water use (e.g., implement Stage 2 of the customer's drought contingency plan).
   b. The City Manager, or his/her designee, will initiate pro rata curtailment of water diversions and/or deliveries for each wholesale customer according to the procedures specified in Section VI of the Plan. Mandatory reductions will not be required if a wholesale customer can supplement reduced surface water deliveries with groundwater supplies adequate to meet demands.
   c. The City Manager, or his/her designee, will provide a weekly report to news media with information regarding current water supply and/or demand conditions, projected water supply and demand conditions if drought conditions persist, and consumer information on water conservation measures and practices.

D. Stage 4 Response -- Emergency Water Shortage Conditions

Whenever emergency water shortage conditions exist as defined in Section VII of the Plan, the City Manager, or his/her designee, shall:

1. Assess the severity of the problem and identify the actions needed and time required to solve the problem.

2. Inform the utility director or other responsible official of each wholesale water customer by telephone or in person and suggest actions, as appropriate, to alleviate problems (e.g., notification of the public to reduce water use until service is restored).

3. If appropriate, notify city, county, and/or state emergency response officials for assistance.

4. Undertake necessary actions, including repairs and/or clean-up as needed.

5. Prepare a post-event assessment report for City use on the incident and critique of emergency response procedures and actions to better prepare for future response measures.

Section IX: Pro Rata Water Allocation

In the event that the triggering criteria specified in Section VII of the Plan for Stage 3 – Severe Water Shortage Conditions or Stage 4 – Emergency Water Shortage Conditions have been met, the City Manager is hereby authorized initiate allocation of water supplies on a pro rata basis in accordance with Texas Water Code Section 11.039. Pro rata allocations for each wholesale customer will be based on a 36-month baseline of water use for each wholesale customer for the previous 36-month period. Where three years of water use information are not available, the baseline will be formulated for that user using available monthly consumption records.

Section X: Enforcement

During Stages 3 and 4 when pro rata allocation of available water supplies is in effect, wholesale customers shall pay the following surcharges on excess water diversions and/or deliveries:

A. 1.2 times the normal water charge for treated water deliveries in excess of the monthly allocation up through 5 percent above the monthly allocation.

B. 1.3 times the normal water charge for treated water deliveries in excess of the monthly allocation from greater than 5 percent through 10 percent above the monthly allocation.

C. 1.4 times the normal water charge for treated water deliveries in excess of the monthly allocation from greater than 10 percent through 15 percent above the monthly allocation.

D. 1.5 times the normal treated water charge for water deliveries more than 15 percent above the monthly allocation.

The above surcharges shall be cumulative.

Section XI: Variances

The City Manager, or his/her designee, may, in writing, grant a temporary variance to the pro rata water allocation policies provided by this Plan if it is determined that failure to grant such variance would cause an emergency condition adversely affecting the public health, welfare, or safety and if one or more of the following conditions are met:

A. Compliance with this Plan cannot be technically accomplished during the duration of the water supply shortage or other condition for which the Plan is in effect.

B. Alternative methods can be implemented which will achieve the same level of reduction in water use.

Persons requesting an exemption from the provisions of this Plan shall file a petition for variance with the City Manager within 5 days after pro rata allocation has been invoked. All petitions for variances shall be reviewed by the City Council of Missouri City, and shall include the following:

1. Name and address of the petitioner(s).
2. Detailed statement with supporting data and information as to how the pro rata allocation of water under the policies and procedures established in the Plan adversely affects the petitioner or what damage or harm will occur to the petitioner or others if petitioner complies with this Resolution.
3. Description of the relief requested.
4. Period of time for which the variance is sought.
5. Alternative measures the petitioner is taking or proposes to take to meet the intent of this Plan and the compliance date.
6. Other pertinent information.

Variances granted by the City Council of Missouri City shall be subject to the following conditions, unless waived or modified by the City Council of Missouri City or its designee:

1. Variances granted shall include a timetable for compliance.
2. Variances granted shall expire when the Plan is no longer in effect, unless the petitioner has failed to meet specified requirements.

No variance shall be retroactive or otherwise justify any violation of this Plan occurring prior to the issuance of the variance.

Section XII: Severability

It is hereby declared to be the intention of the City Council of Missouri City that the sections, paragraphs, sentences, clauses, and phrases of this Plan are severable and, if any phrase, clause, sentence, paragraph, or section of this Plan shall be declared unconstitutional by the valid judgment or decree of any court of competent jurisdiction, such unconstitutionality shall not affect any of the remaining phrases, clauses, sentences, paragraphs, and sections of this Plan, since the same would not have been enacted by the City Council of Missouri City without the incorporation into this Plan of any such unconstitutional phrase, clause, sentence, paragraph, or section.

Appendix A

Service Area Maps

Appendix B

Resolution Adopting the Water Conservation Plan

Insert Future – Resolution Adopting the Water Conservation Plan

Appendix C

Notification to Wholesale Purchasers

Insert Future – Notification to Wholesale Purchasers

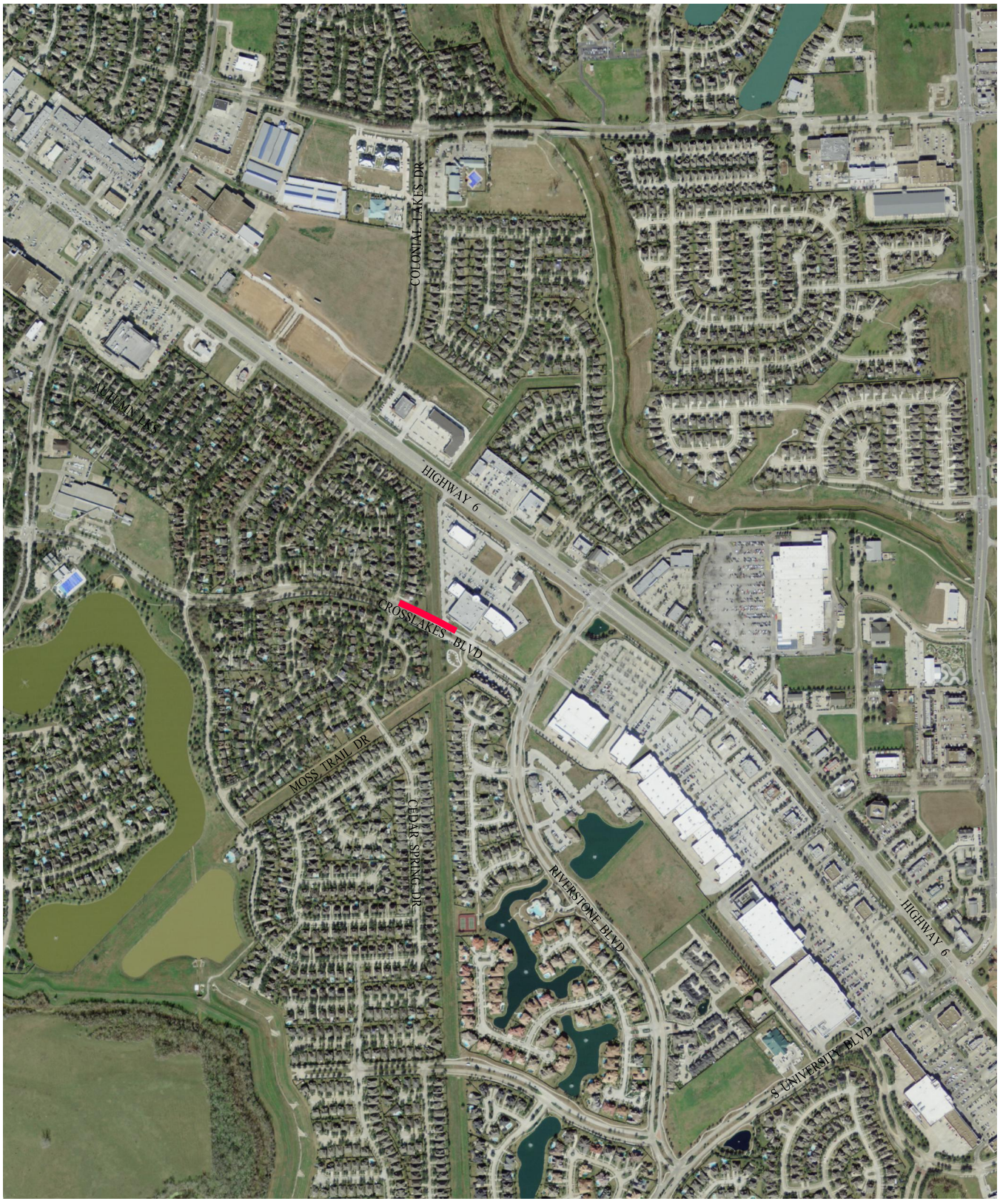
Appendix D

City of Missouri City Water Rate Structure

List of Acronyms and Abbreviations

AQI	Air Quality Index
ASTM	American Society for Testing and Materials
BOD	Biochemical Oxygen Demand
BRA	Brazos River Authority
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CMAS	Compete-Mix Activated Sludge
COMC	City of Missouri City
CWSRF	Clean Water State Revolving Fund
DWSRF	Drinking Water State Revolving Fund
DO	Dissolved Oxygen
eHT	Enprotec / Hibbs & Todd, Inc.
EPA	U.S. Environmental Protection Agency
ESFC	Equivalent Single Family Connections
EST	Elevated Storage Tanks
ETJ	Extra-Territorial Jurisdiction
FEMA	Federal Emergency Management Agency
FIRM	FEMA Flood Insurance Rate Map
FBCSD	Fort Bend County Subsidence District
FM	Farm-to-Market Road
ft/s	Feet per Second
GCWA	Gulf Coast Water Authority
GIS	Geographic Information System
gpd	Gallons per Day
gpm	Gallons per Minute
GRP	Groundwater Reduction Plan
GW	Ground Water
GWTP	Ground Water Treatment Plant
H-GAC	Houston-Galveston Area Council
HRT	Hydraulic Retention Time
IOU	Investor Owned Utilities
IPaC	Information, Planning, and Conservation system
MG	Million Gallons
MGD	Million Gallons per Day
mg/L	Milligrams per Liter
MUD	Municipal Utility District
NH_3	Ammonia
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
NWP	Nationwide Permit
O & M	Operation & Maintenance
PE	Professional Engineer

PLC	Programmable Logic Controller
PS	Pump Station
RWTP	Regional Water Treatment Plant
RO	Reverse Osmosis
ROW	Right Of Way
SAWS	San Antonio Water System
SB1	Senate Bill 1
SB-FB	Steep Bank - Flat Bank
SBR	Sequencing Batch Reactor
SCADA	Supervisory Control and Data Acquisition
SDWA	Safe Drinking Water Act
SFY	State Fiscal Year
SH	State Highway
SPLID	Sienna Plantation Levee Improvement District
sq mi	Square Miles
SW	Surface Water
SWP3	Storm Water Pollution Prevention Plan
SWTP	Surface Water Treatment Plant
SWWC	Southwest Water Company
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TMDL	Total Daily Maximum Load
TPDES	Texas Pollution Discharge Elimination System
TPWD	Texas Parks & Wildlife Department
TSS	Total Suspended Solids
TWDB	Texas Water Development Board
TxDOT	Texas Department of Transportation
TXNDD	Texas Natural Diversity Database
UD	Utility District
US	United States
USA	Utility Service Area
USACE	United States Corps of Engineers
USFWS	U.S. Fish and Wildlife Services
WC & ID	Water Control & Improvement District
WHAB	Wildlife Habitat Assessment
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant



LEGEND

PROPOSED WATER LINE

N

500 0 1000

SCALE IN FEET

AERIAL PHOTO
WATER OPTION 1

FIRST COLONY MUD #9 AND
FORT BEND COUNTY MUD #115
INTERCONNECT
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

LEGEND

PROPOSED WATER LINE

N

500 0 1000

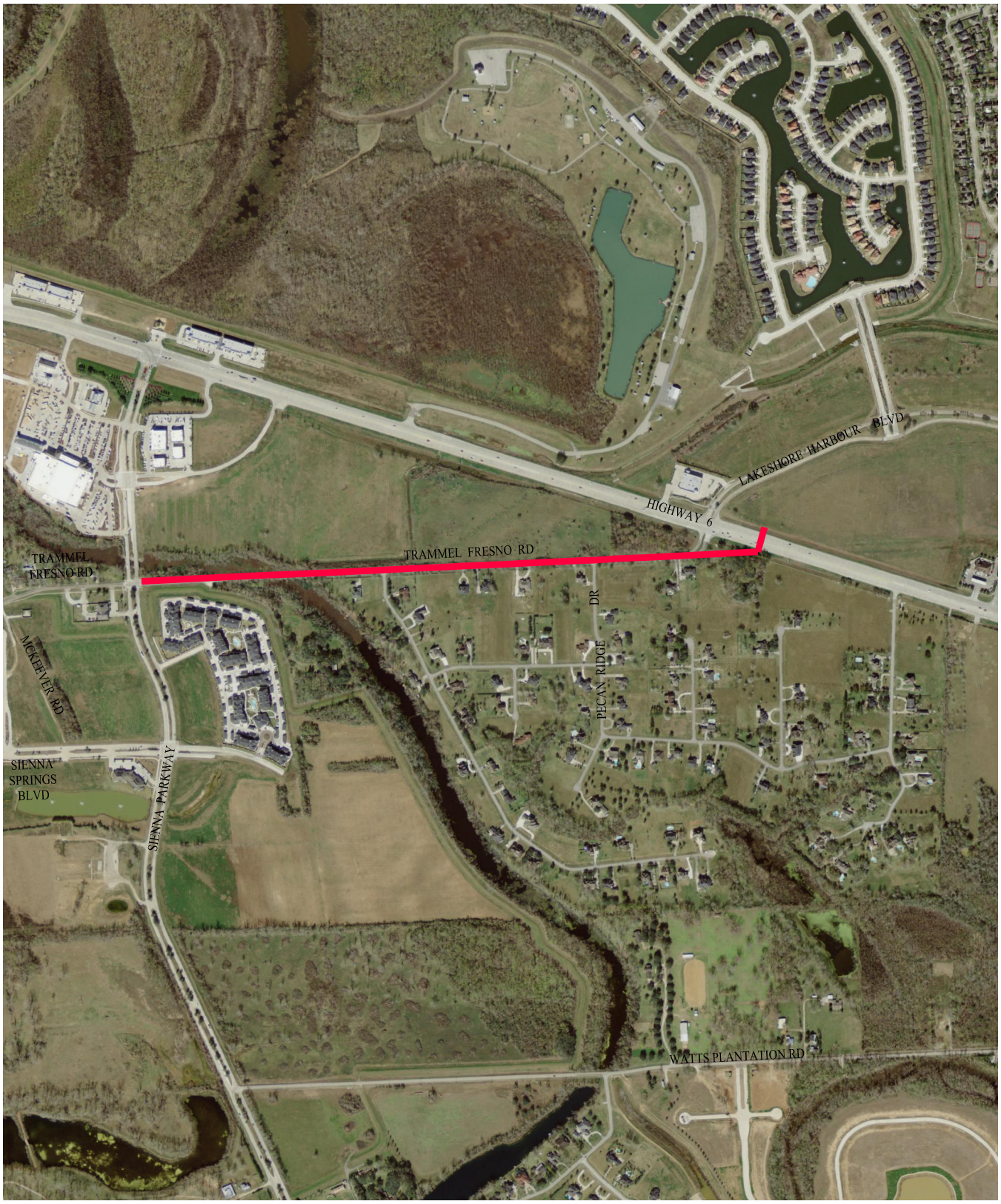
SCALE IN FEET

AERIAL PHOTO
WATER OPTION 2

MUSTANG BAYOU AND SIENNA PLANTATION INTERCONNECT NO. 2
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

N

500 0 1000

SCALE IN FEET

AERIAL PHOTO
WATER OPTION 3

MUSTANG BAYOU AND SIENNA PLANTATION INTERCONNECT NO. 3
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151

LEGEND

PROPOSED WATER LINE

N

500 0 1000

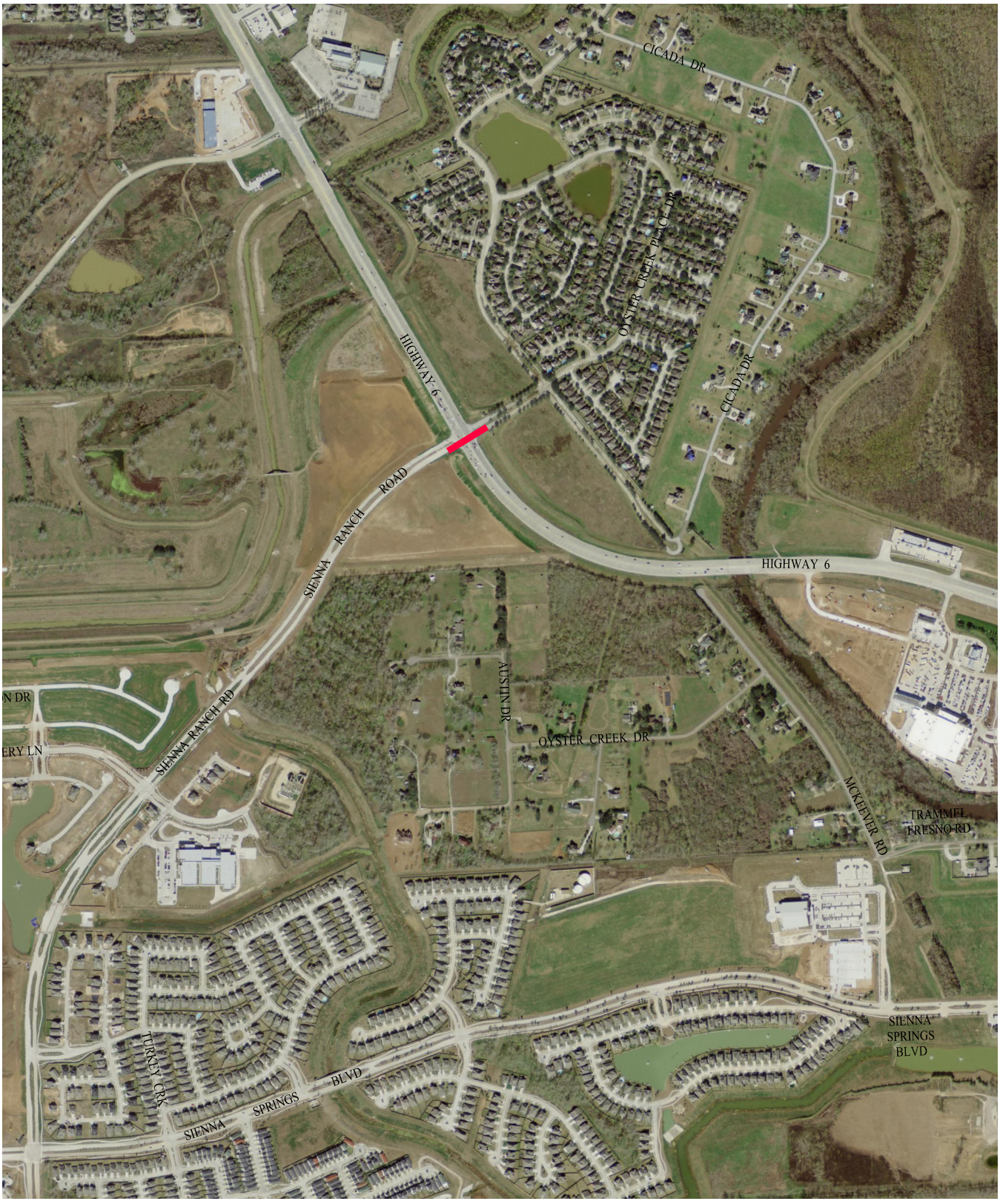
SCALE IN FEET

AERIAL PHOTO
WATER OPTION 4

SIENNA PLANTATION
INTERNAL INTERCONNECT
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

N

500 0 1000

SCALE IN FEET

AERIAL PHOTO
WATER OPTION 5

SIENNA PLANTATION AND
PALMER PLANTATION
INTERCONNECT NO. 1
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151

LEGEND

PROPOSED WATER LINE

N

500 0 1000

SCALE IN FEET

AERIAL PHOTO
WATER OPTION 6

SILVER RIDGE DEVELOPMENT AND SIENNA PLANTATION INTERCONNECT NO. 1
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

LEGEND

PROPOSED WATER LINE

N

500 0 1000

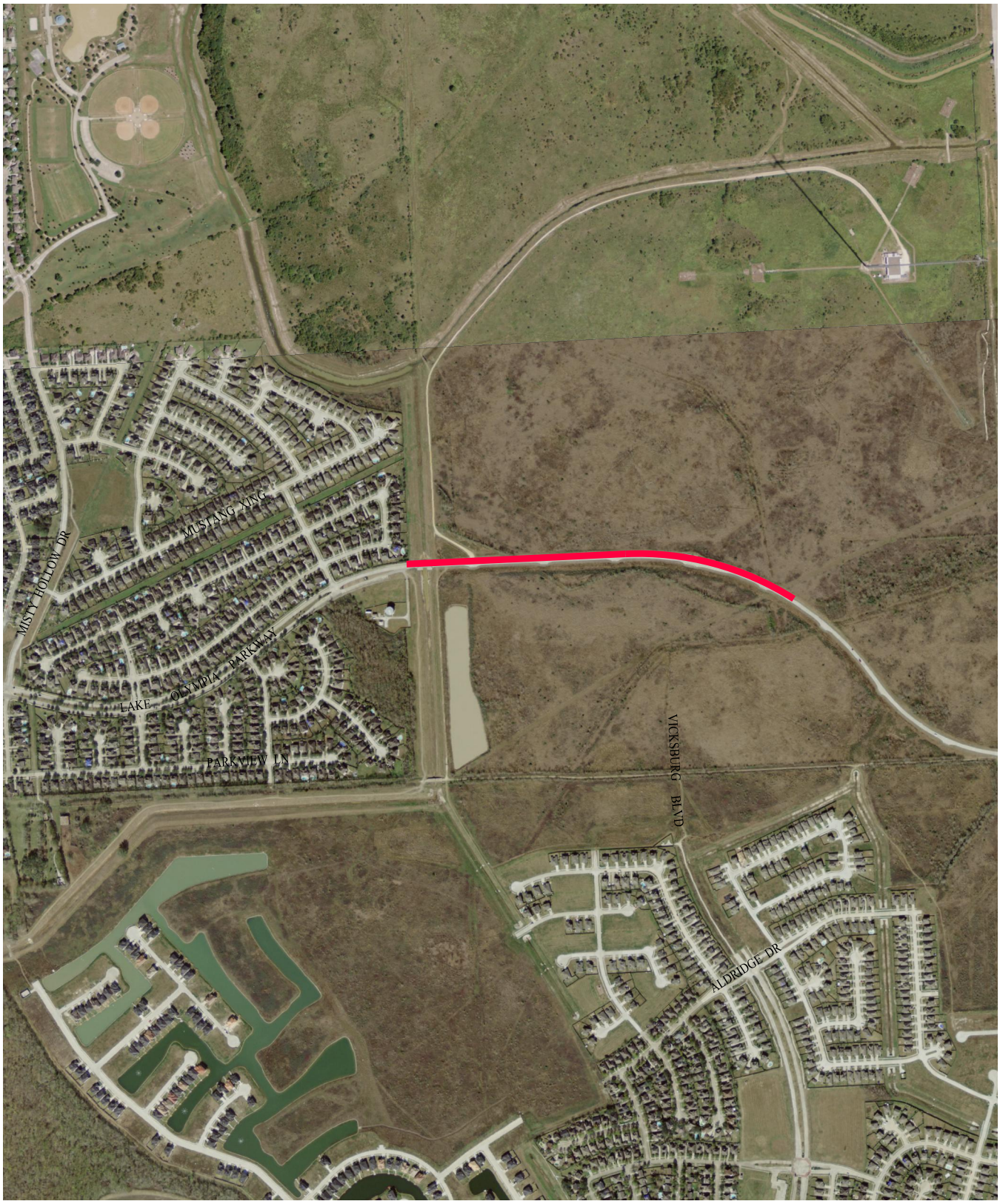
SCALE IN FEET

AERIAL PHOTO
WATER OPTION 7

FORT BEND COUNTY MUD #149 AND
SIENNA PLANTATION
INTERCONNECT NO. 1
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

N

500 0 1000

SCALE IN FEET

AERIAL PHOTO
WATER OPTION 12

MUSTANG BAYOU AND PALMER PLANTATION INTERCONNECT 2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151

LEGEND

PROPOSED WATER LINE

N

500 0 1000

SCALE IN FEET

AERIAL PHOTO
WATER OPTION 13

MUSTANG BAYOU AND QUAIL VALLEY INTERCONNECT 2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151

LEGEND

PROPOSED NEW ELEVATED STORAGE TAN□ LOCATION

N

500 0 1000

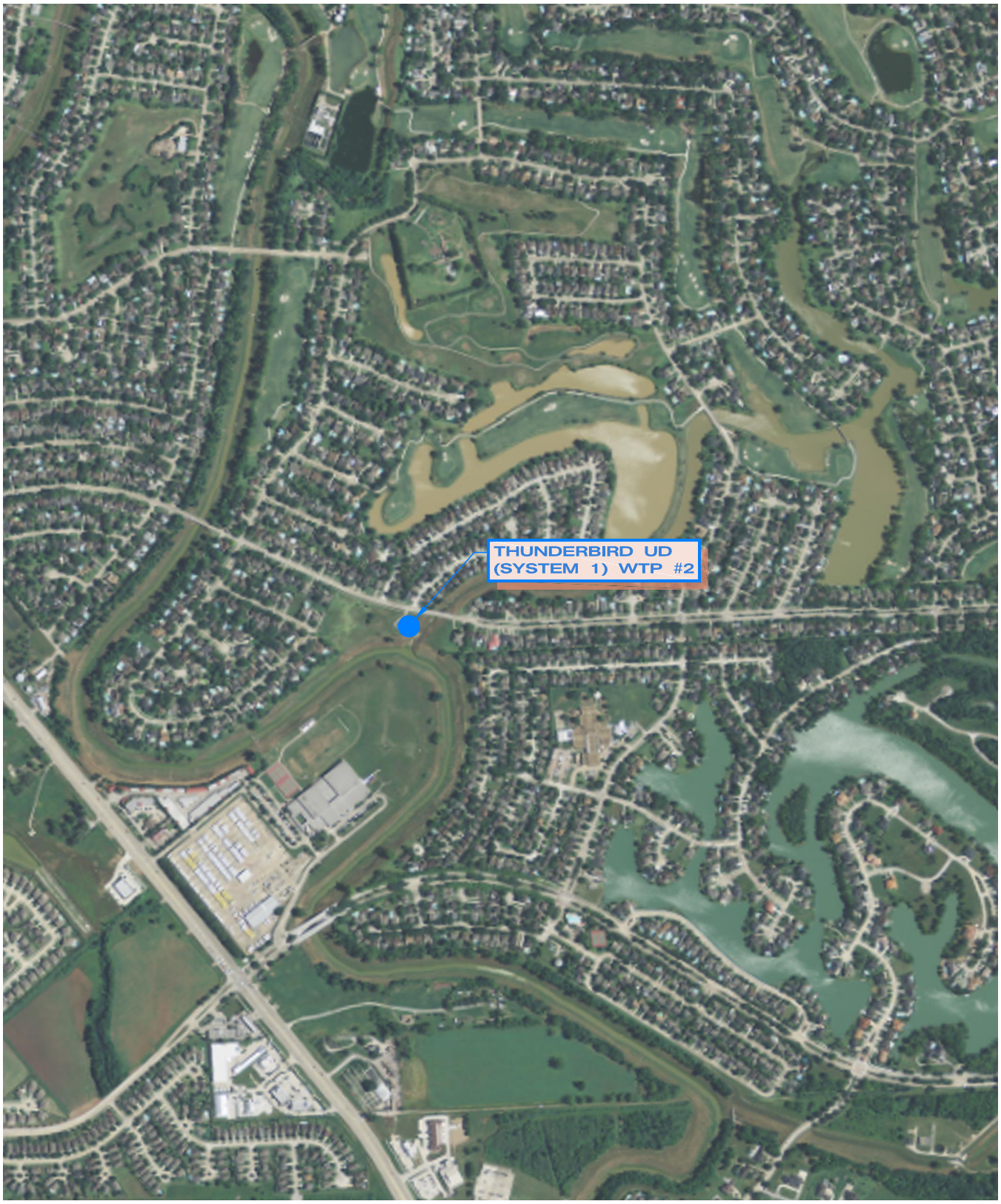
SCALE IN FEET

AERIAL PHOTO

HARRIS COUNTY WC & ID
FONDREN RD. WTP #2
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/14/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

PROPOSED NEW ELEVATED STORAGE TAN□ LOCATION

N

500 0 1000

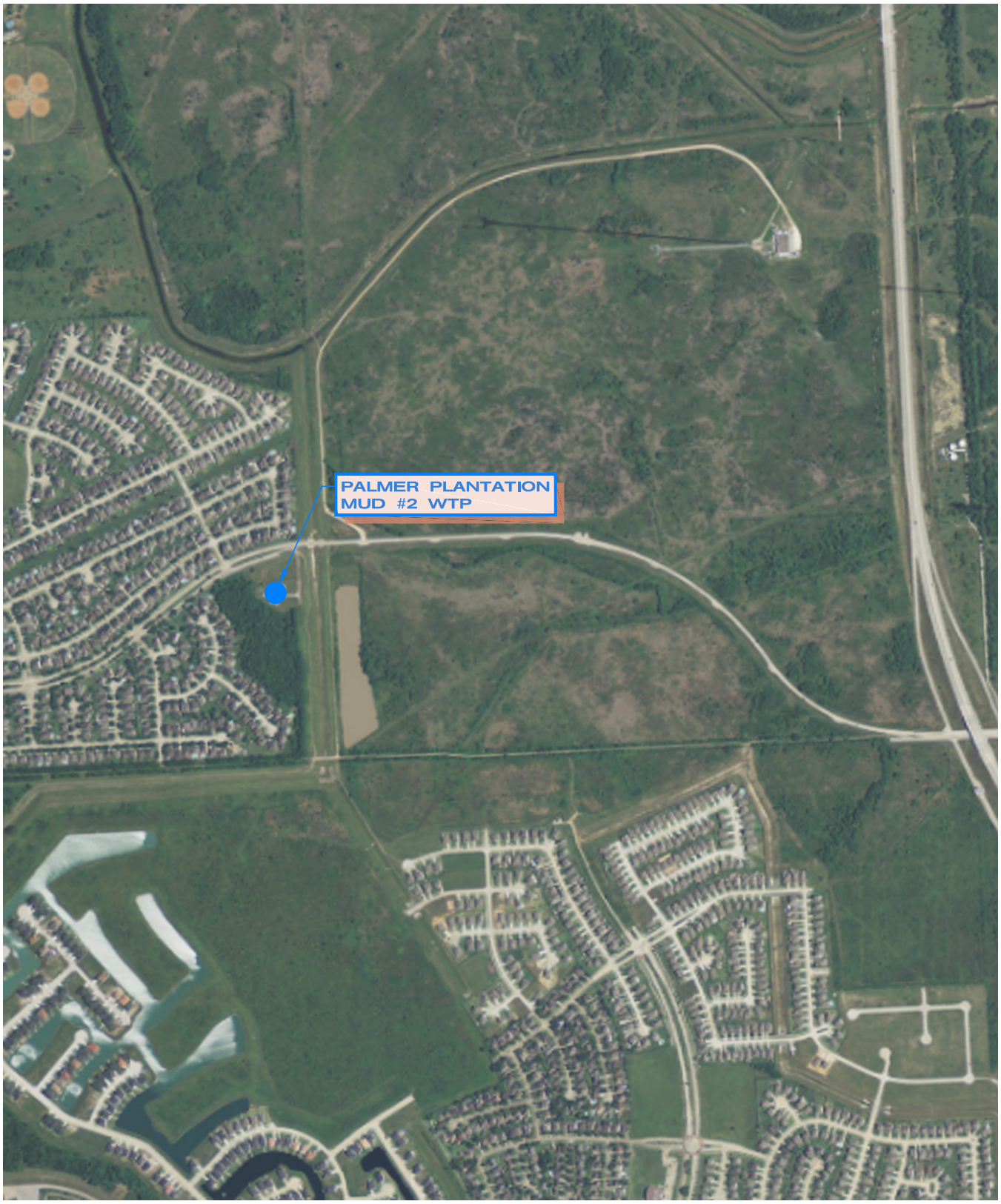
SCALE IN FEET

AERIAL PHOTO

THUNDERBIRD UD
(SYSTEM 1) WTP #2
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/14/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

PROPOSED NEW ELEVATED STORAGE TAN□ LOCATION

N

500 0 1000

SCALE IN FEET

AERIAL PHOTO

PALMER PLANTATION
WTP #2
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/14/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

LEGEND

PROPOSED NEW ELEVATED STORAGE TANK LOCATION

N

500 0 1000

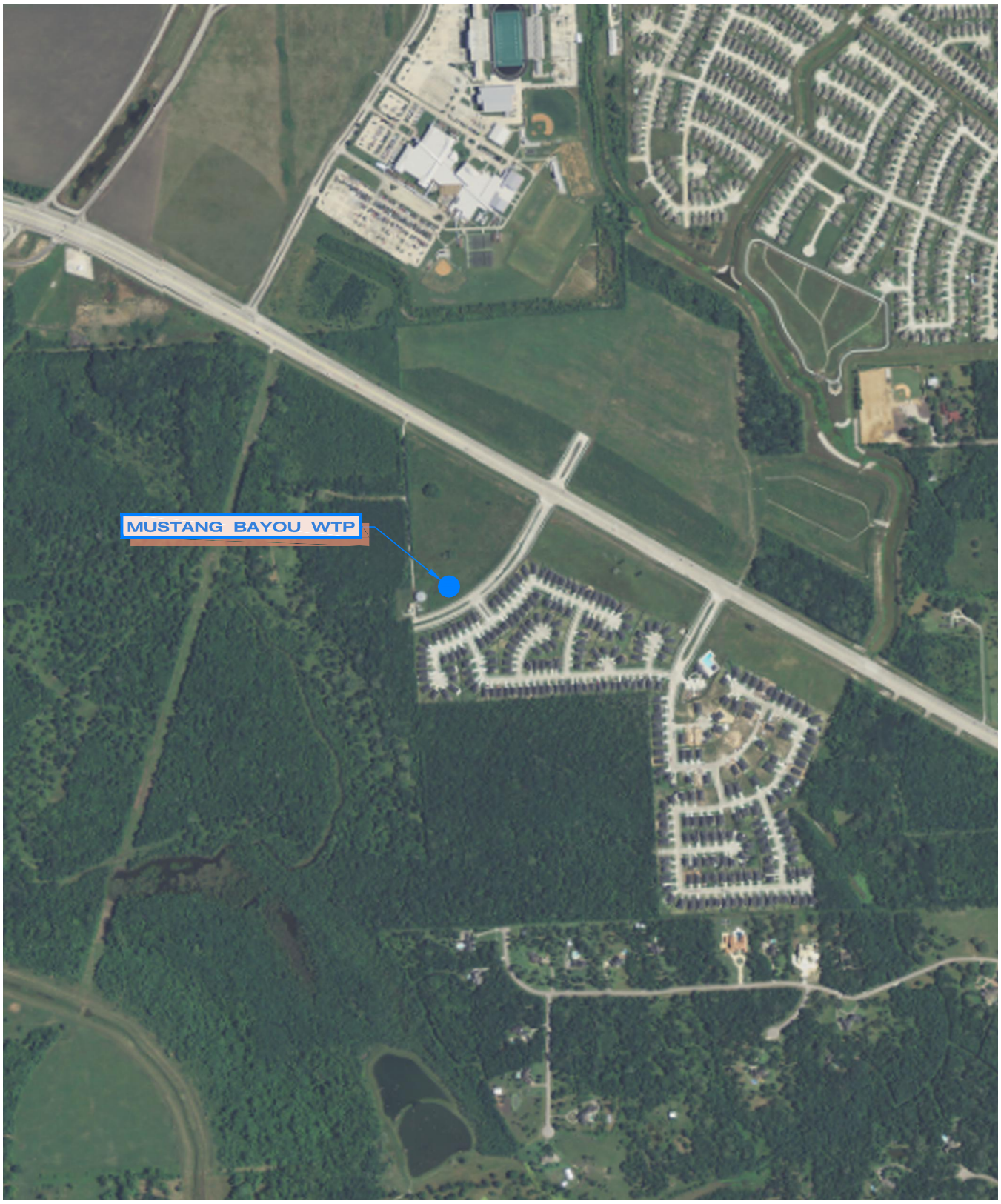
SCALE IN FEET

AERIAL PHOTO

FORT BEND COUNTY
MUD #149 WTP
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/14/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



LEGEND

PROPOSED NEW ELEVATED STORAGE TAN□ LOCATION

N

500 0 1000

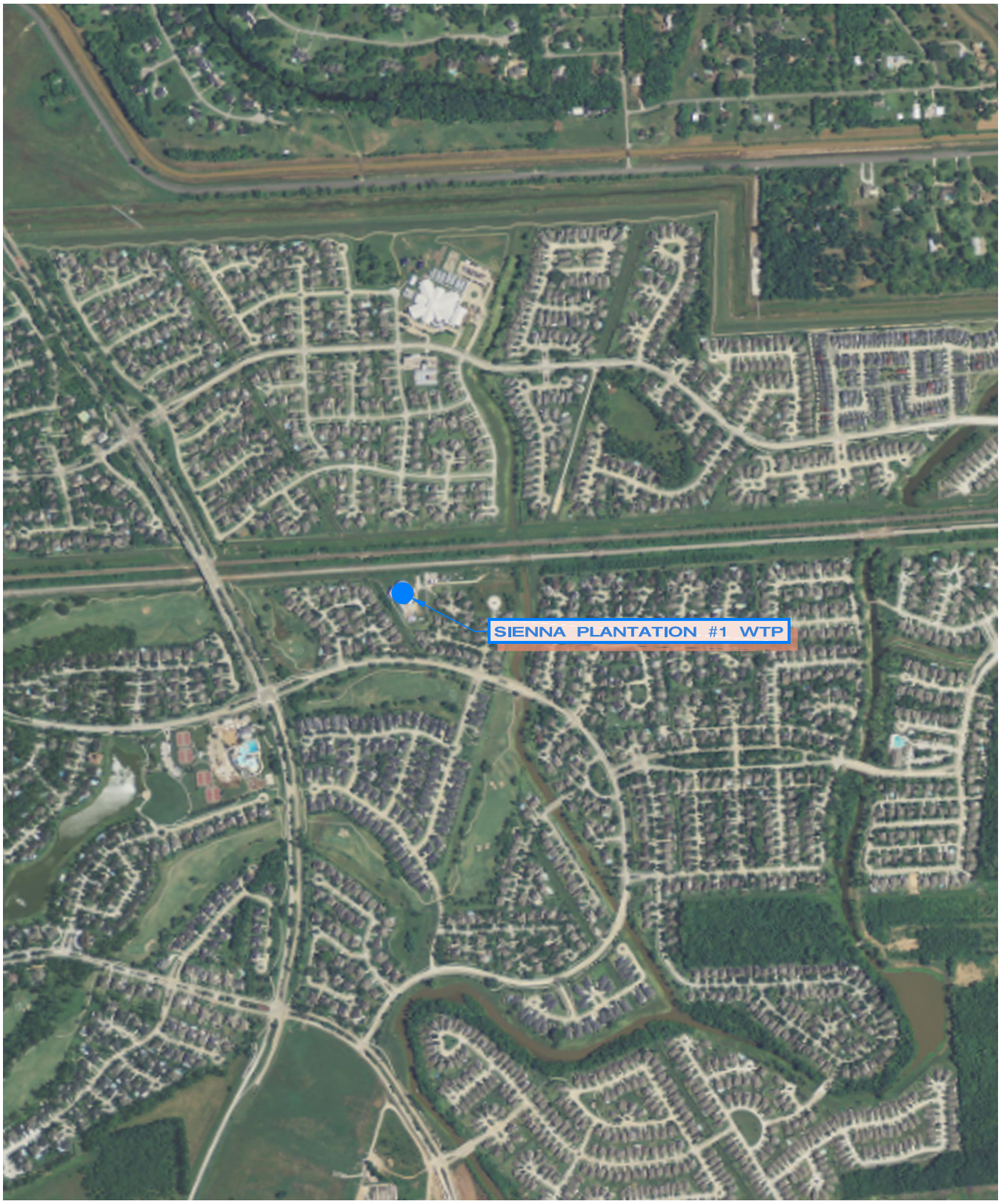
SCALE IN FEET

AERIAL PHOTO

MUSTANG BAYOU WTP
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/14/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

PROPOSED NEW ELEVATED STORAGE TAN□ LOCATION

N

500 0 1000

SCALE IN FEET

AERIAL PHOTO

SIENNA
PLANTATION #1 WTP
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/14/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

N

500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATION
- PROPOSED WWTP LOCATION

	1
	2
3	4
5	6
7	
8	9
10	11

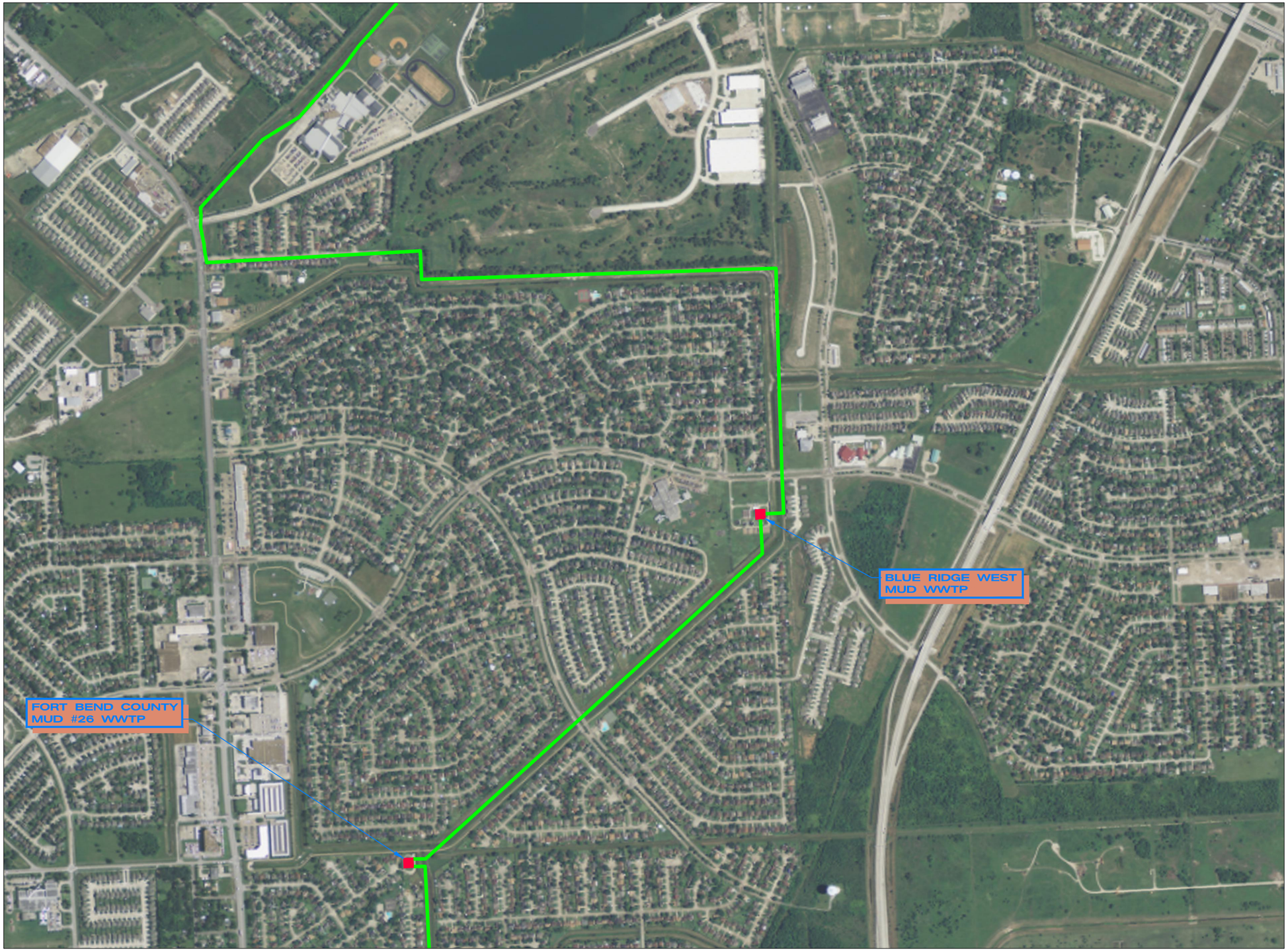
KEY MAP

AERIAL PHOTO

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



N

500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATION
- PROPOSED WWTP LOCATION

	1
	2
3	4
5	6
7	
8	9
10	11

KEY MAP

AERIAL PHOTO

2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

N

500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATION
- PROPOSED WWTP LOCATION

	1
	2
3	4
5	6
7	
8	9
10	11

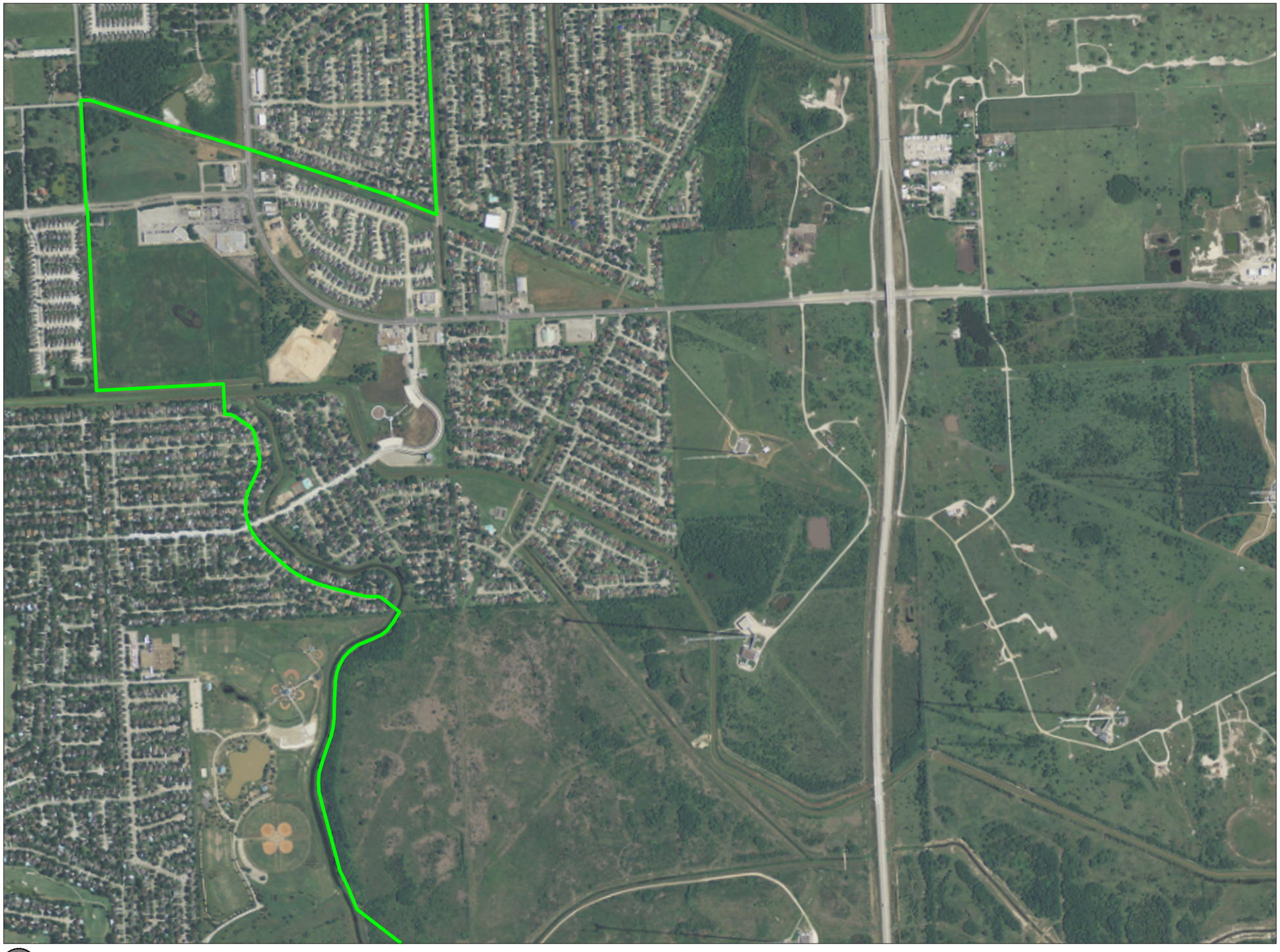
KEY MAP

AERIAL PHOTO

2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



N

500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATION
- PROPOSED WWTP LOCATION

	1
	2
3	4
5	6
7	
8	9
10	11

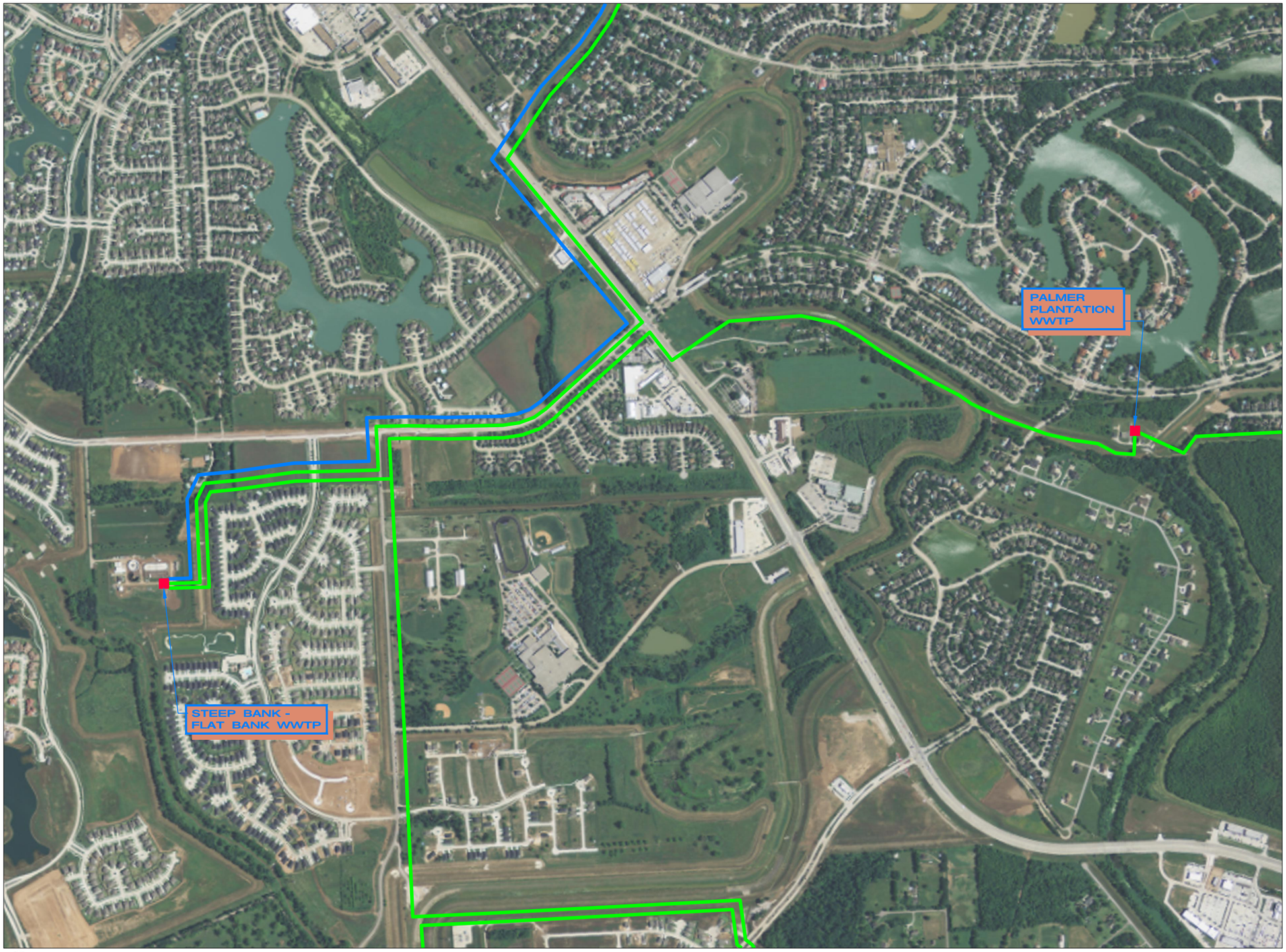
KEY MAP

AERIAL PHOTO

2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



N

500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATION
- PROPOSED WWTP LOCATION

	1
	2
3	4
5	6
7	
8	9
10	11

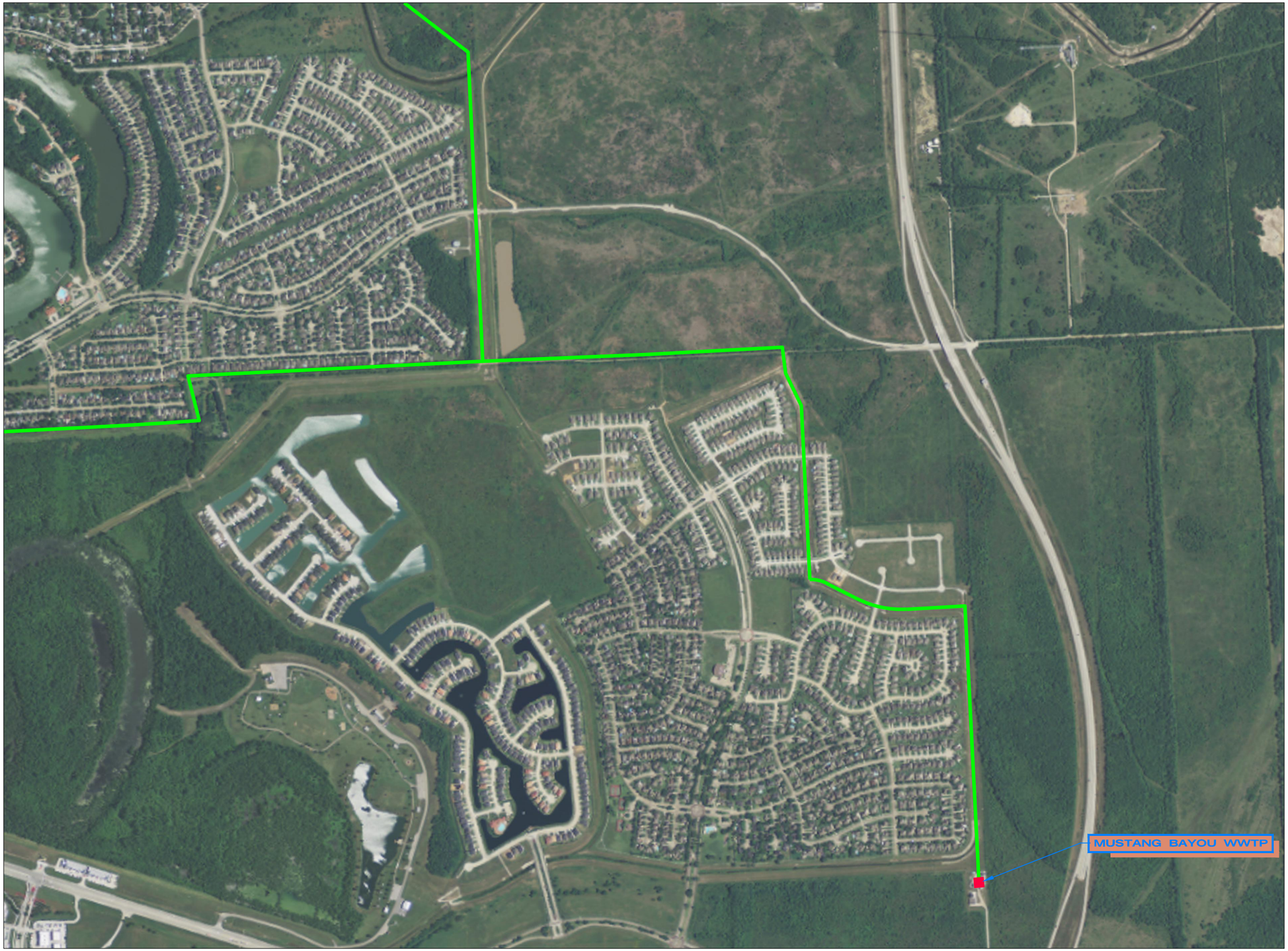
KEY MAP

AERIAL PHOTO

2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



N

500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATION
- PROPOSED WWTP LOCATION

	1
	2
3	4
5	6
7	
8	9
10	11

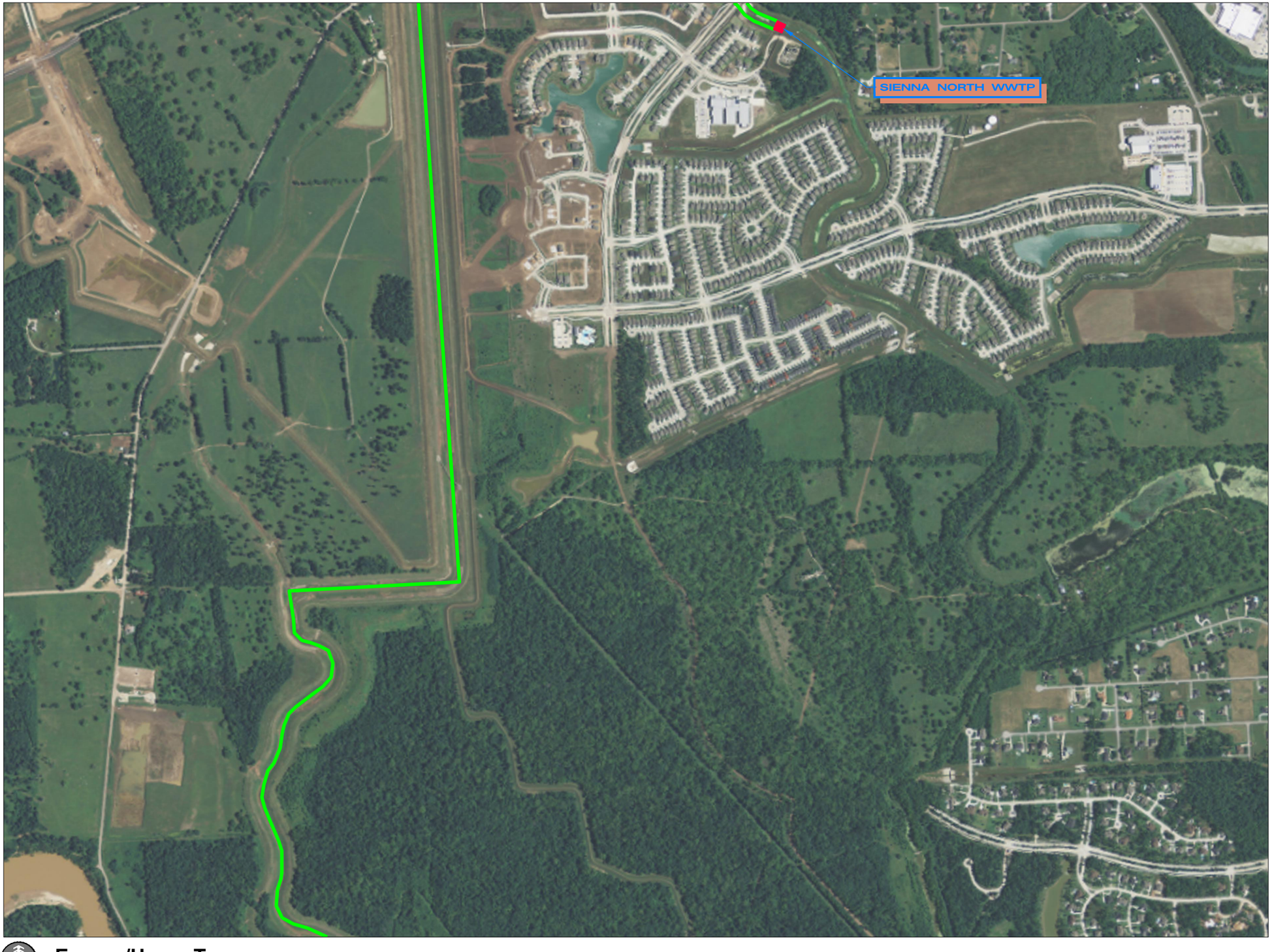
KEY MAP

AERIAL PHOTO

2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



N

500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATION
- PROPOSED WWTP LOCATION

	1
	2
3	4
5	6
7	
8	9
10	11

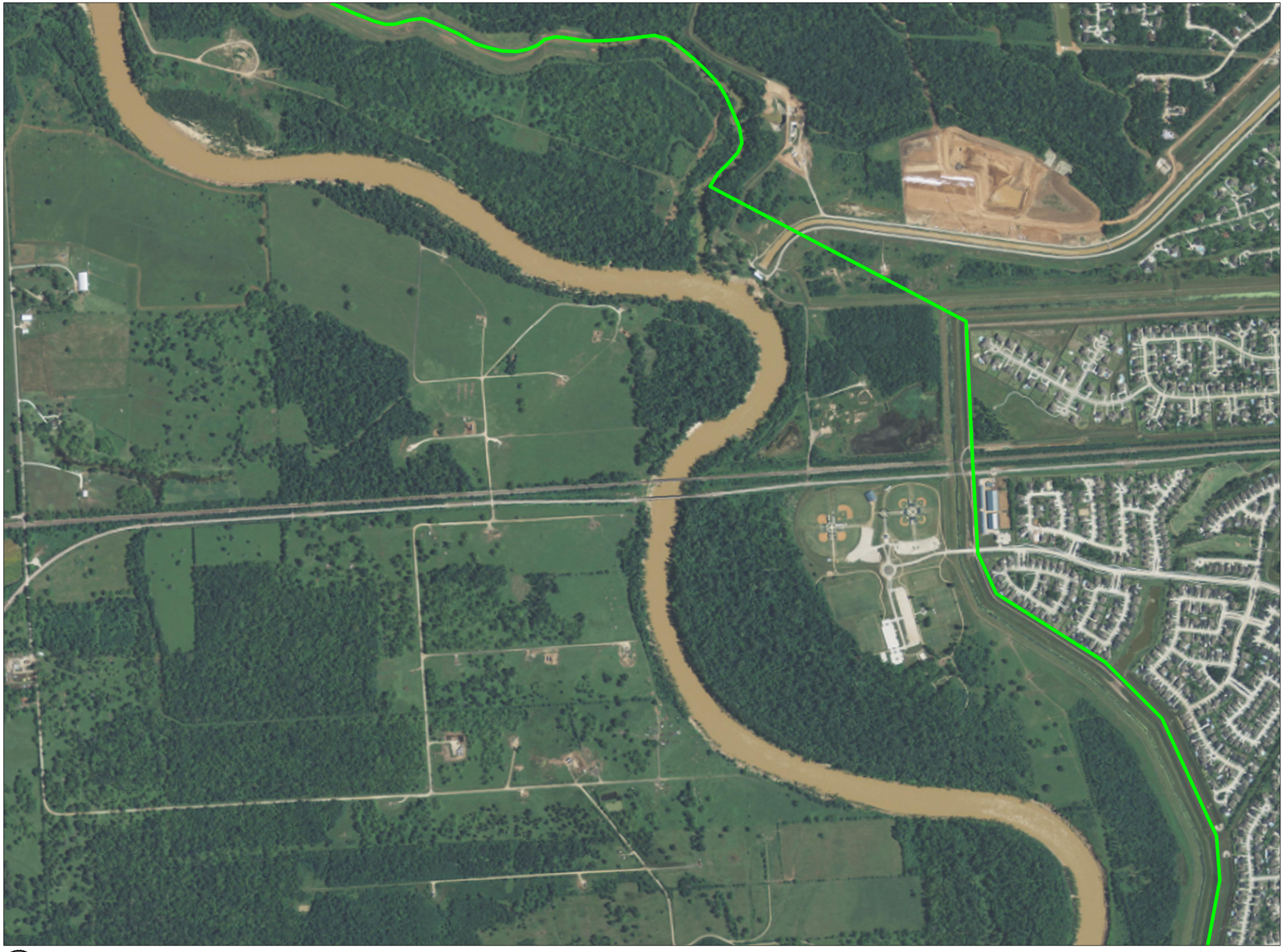
KEY MAP

AERIAL PHOTO

2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



N

500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATION
- PROPOSED WWTP LOCATION

	1
	2
3	4
5	6
7	
8	9
10	11

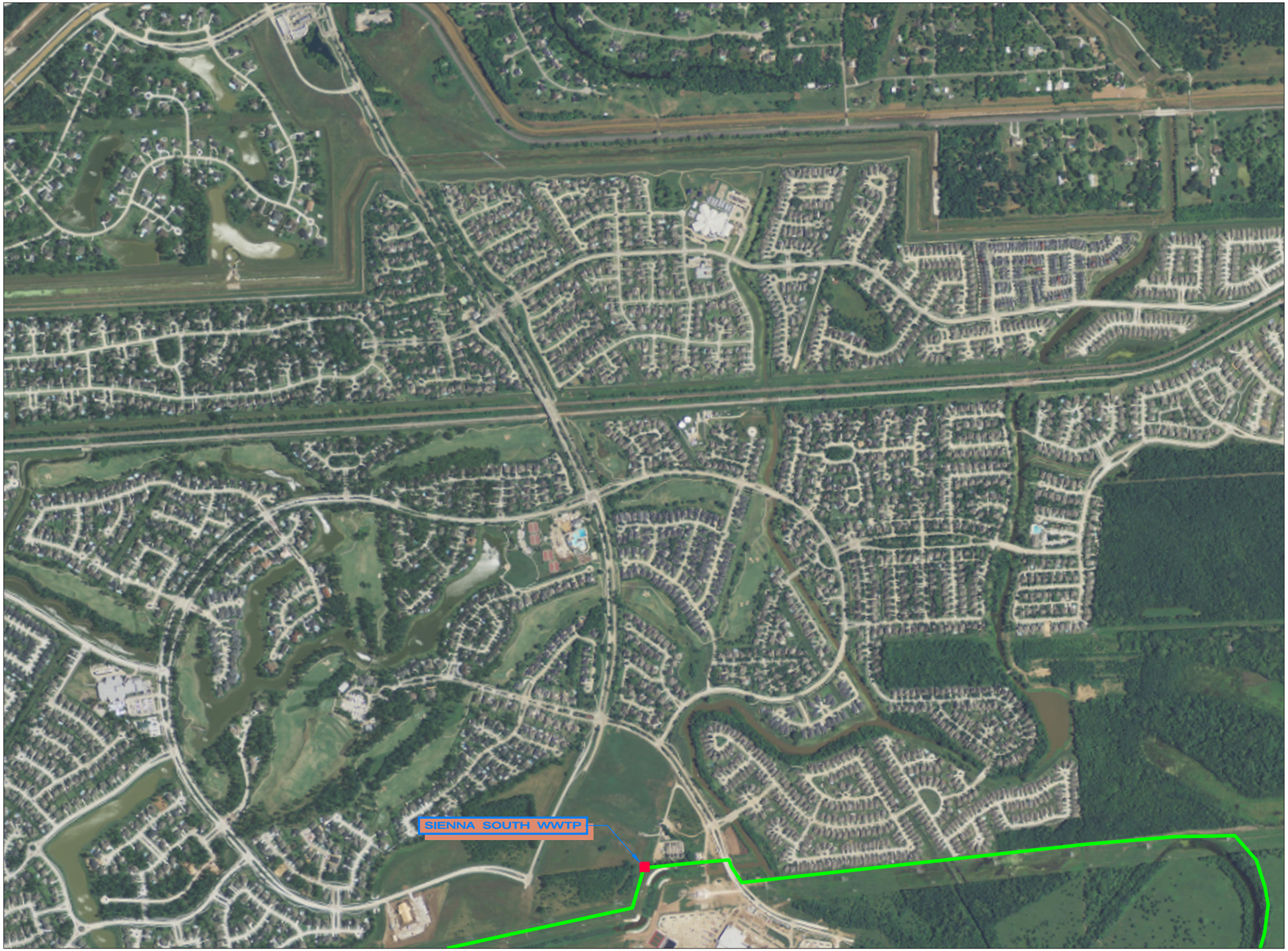
KEY MAP

AERIAL PHOTO

2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



N

500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATION
- PROPOSED WWTP LOCATION

	1
	2
3	4
5	6
7	
8	9
10	11

KEY MAP

AERIAL PHOTO

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

N

500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATION
- PROPOSED WWTP LOCATION

	1
	2
3	4
5	6
7	
8	9
10	11

KEY MAP

AERIAL PHOTO

2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151

N

500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATION
- PROPOSED WWTP LOCATION

	1
	2
3	4
5	6
7	
8	9
10	11

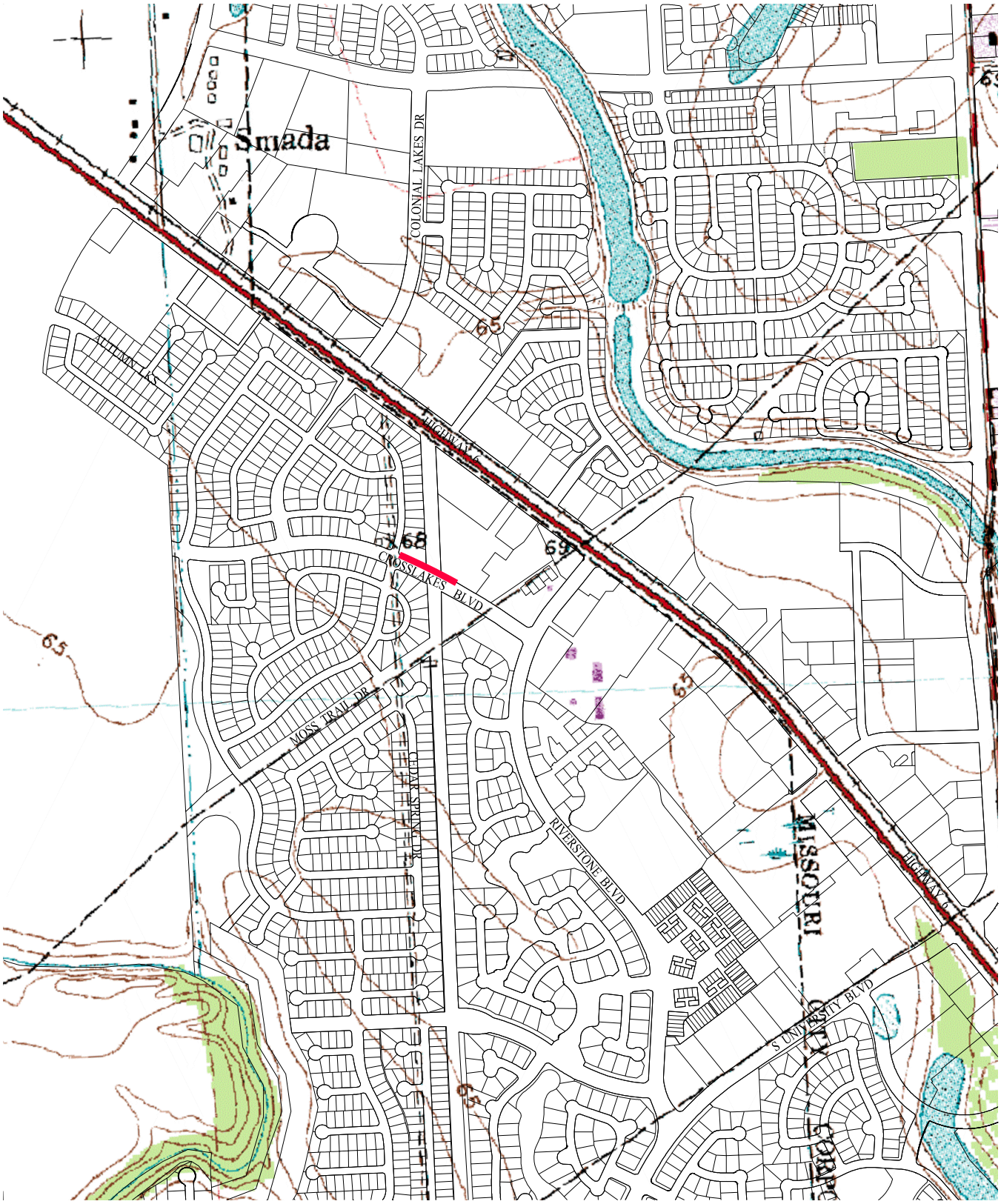
KEY MAP

AERIAL PHOTO

2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 01/27/2012

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

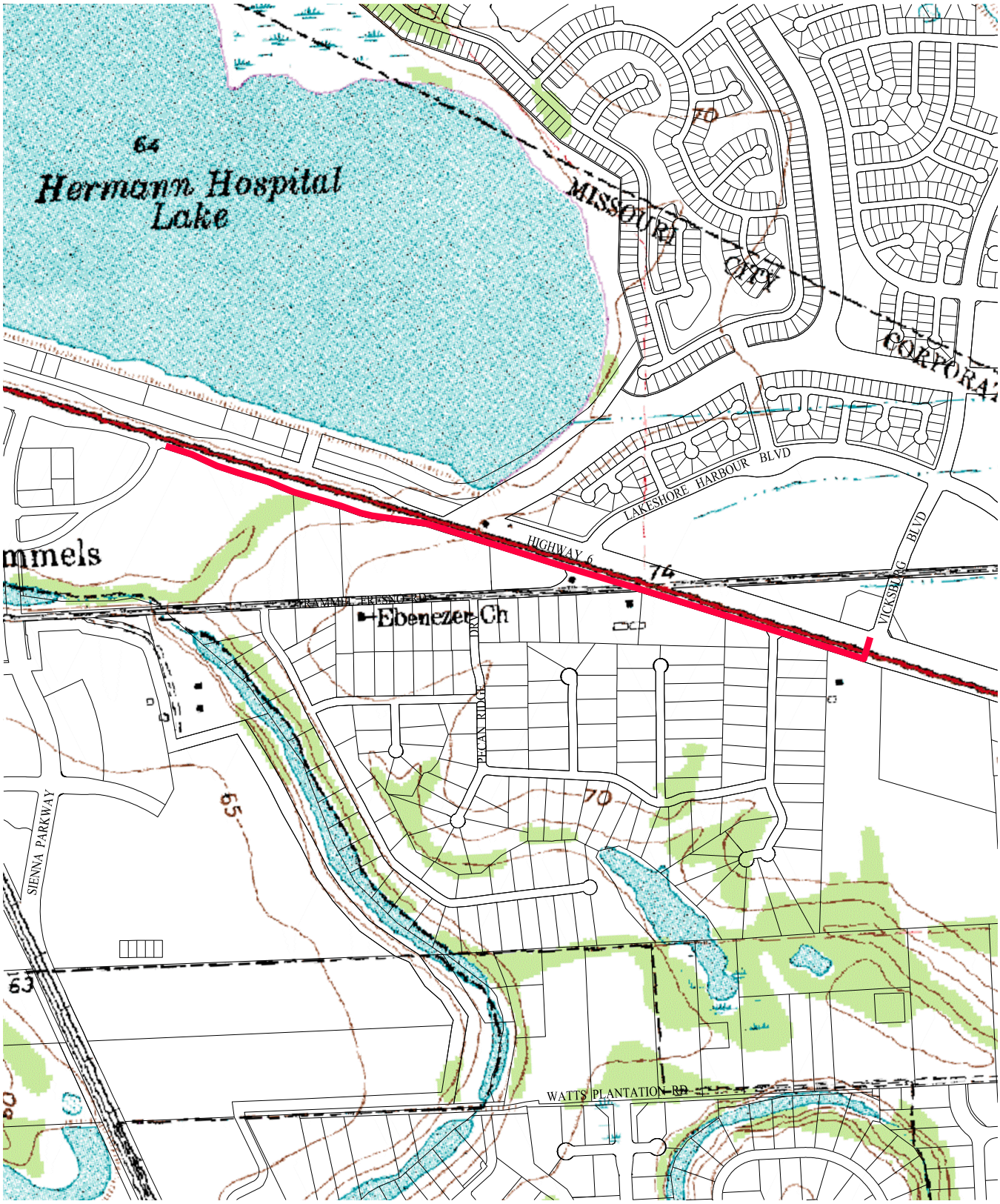
SCALE IN FEET

USGS MAP
WATER OPTION 1

FIRST COLONY MUD #9 AND
FORT BEND COUNTY MUD #115
INTERCONNECT
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

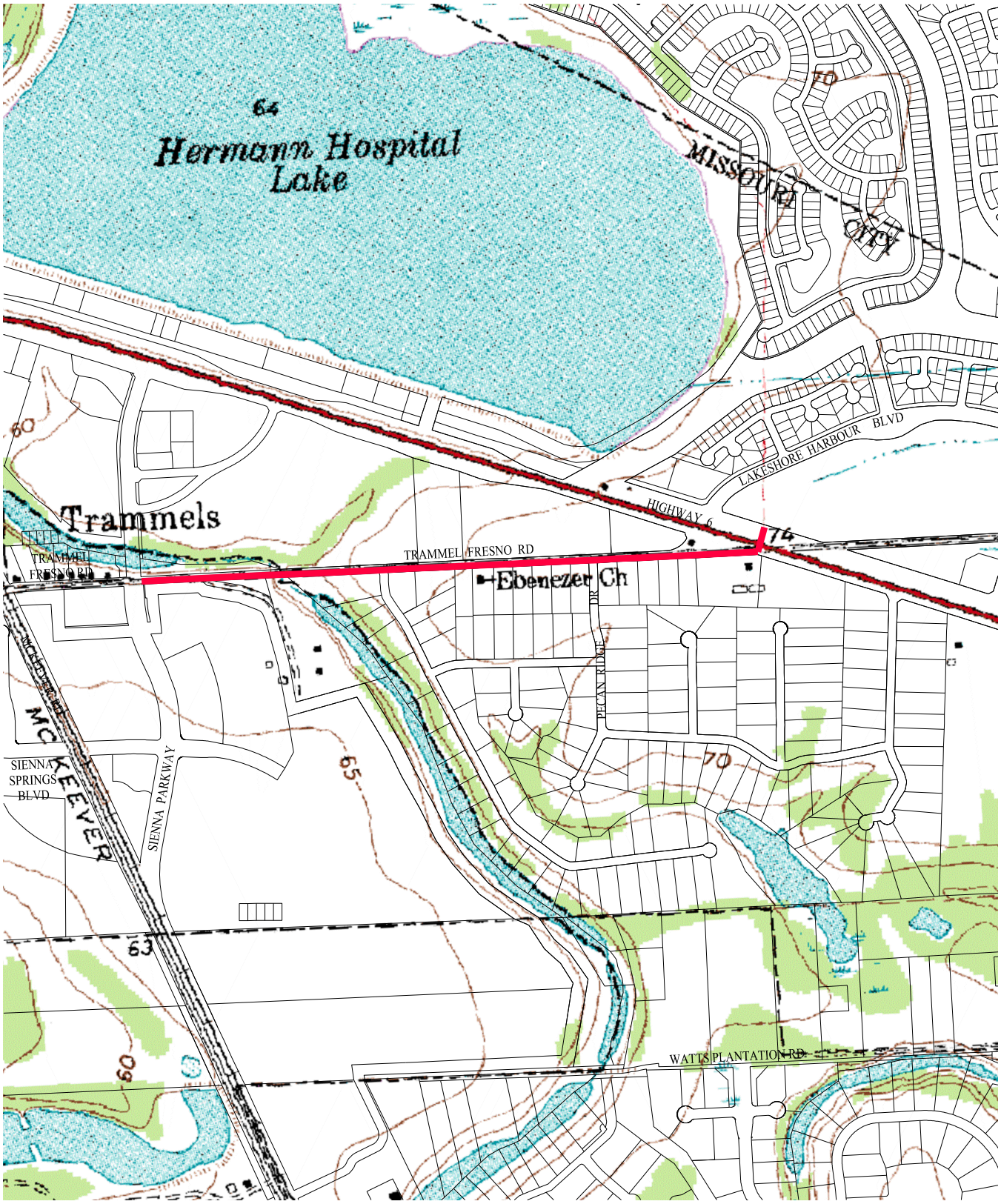
SCALE IN FEET

USGS MAP
WATER OPTION 2

MUSTANG BAYOU AND SIENNA PLANTATION INTERCONNECT NO. 2
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

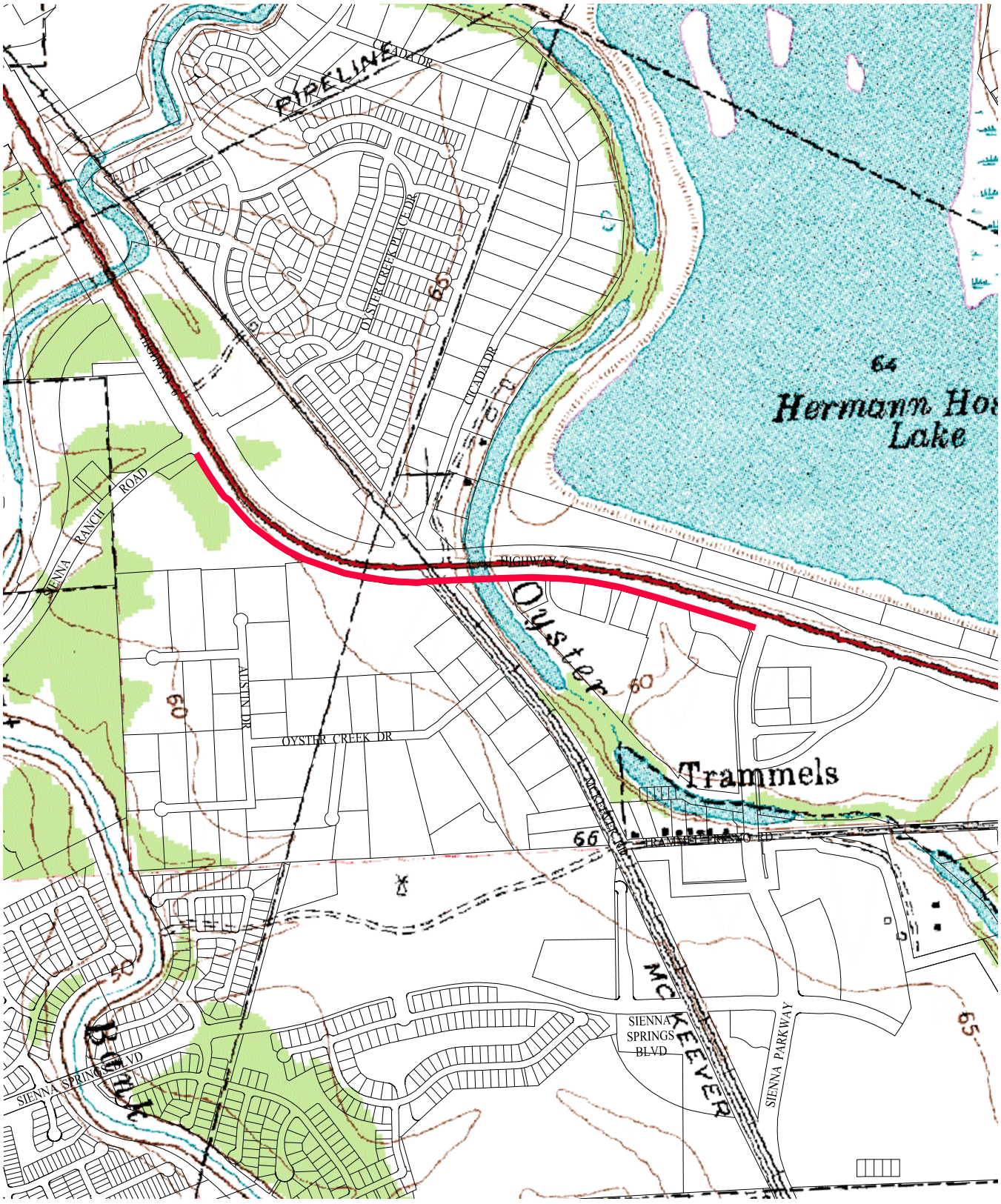
SCALE IN FEET

USGS MAP
WATER OPTION 3

MUSTANG BAYOU AND SIENNA PLANTATION INTERCONNECT NO. 3
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

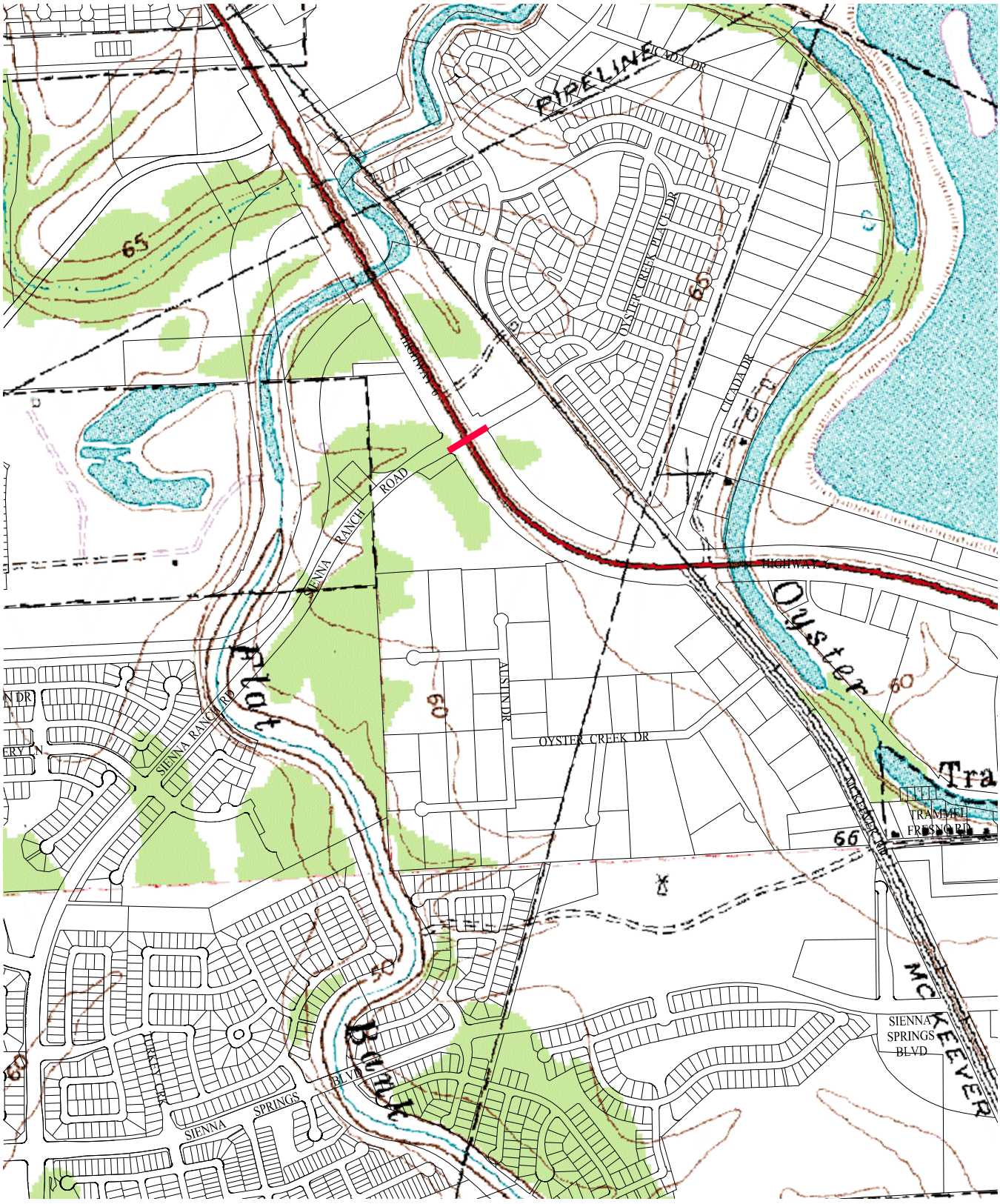
SCALE IN FEET

USGS MAP
WATER OPTION 4

SIENNA PLANTATION
INTERNAL INTERCONNECT
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

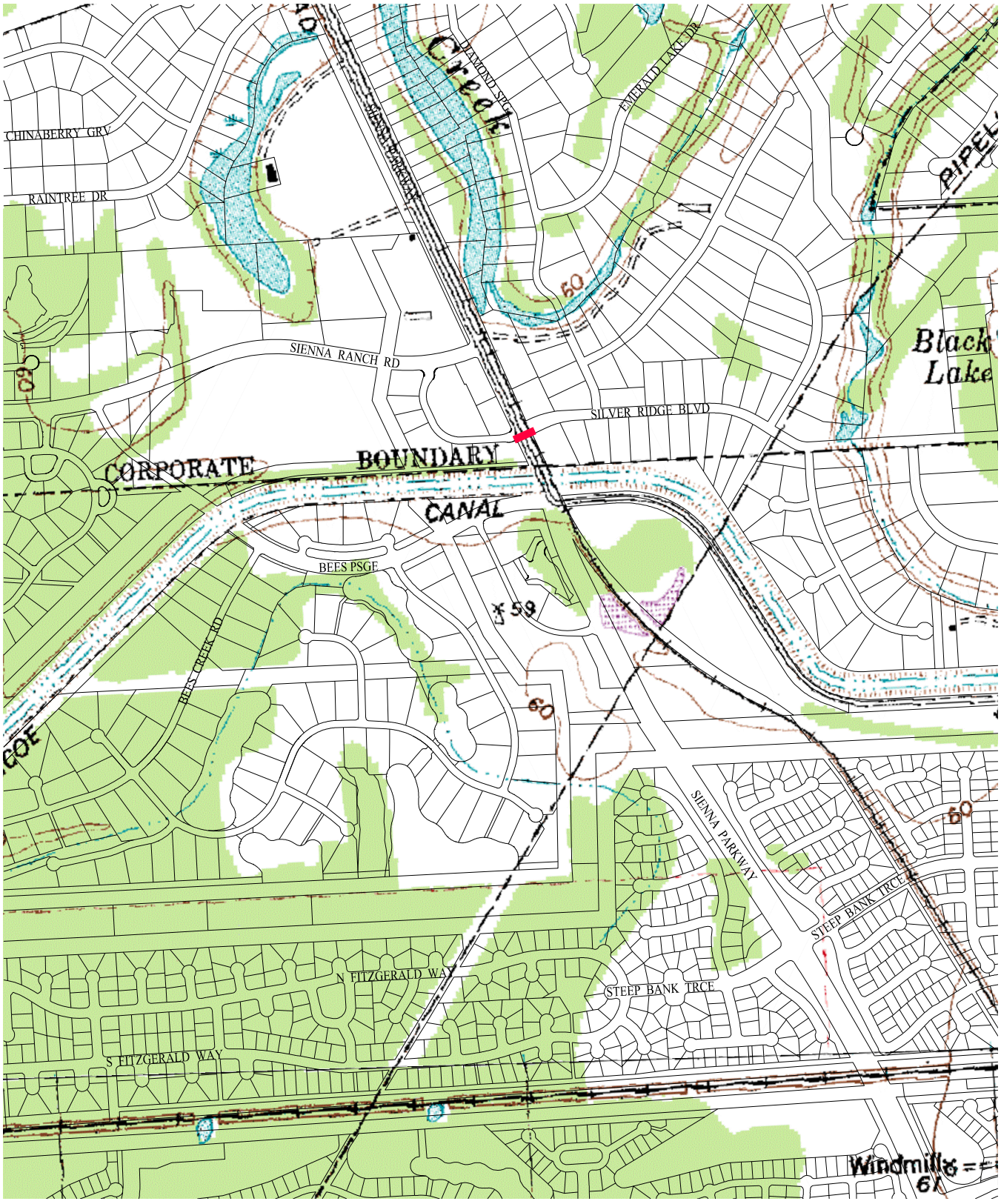
SCALE IN FEET

USGS MAP
WATER OPTION 5

SIENNA PLANTATION AND PALMER PLANTATION INTERCONNECT NO. 1
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

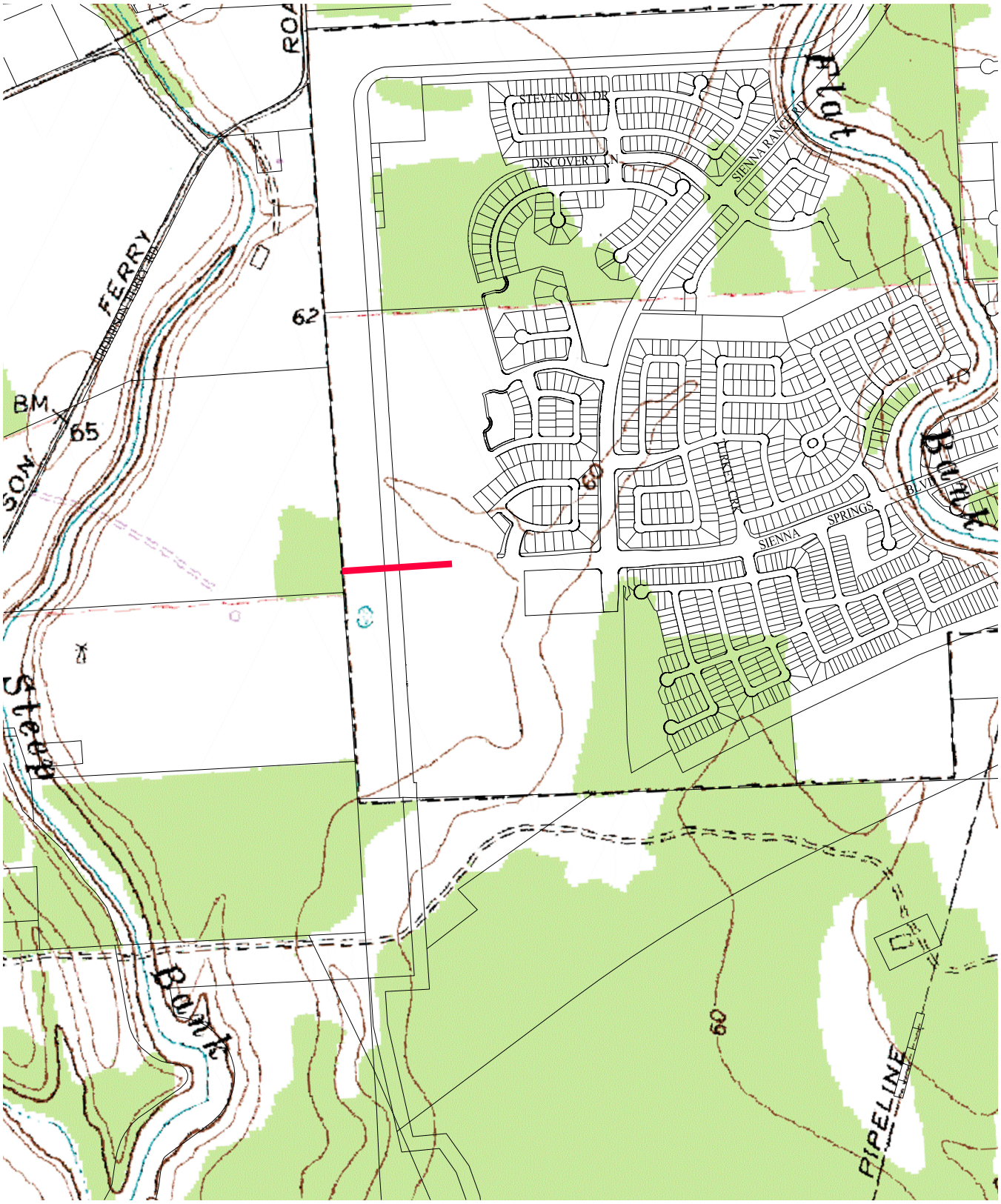
SCALE IN FEET

USGS MAP
WATER OPTION 6

SILVER RIDGE DEVELOPMENT AND SIENNA PLANTATION INTERCONNECT NO. 1
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

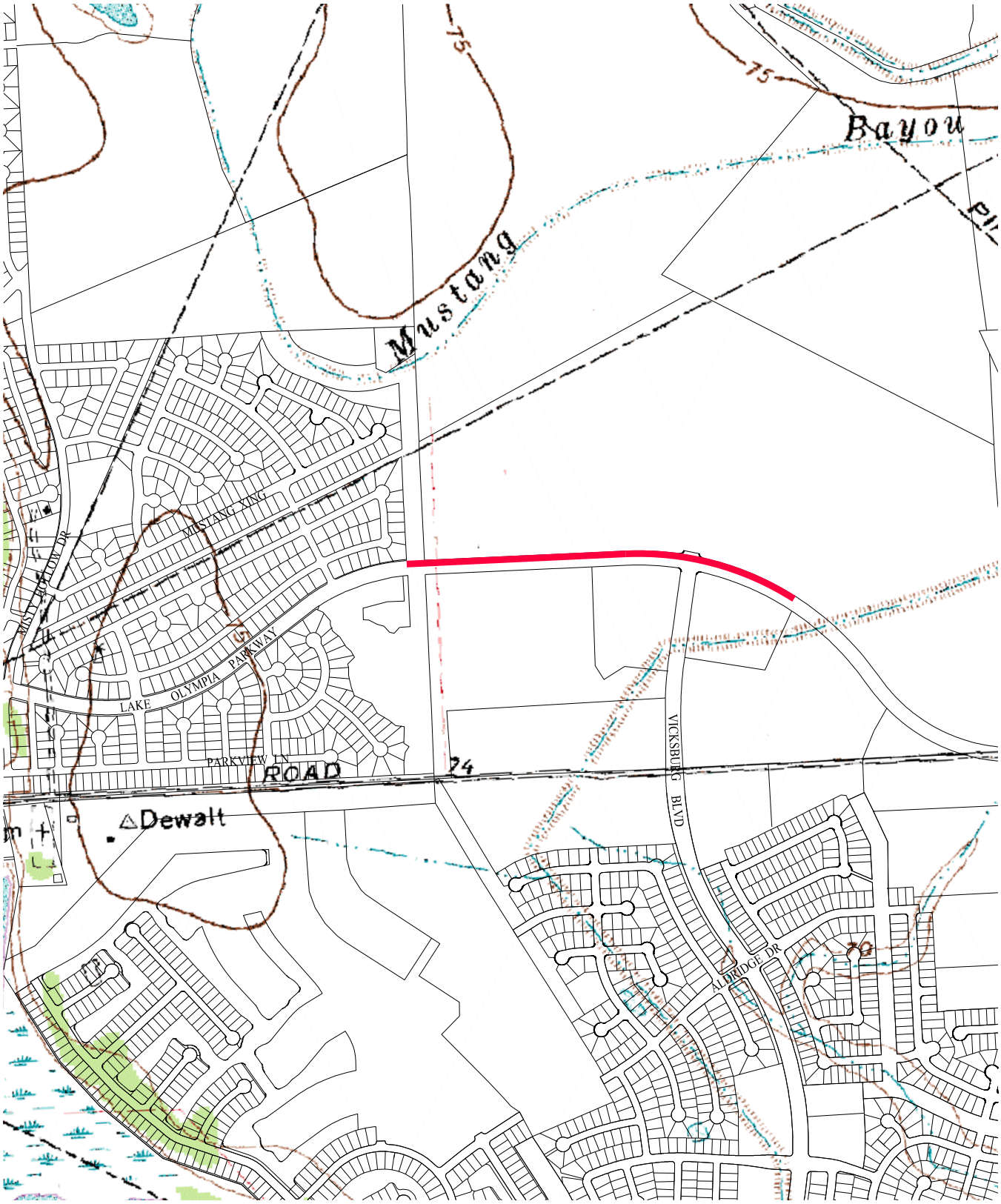
SCALE IN FEET

USGS MAP
WATER OPTION 7

FORT BEND COUNTY MUD #149 AND SIENNA PLANTATION INTERCONNECT NO. 1
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

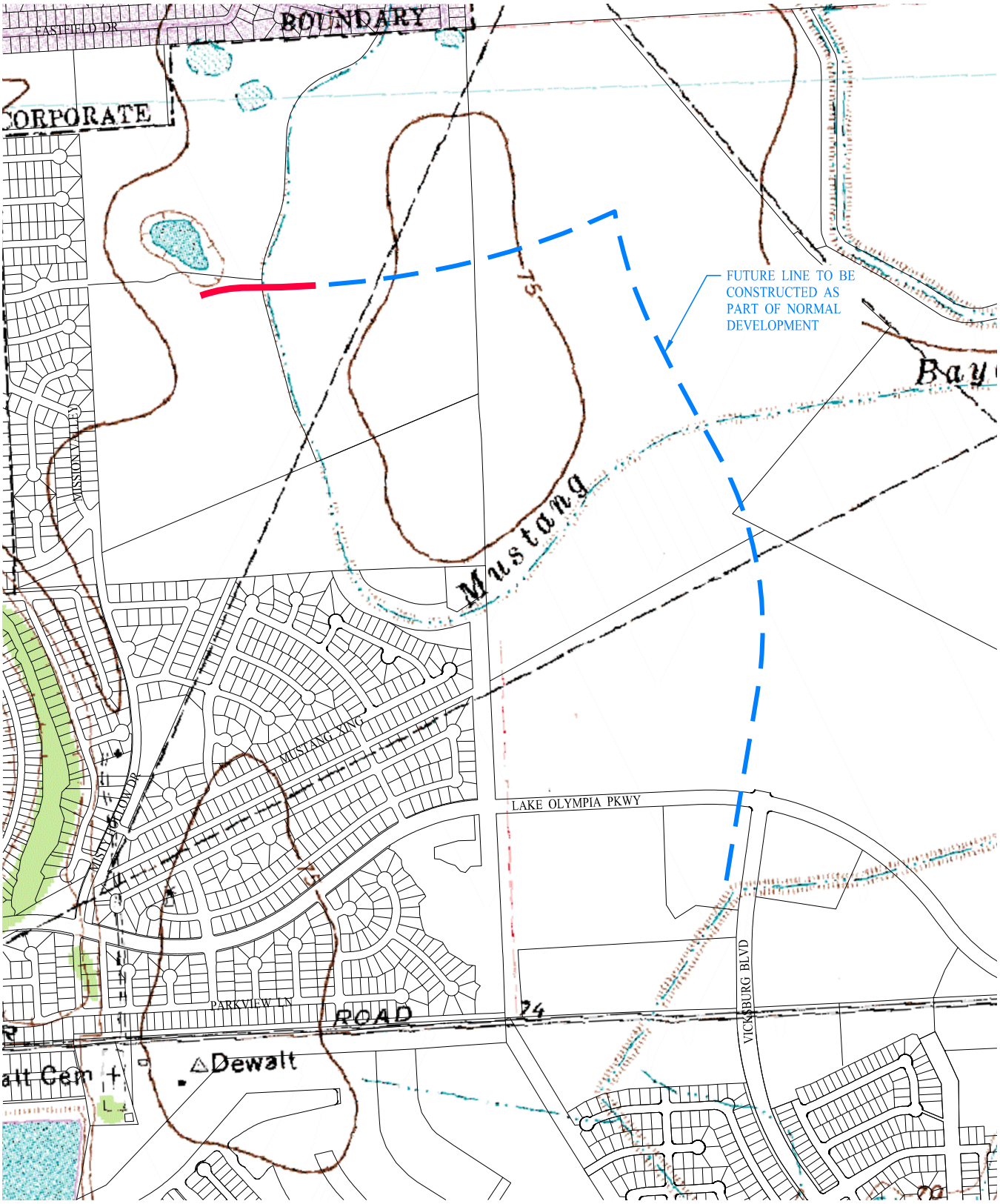
SCALE IN FEET

USGS MAP
WATER OPTION 12

MUSTANG BAYOU AND PALMER PLANTATION INTERCONNECT 2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

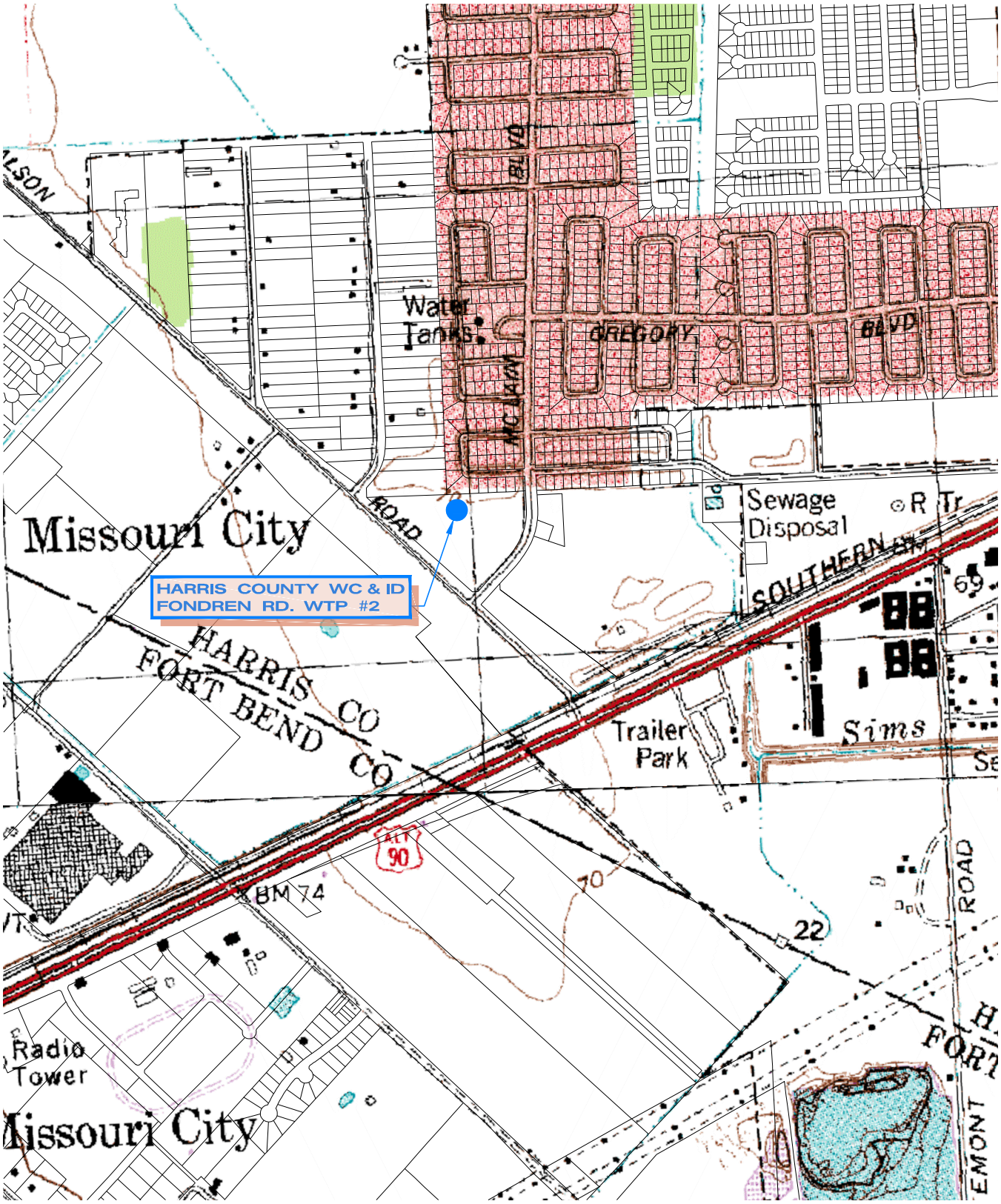
SCALE IN FEET

USGS MAP
WATER OPTION 13

MUSTANG BAYOU AND QUAIL VALLEY INTERCONNECT 2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



LEGEND

PROPOSED NEW ELEVATED STORAGE TANK LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

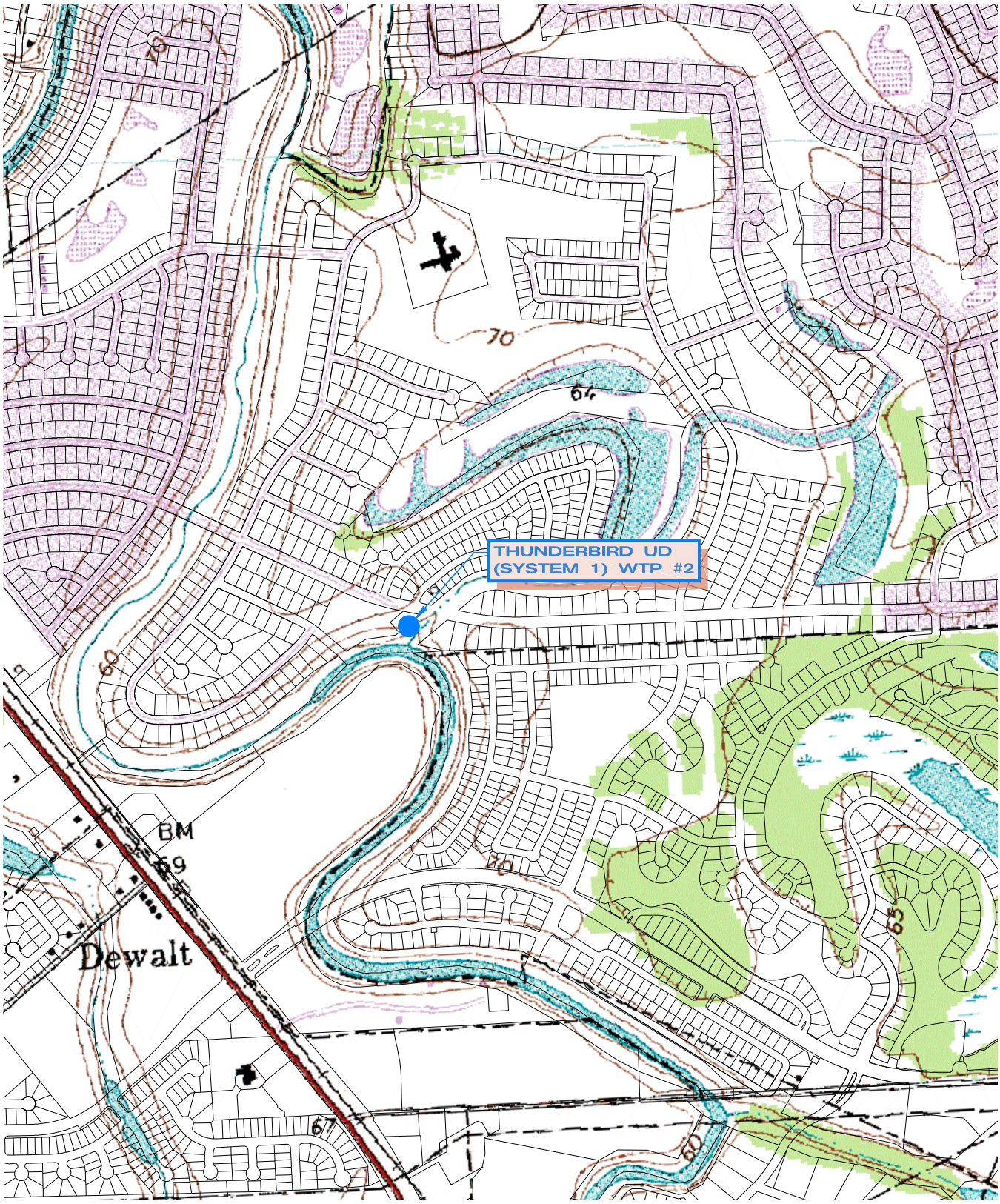
SCALE IN FEET

USGS MAP

HARRIS COUNTY WC & ID
FONDREN RD. WTP #2
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/14/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



LEGEND

PROPOSED NEW ELEVATED STORAGE TANK LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

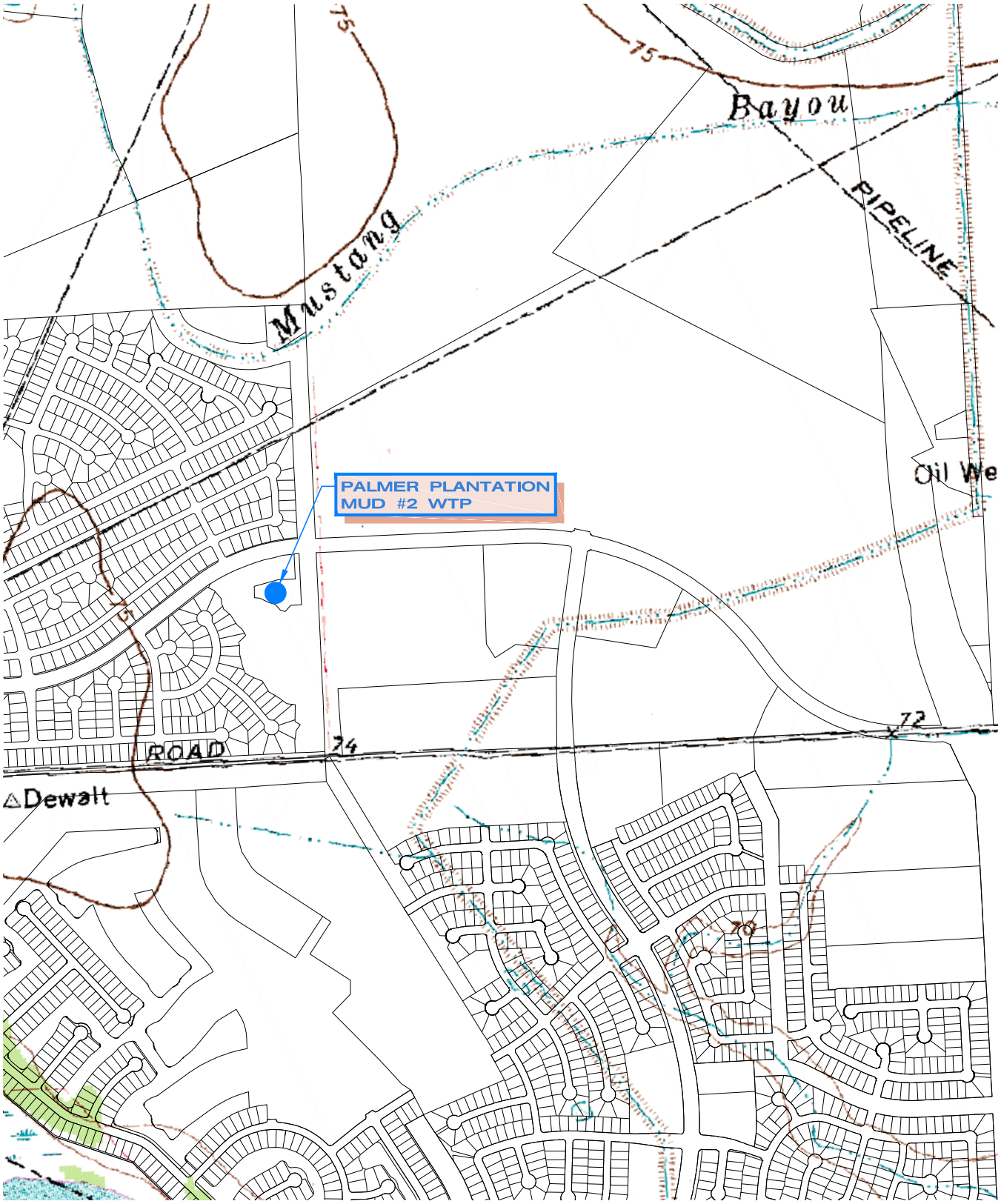
SCALE IN FEET

USGS MAP

THUNDERBIRD UD
(SYSTEM 1) WTP #2
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/14/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



LEGEND

PROPOSED NEW ELEVATED STORAGE TAN□ LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

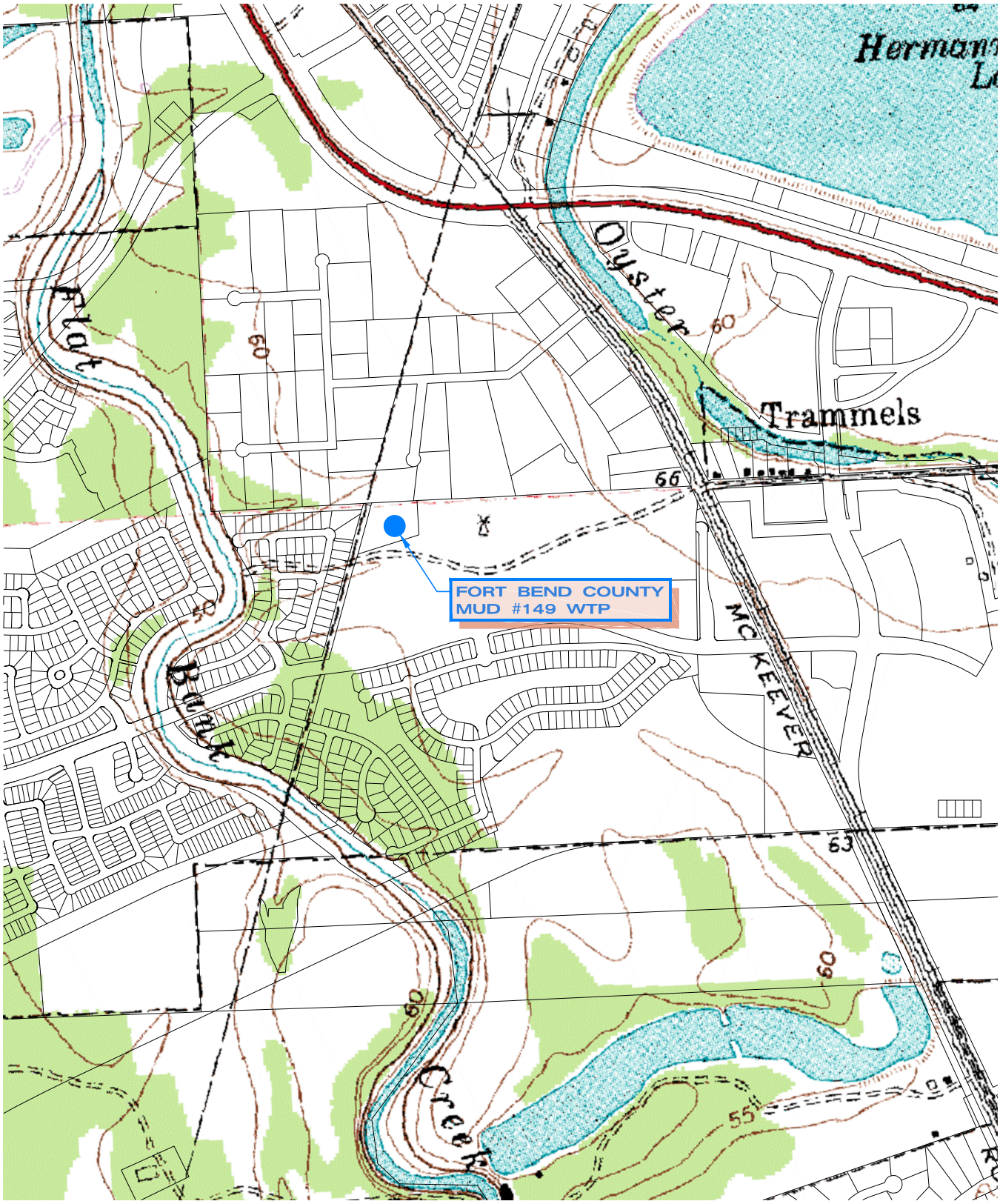
SCALE IN FEET

USGS MAP

PALMER PLANTATION
WTP #2
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/14/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



LEGEND

PROPOSED NEW ELEVATED STORAGE TANK LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

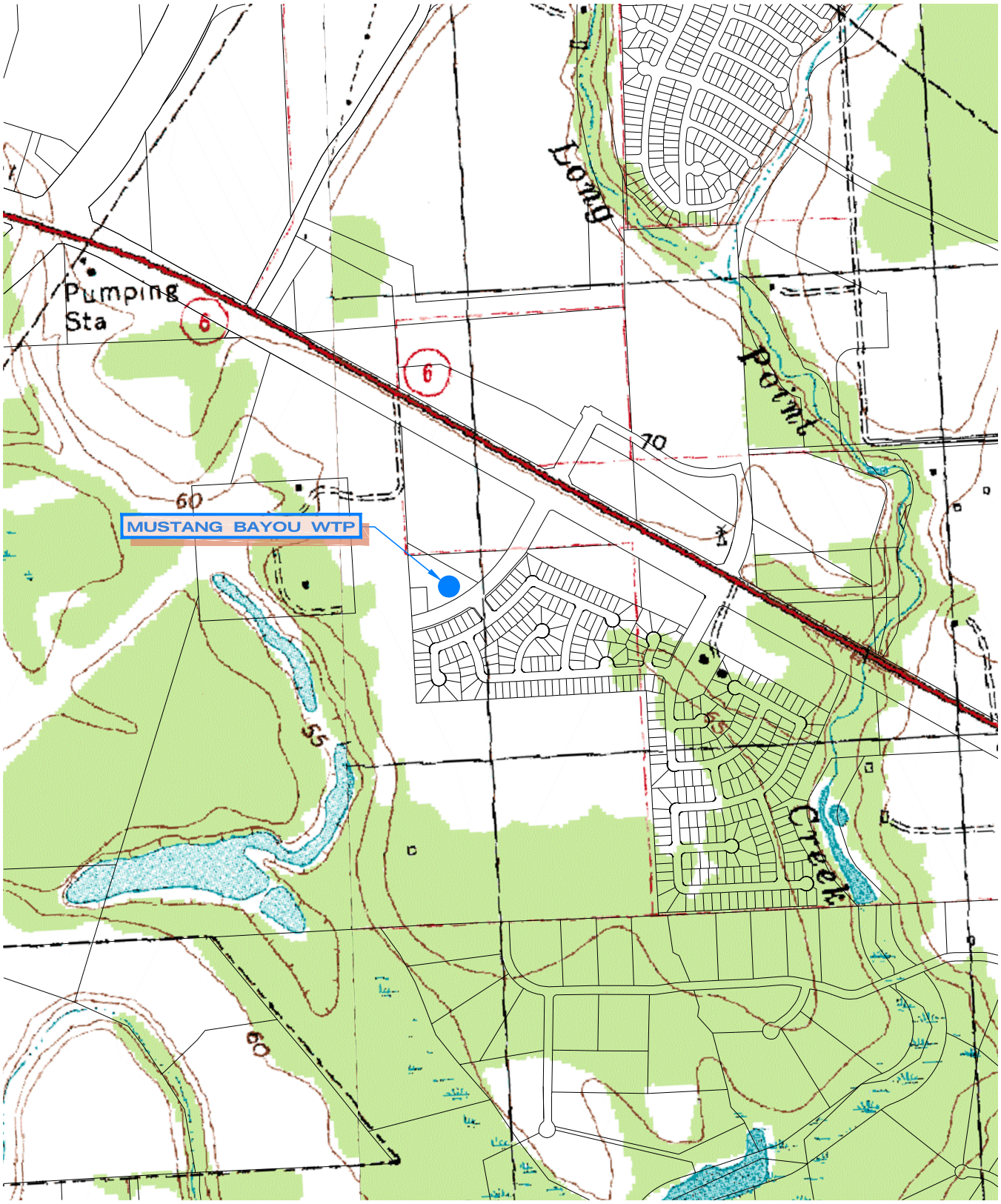
SCALE IN FEET

USGS MAP

FORT BEND COUNTY
MUD #149 WTP
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/14/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



LEGEND

PROPOSED NEW ELEVATED STORAGE TANK LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

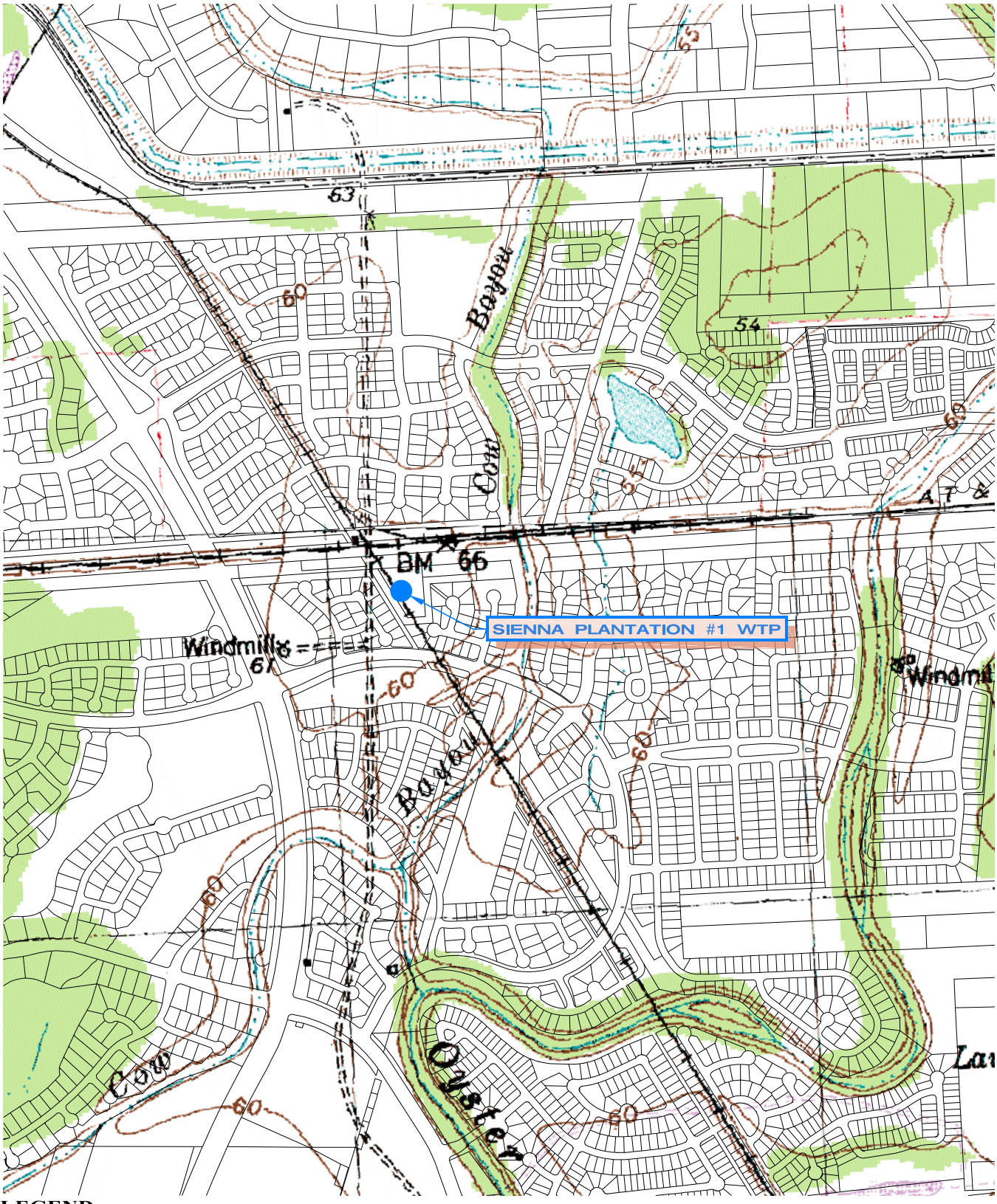
SCALE IN FEET

USGS MAP

MUSTANG BAYOU WTP
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/14/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

PROPOSED NEW ELEVATED STORAGE TANK LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

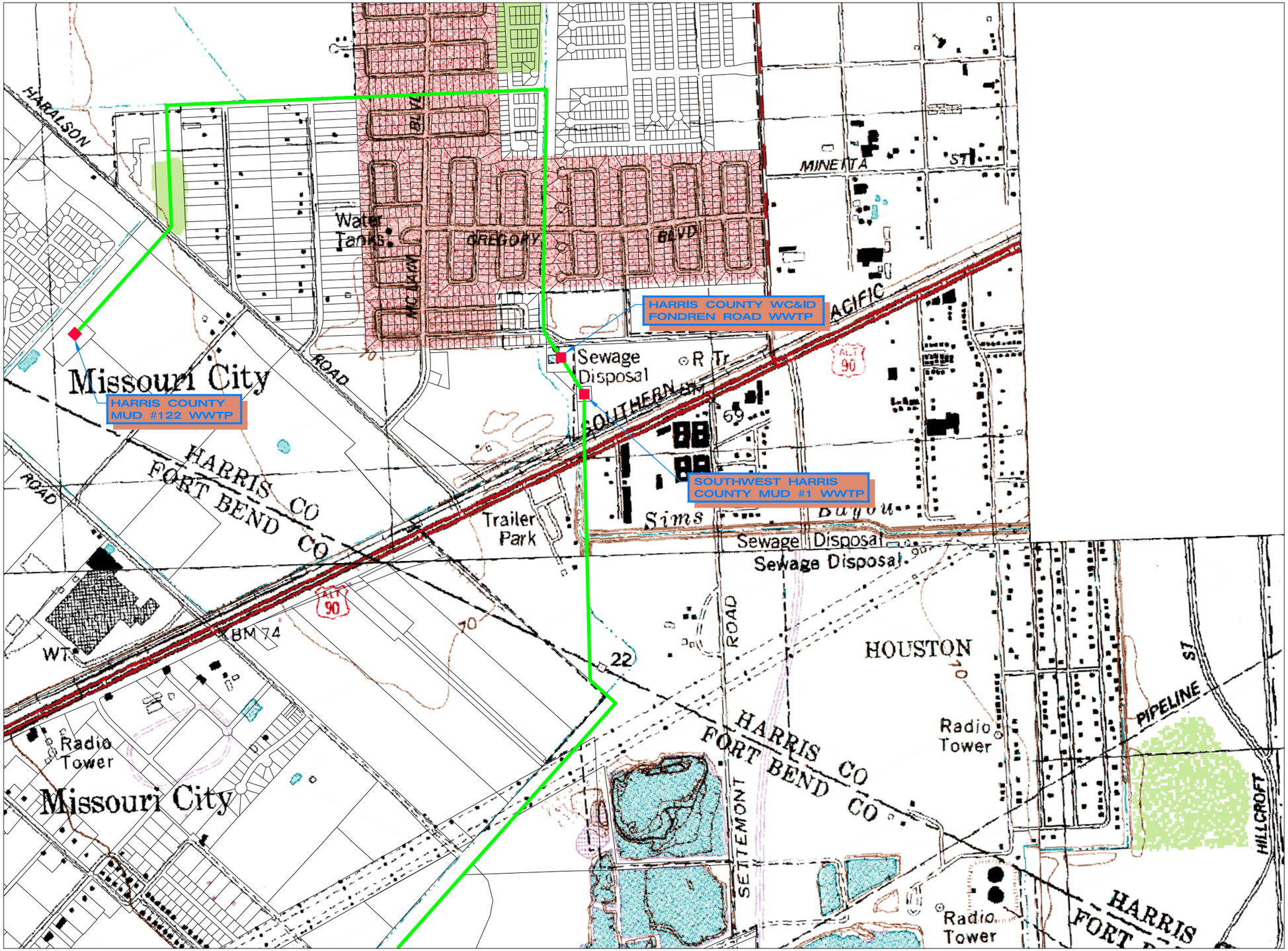
SCALE IN FEET

USGS MAP

SIENNA PLANTATION #1 WTP 2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/14/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

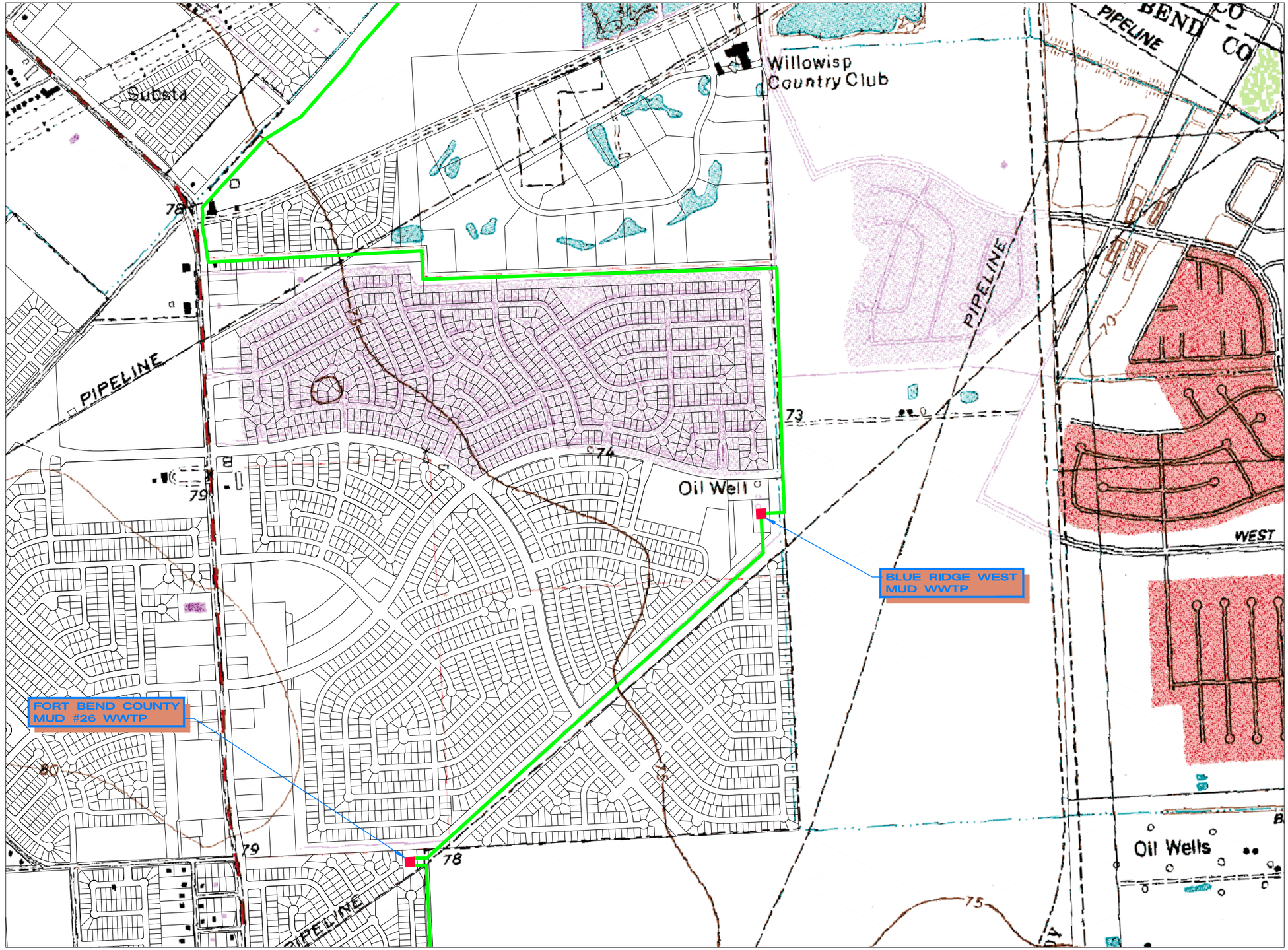
KEY MAP

USGS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

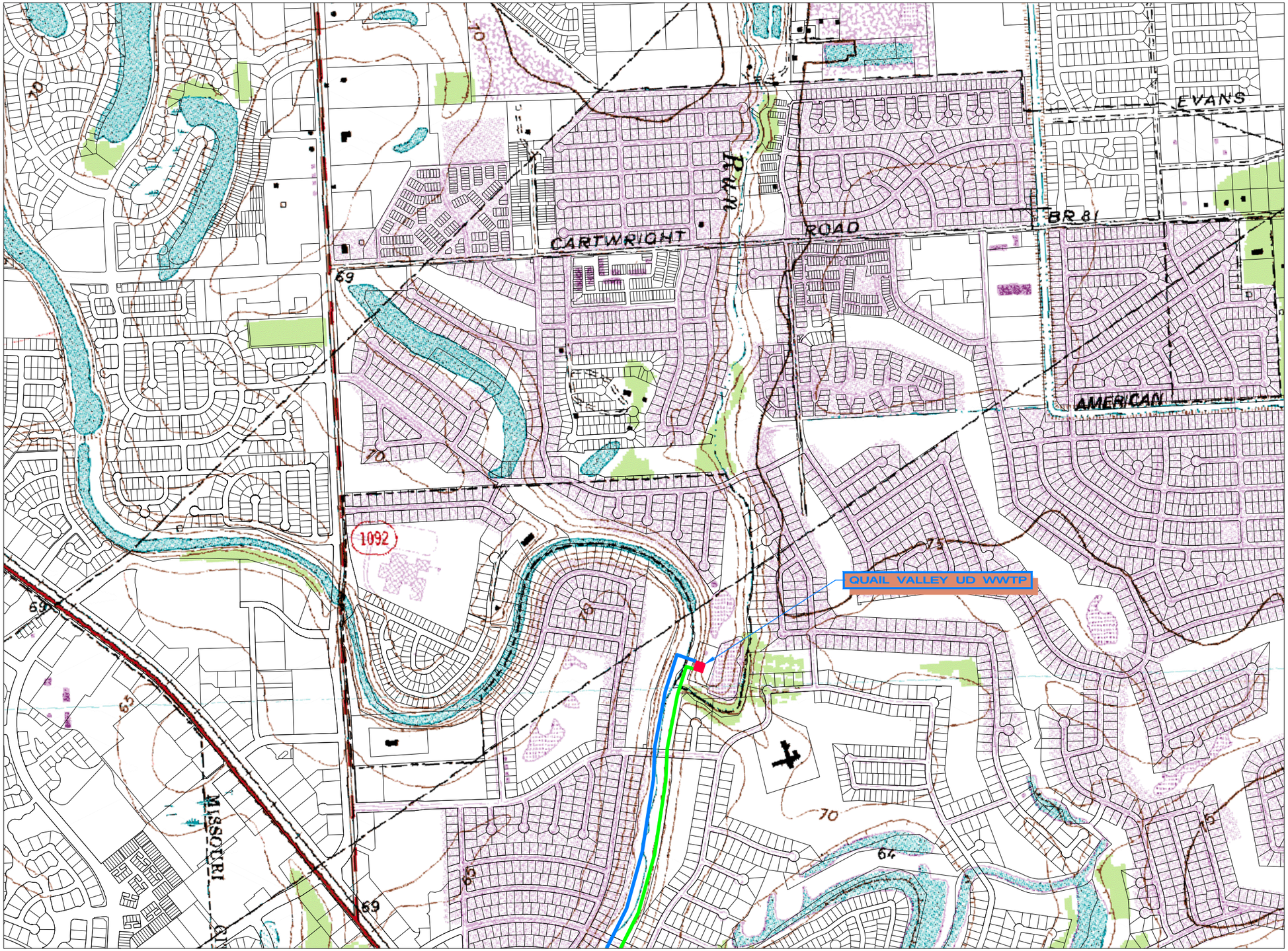
KEY MAP

USGS MAP

2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



N

500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

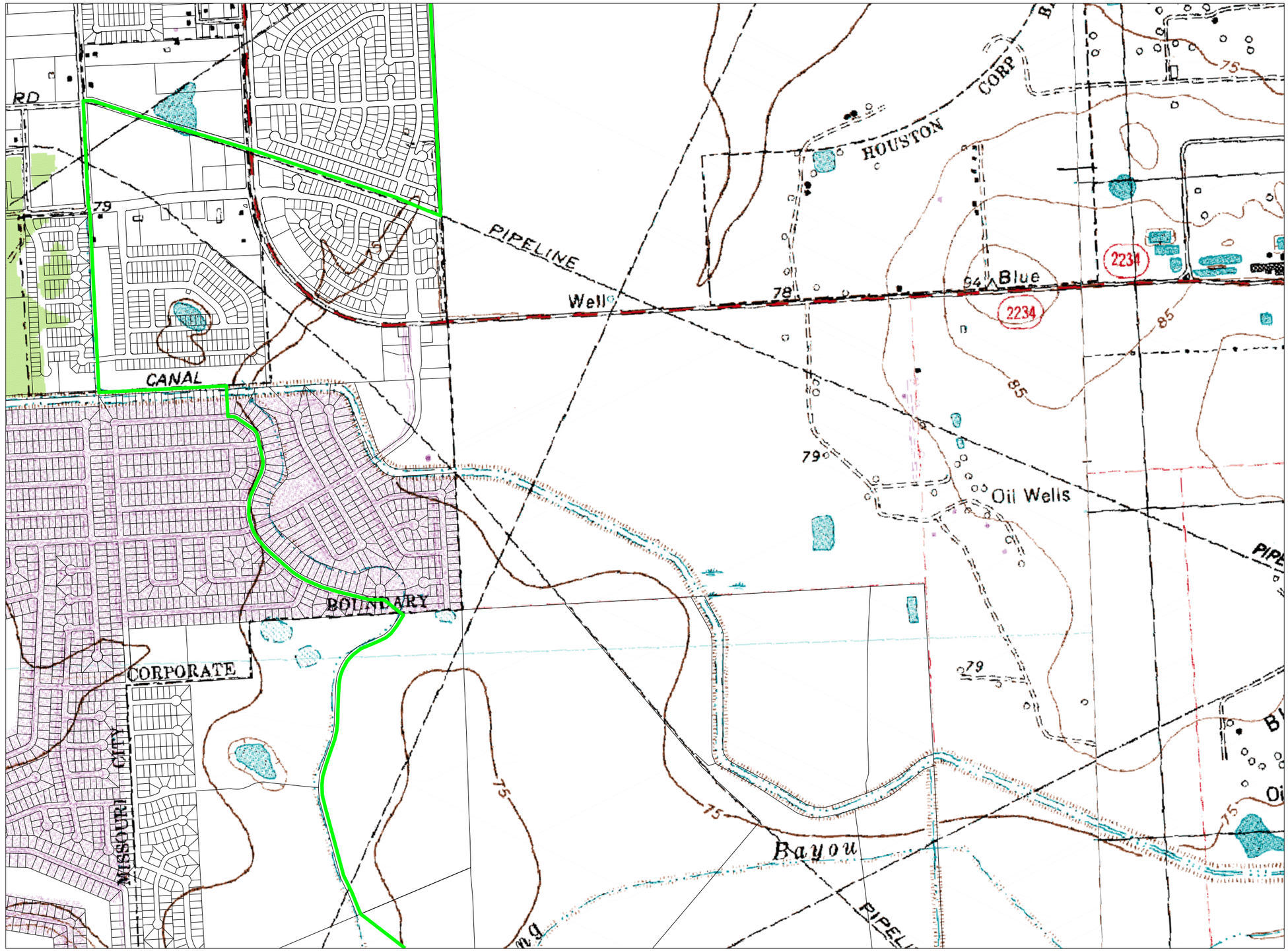
KEY MAP

USGS MAP

2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

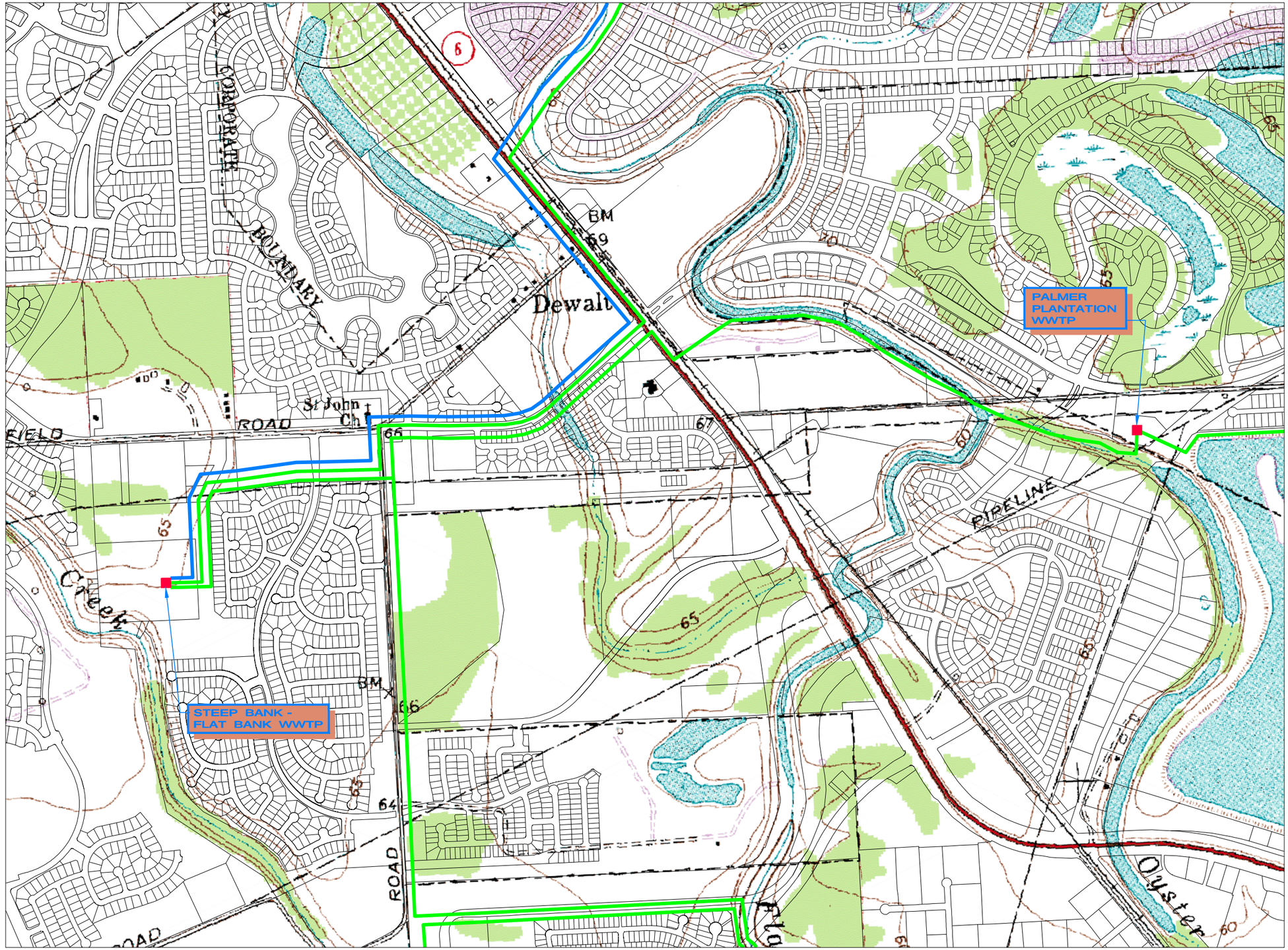
KEY MAP

USGS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

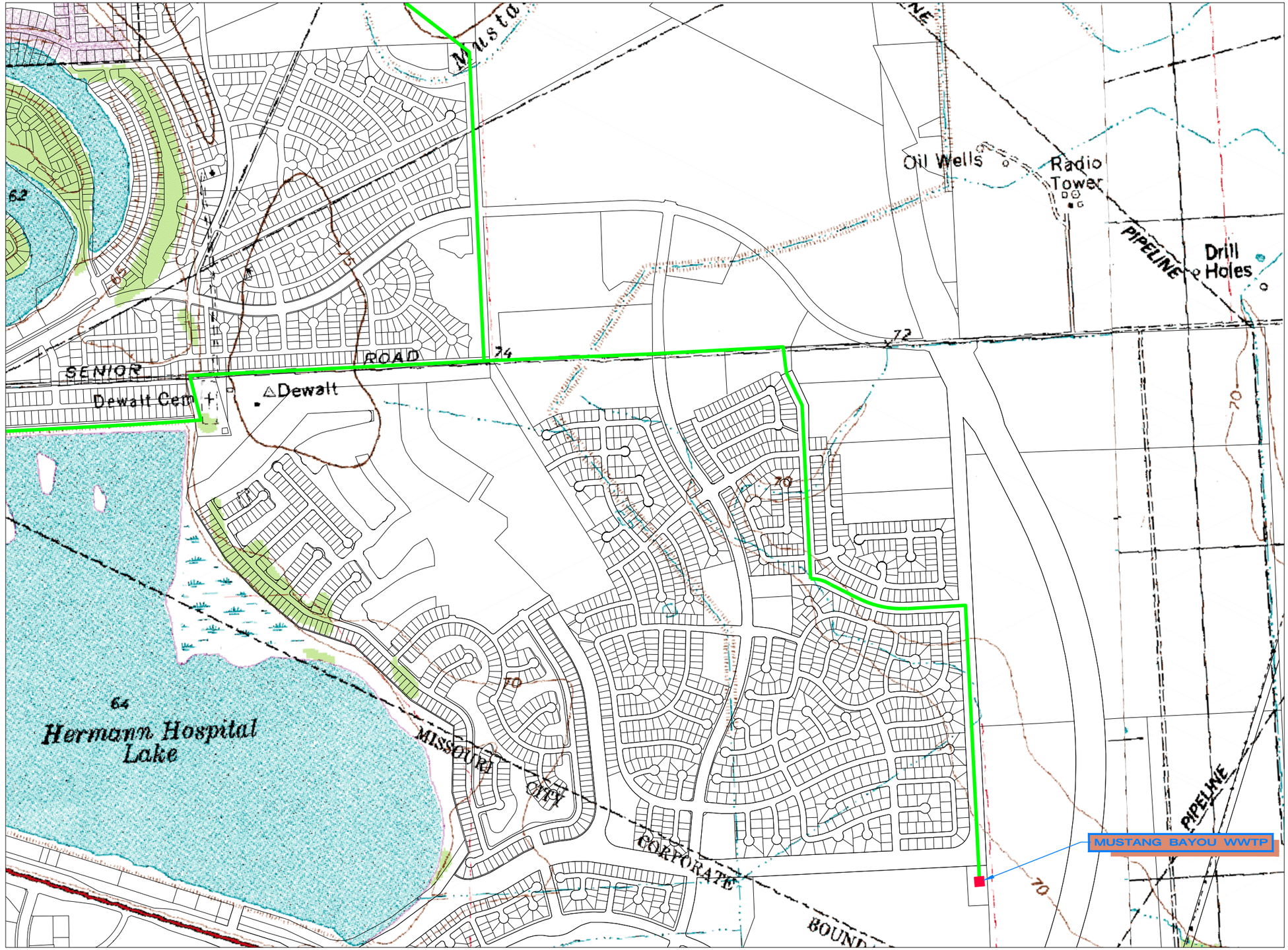
KEY MAP

USGS MAP

2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

KEY MAP

USGS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151

500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

KEY MAP

USGS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151

500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

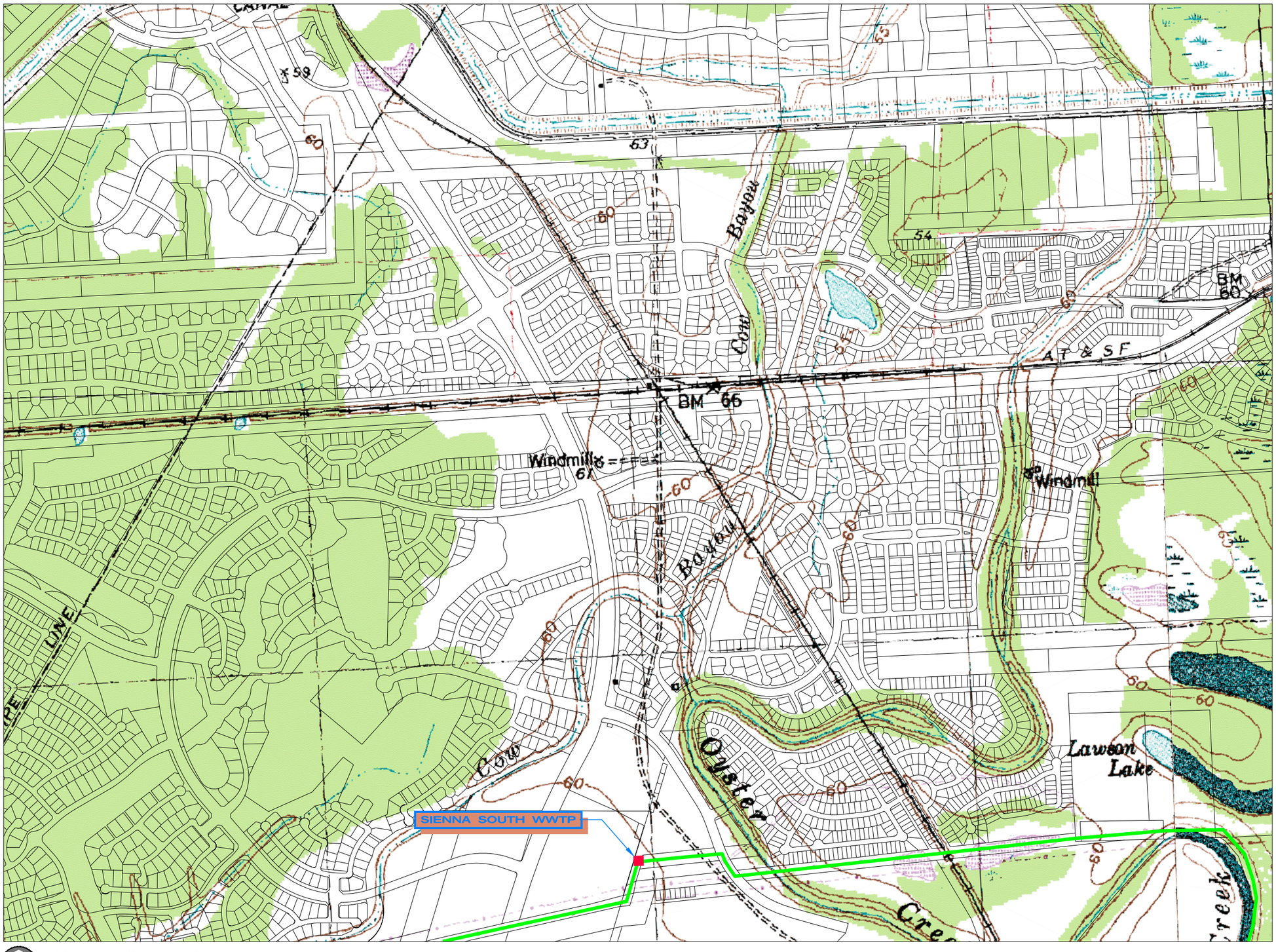
KEY MAP

USGS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

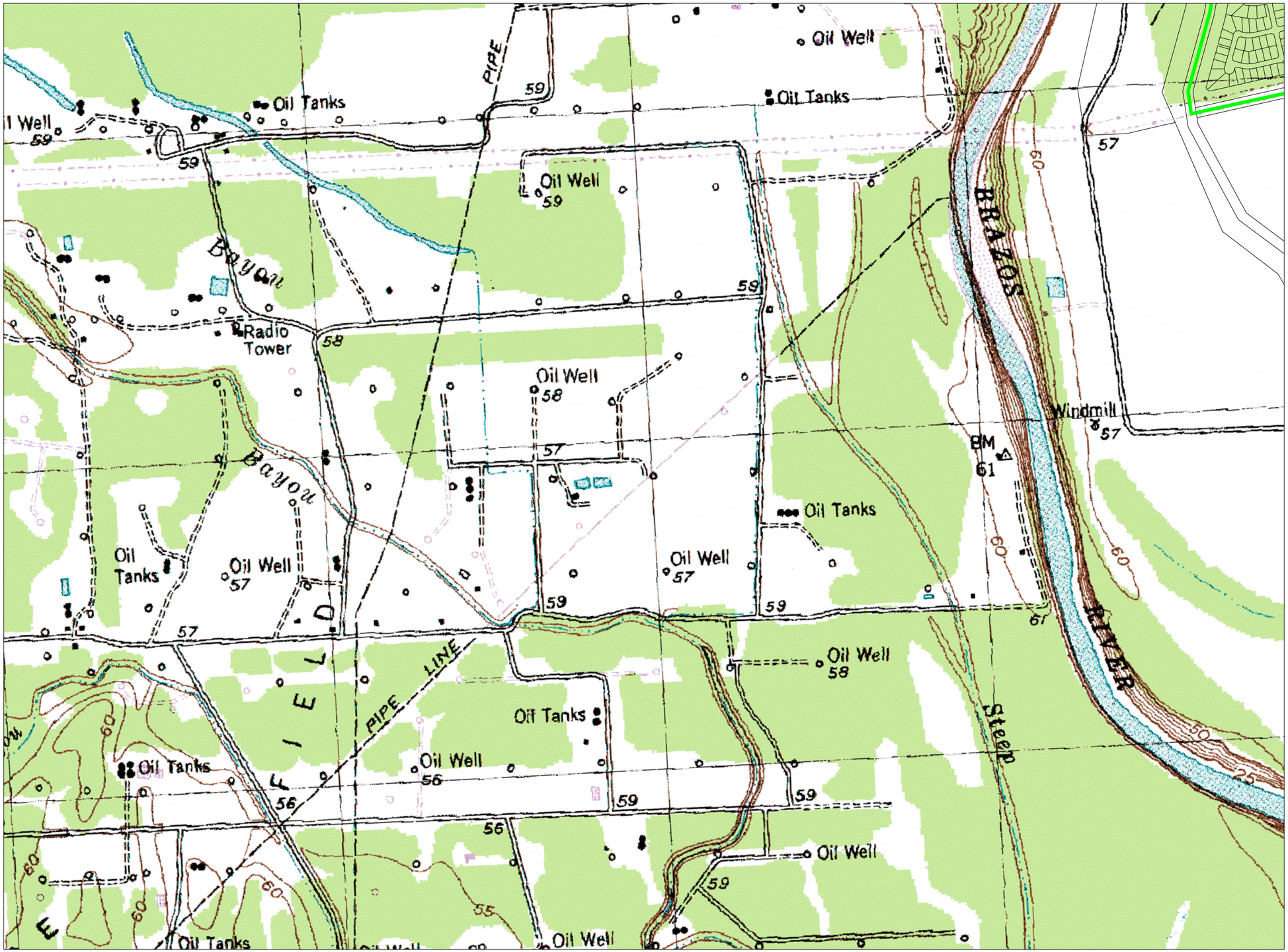
KEY MAP

USGS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

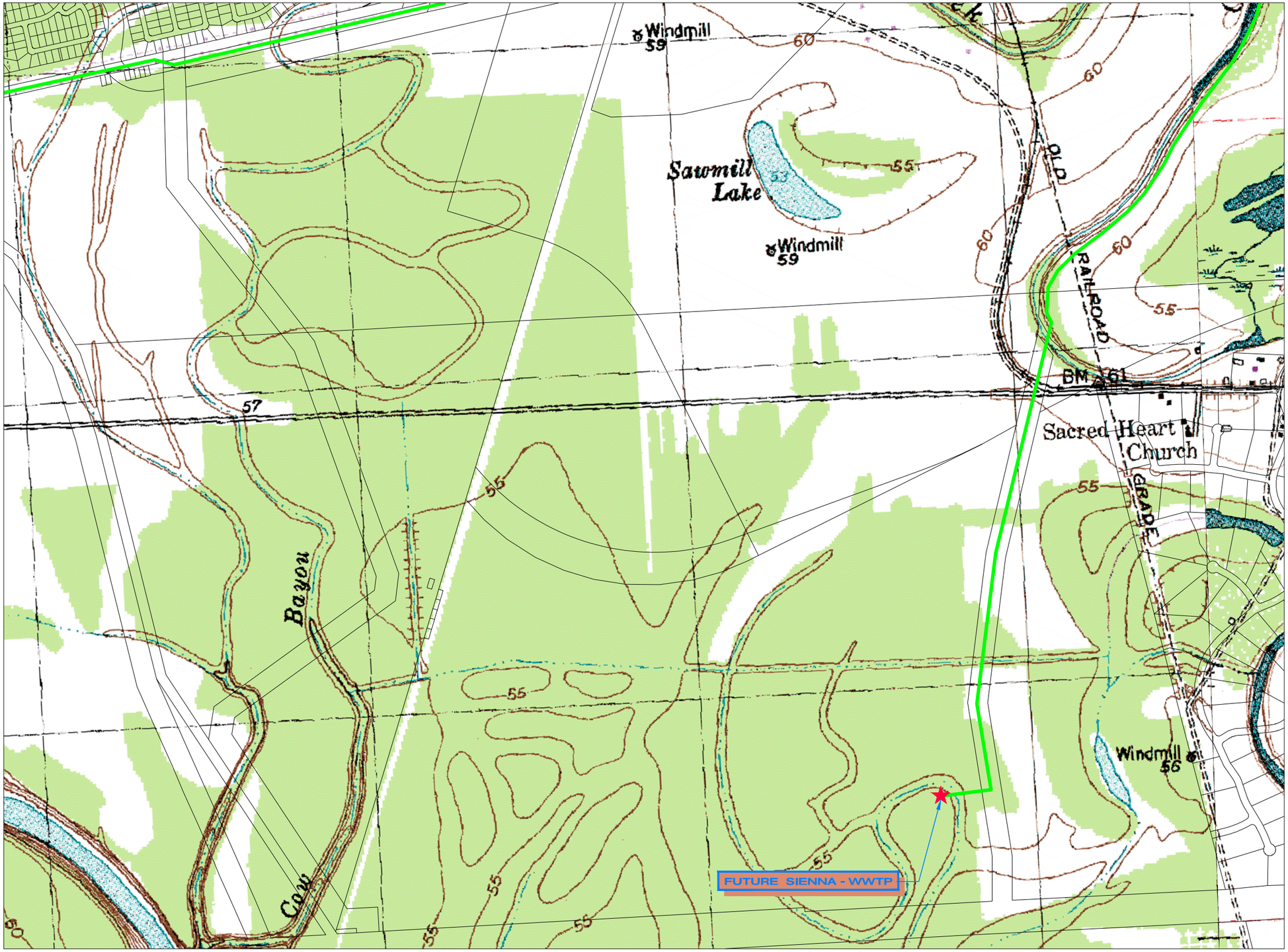
KEY MAP

USGS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

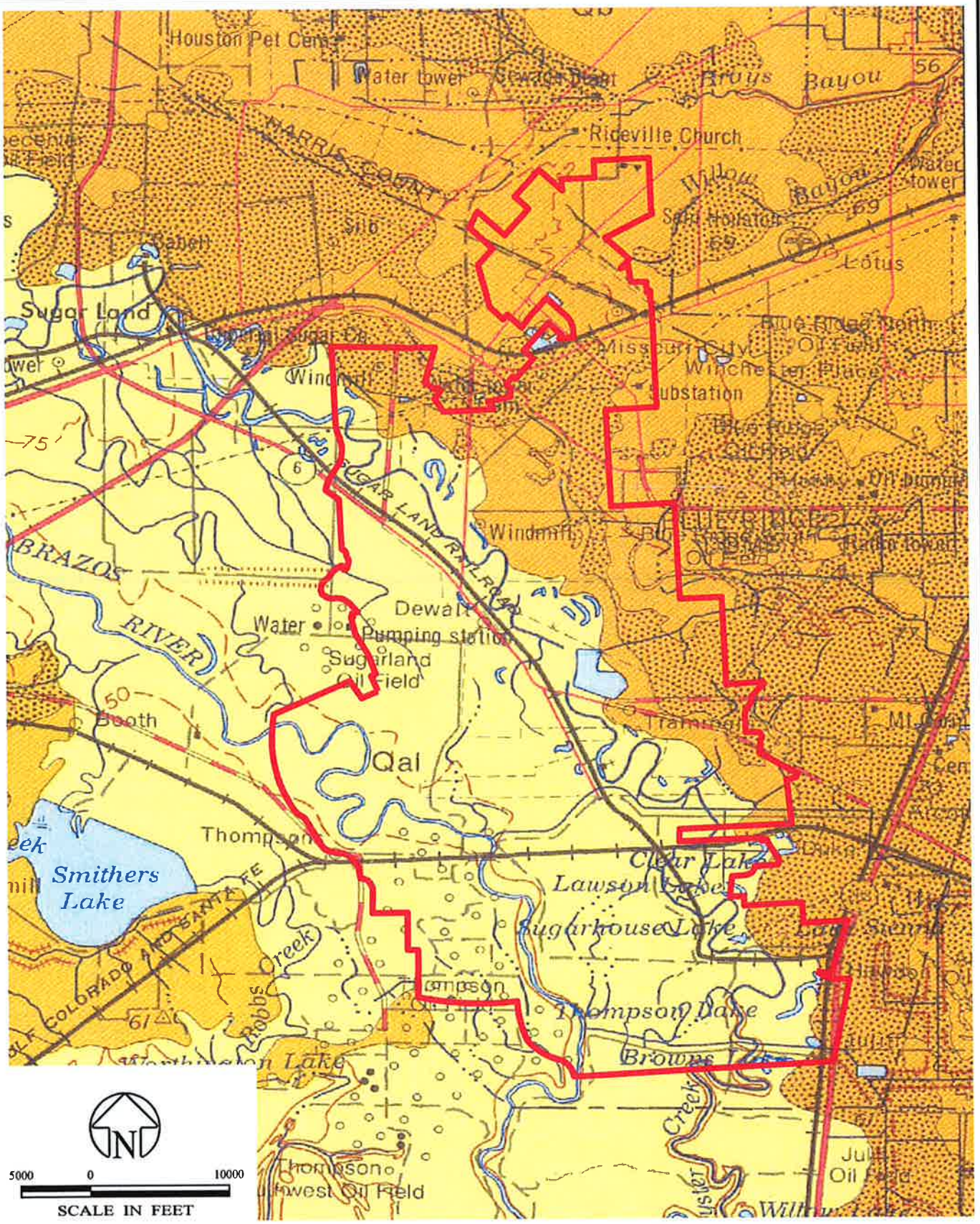
KEY MAP

USGS MAP

2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 01/27/2012

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



NOTE:

EXCERPTED FROM GEOLOGICAL ATLAS OF TEXAS, HOUSTON SHEET.

LEGEND

PROJECT AREA

GEOLOGIC ATLAS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

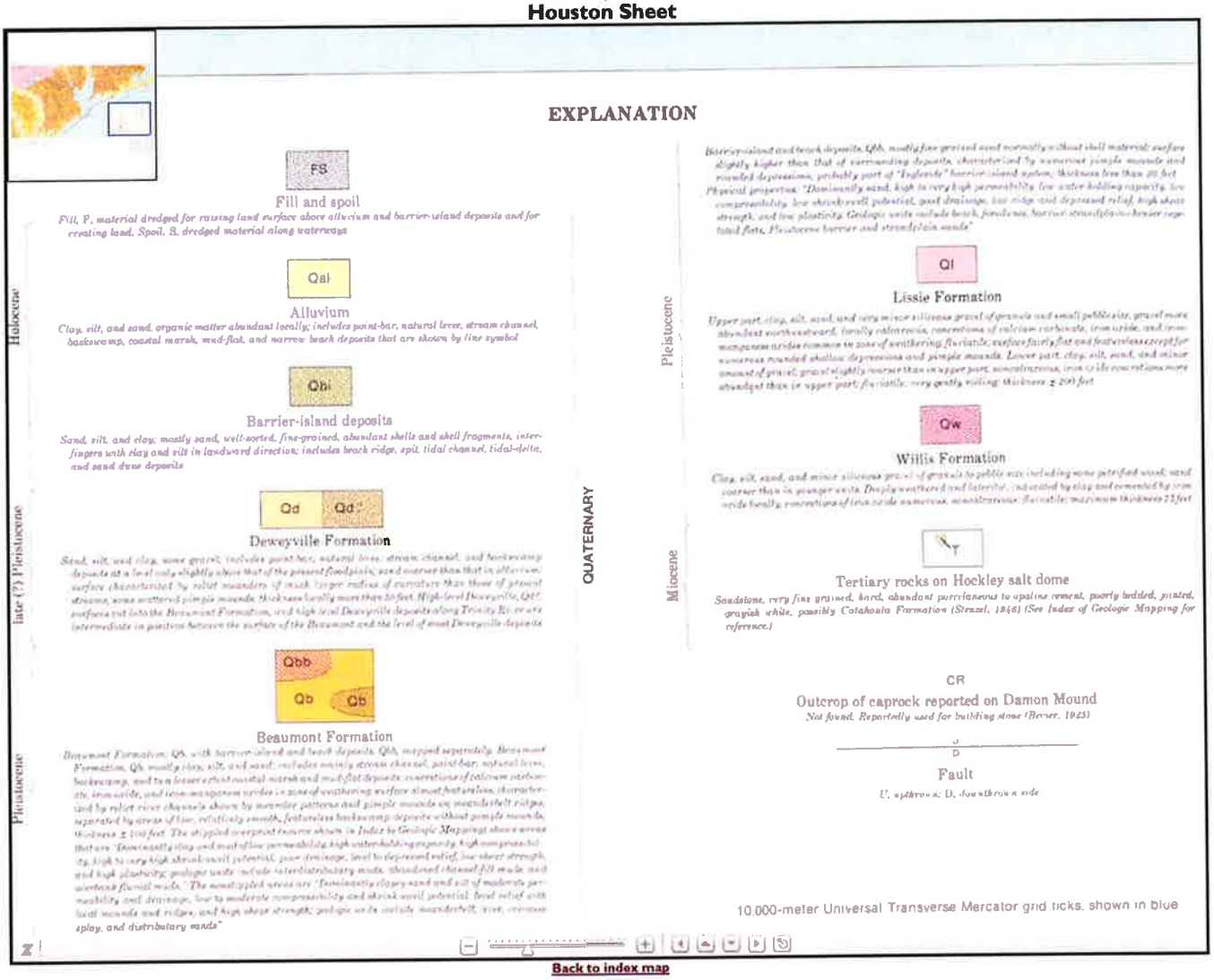
10-5052

09/15/2011

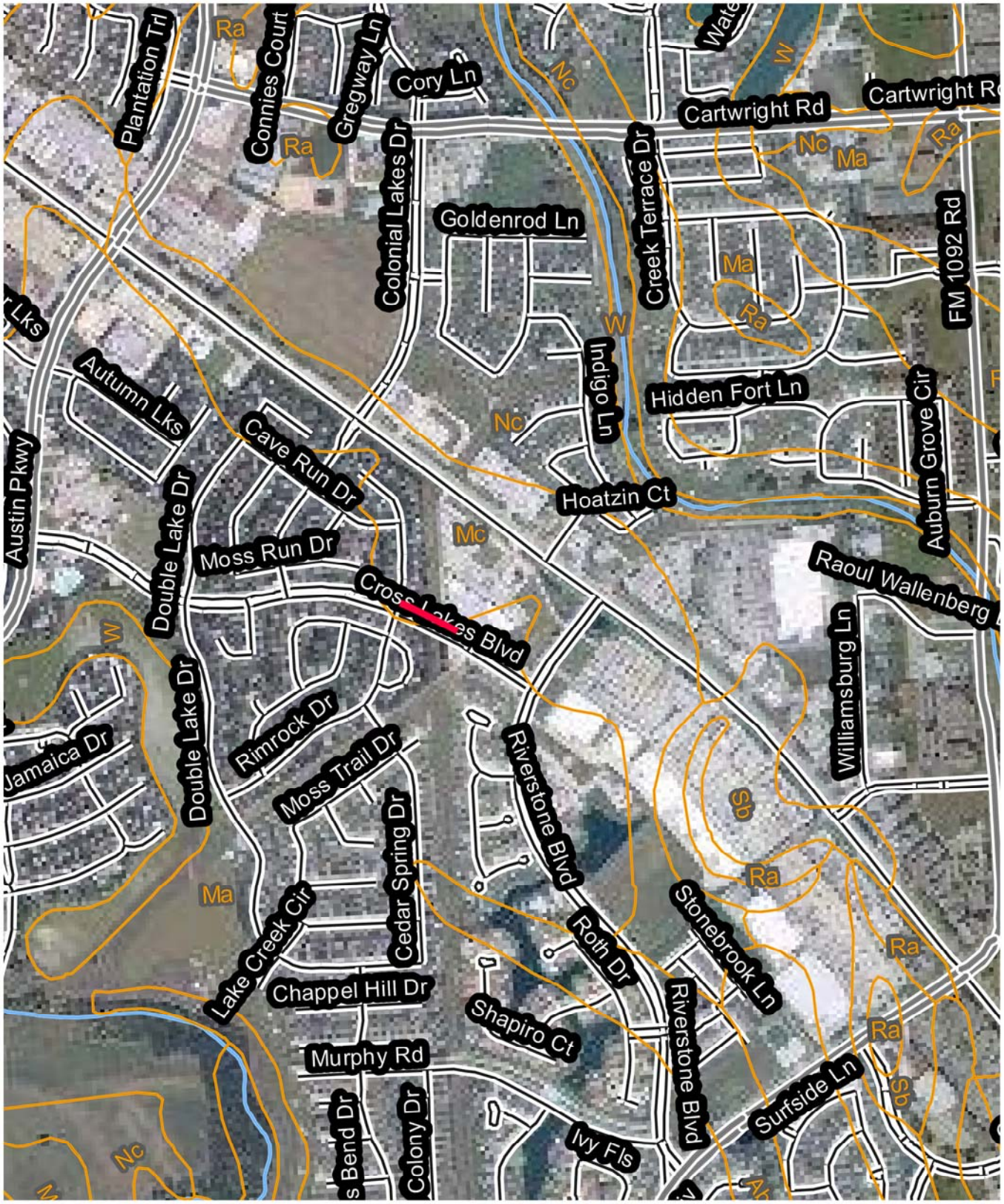
ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151

Texas Water Development Board

Houston Sheet



Back to index map



LEGEND

PROPOSED WATER LINE

N

500 0 1000

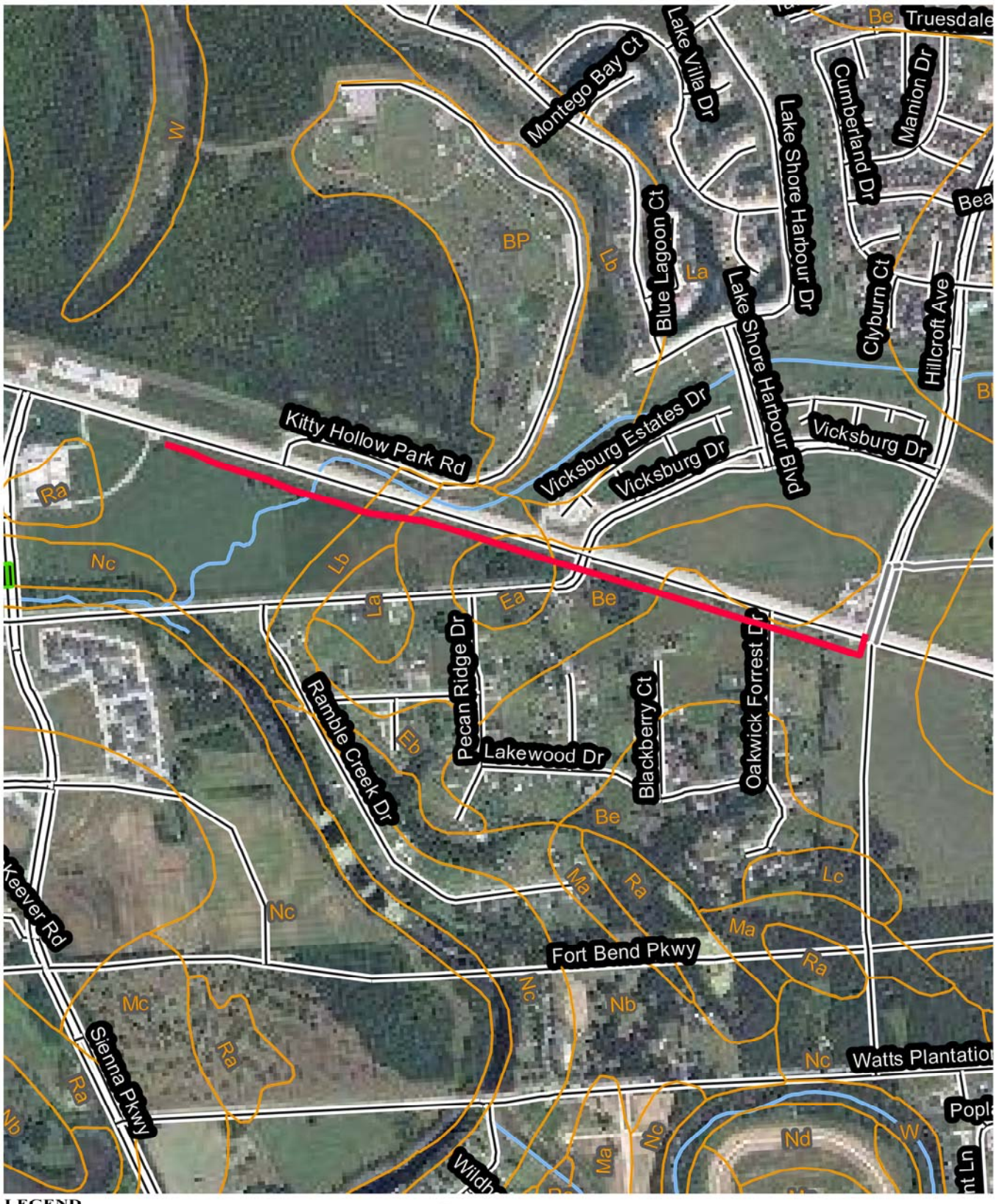
SCALE IN FEET

SOILS MAP
WATER OPTION 1

FIRST COLONY MUD #9 AND
FORT BEND COUNTY MUD #115
INTERCONNECT
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

N

500 0 1000

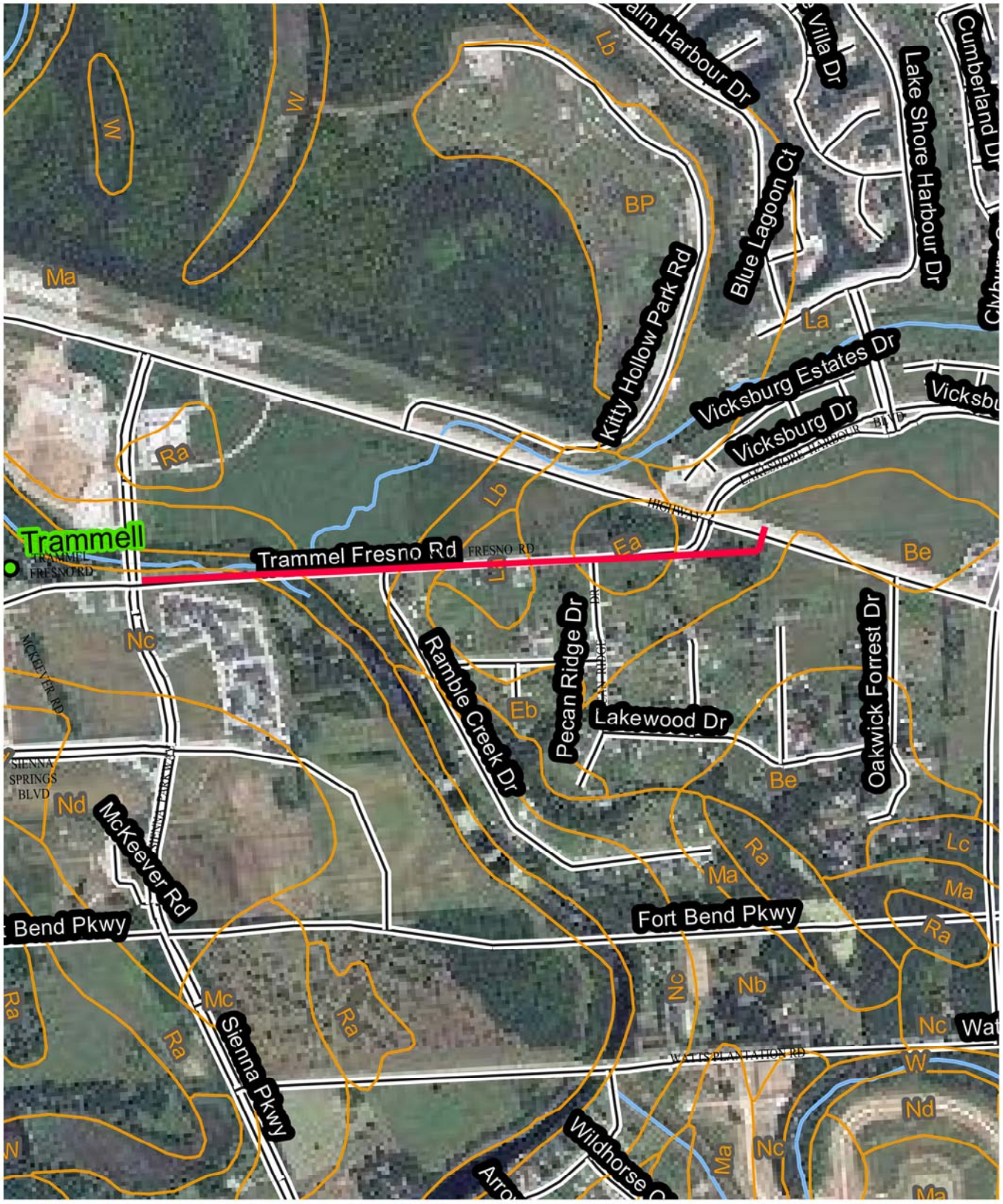
SCALE IN FEET

SOILS MAP
WATER OPTION 2

MUSTANG BAYOU AND SIENNA PLANTATION INTERCONNECT NO. 2
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

N

500 0 1000

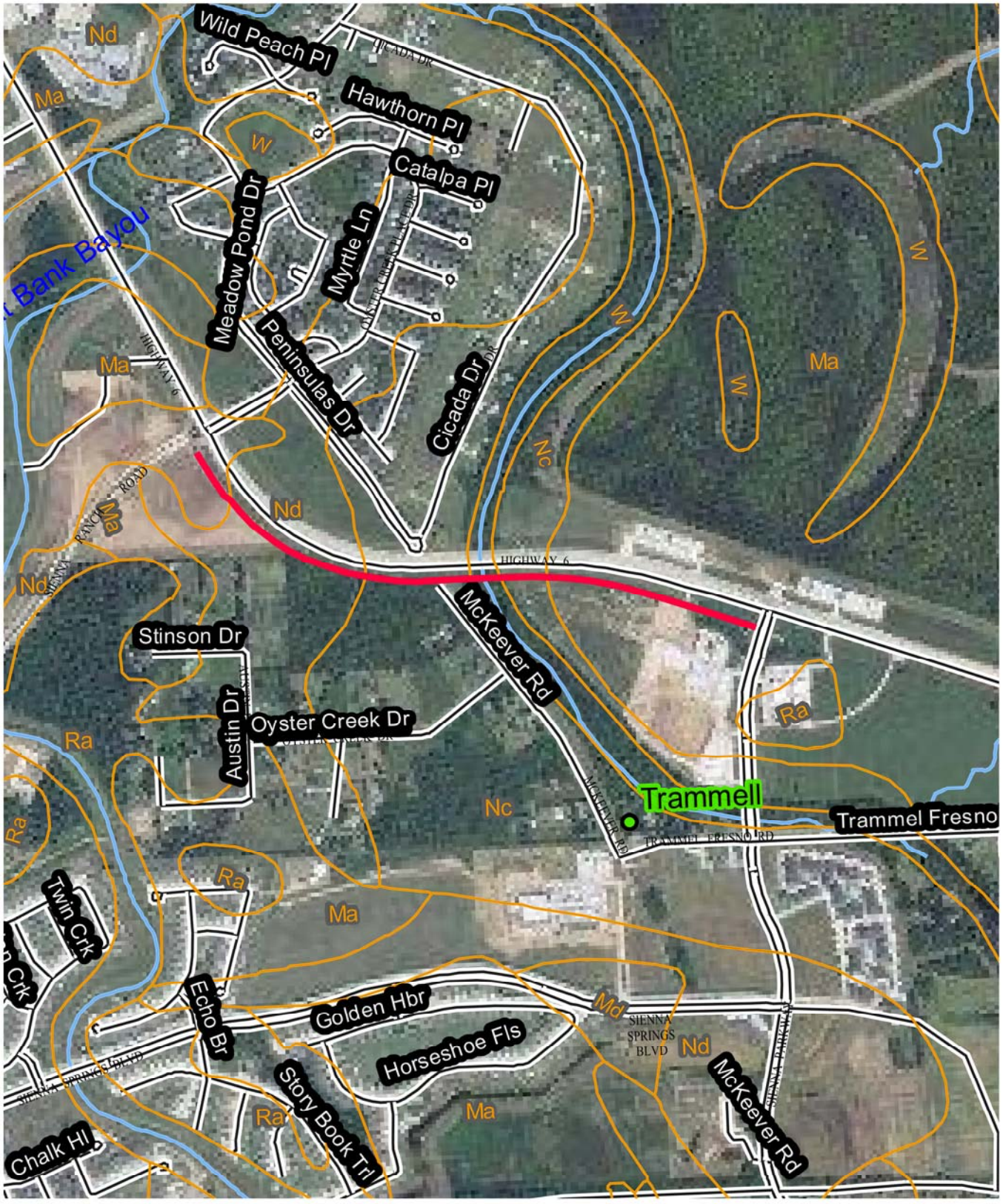
SCALE IN FEET

SOILS MAP
WATER OPTION 3

MUSTANG BAYOU AND SIENNA PLANTATION INTERCONNECT NO. 3
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

N

500 0 1000

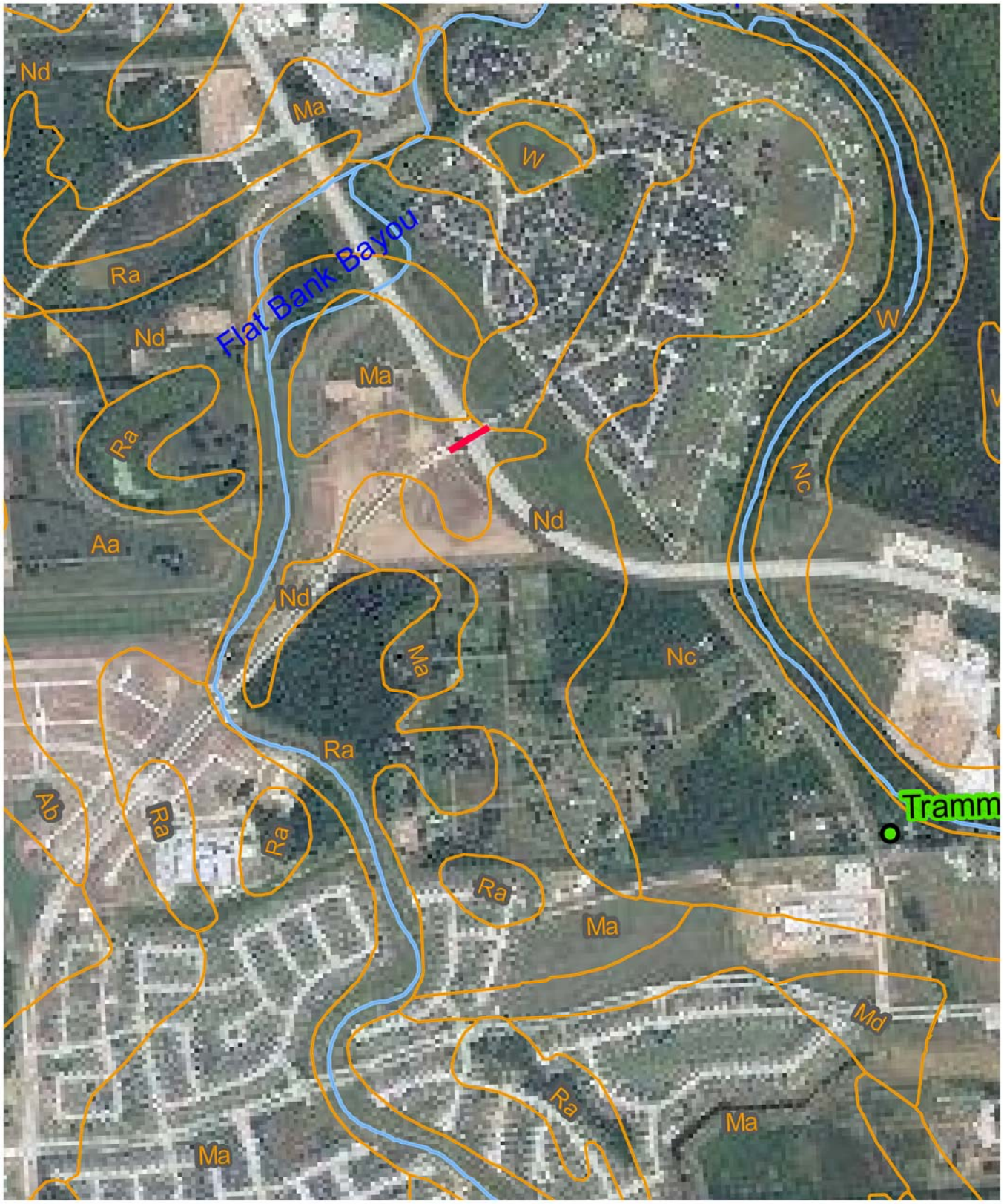
SCALE IN FEET

SOILS MAP
WATER OPTION 4

SIENNA PLANTATION
INTERNAL INTERCONNECT
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

N

500 0 1000

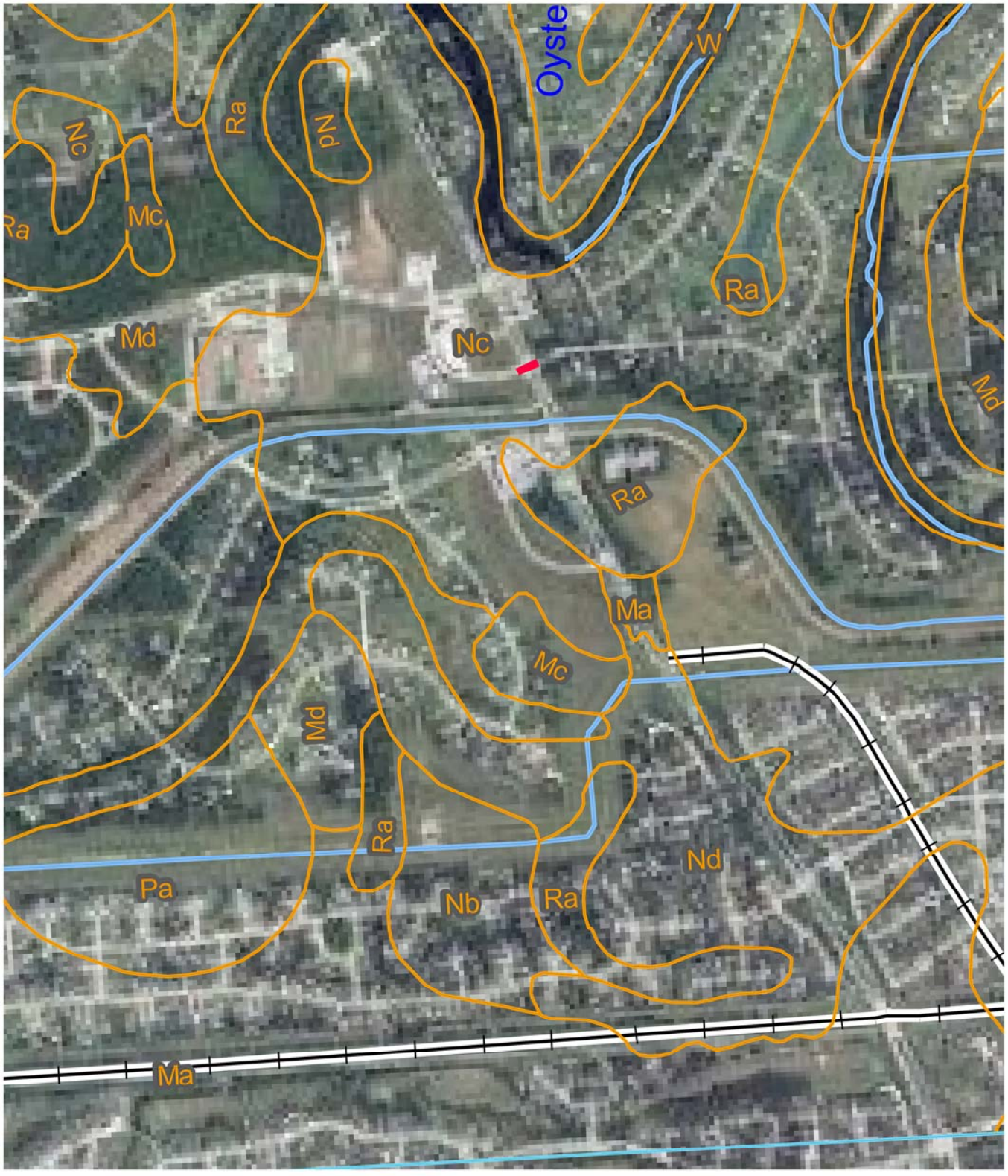
SCALE IN FEET

SOILS MAP
WATER OPTION 5

SIENNA PLANTATION AND
PALMER PLANTATION
INTERCONNECT NO. 1
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

N

500 0 1000

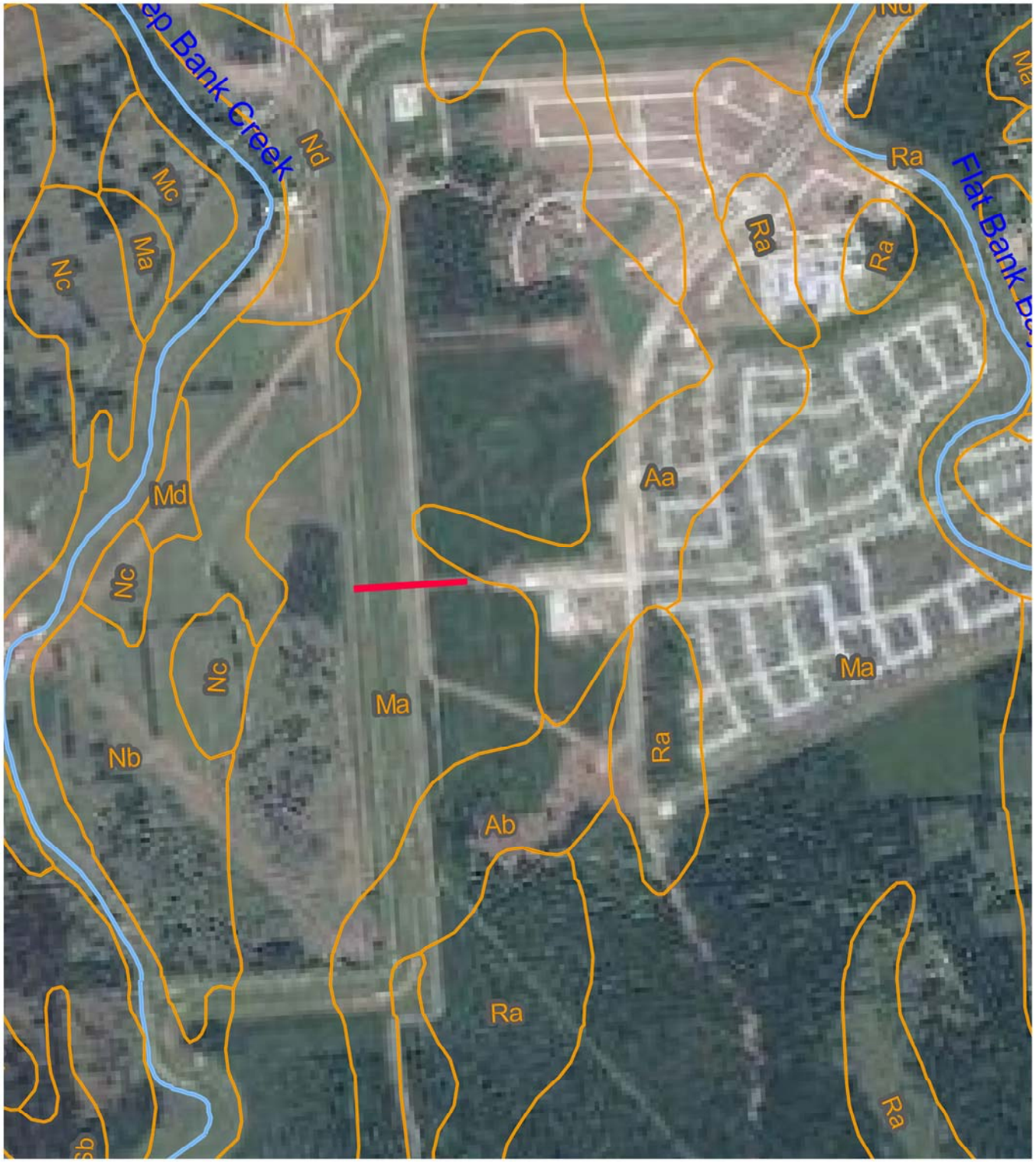
SCALE IN FEET

SOILS MAP
WATER OPTION 6

SILVER RIDGE DEVELOPMENT AND
SIENNA PLANTATION
INTERCONNECT NO. 1
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

N

500 0 1000

SCALE IN FEET

SOILS MAP
WATER OPTION 7

FORT BEND COUNTY MUD #149 AND
SIENNA PLANTATION
INTERCONNECT NO. 1
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

LEGEND

PROPOSED WATER LINE

N

500 0 1000

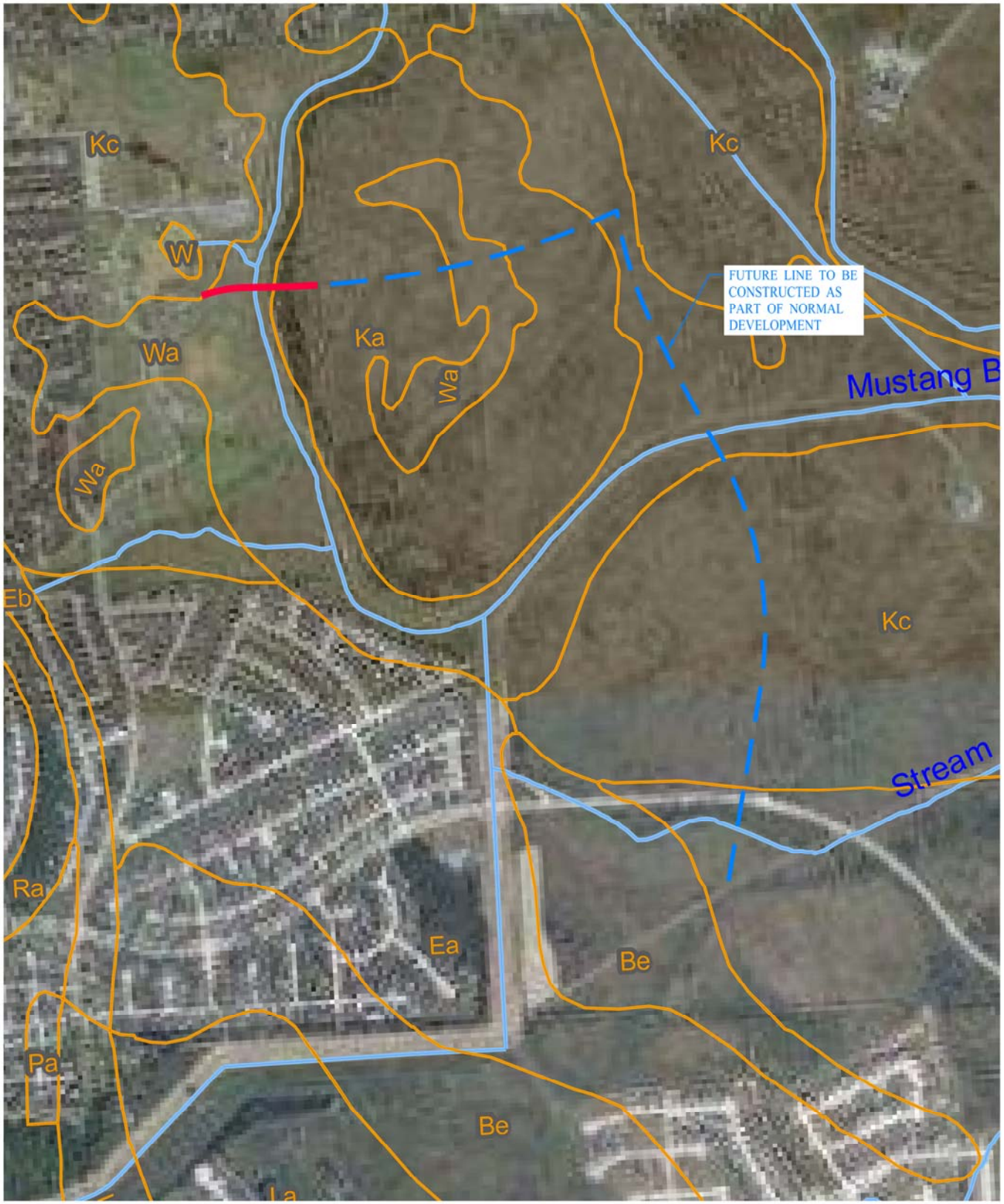
SCALE IN FEET

SOILS MAP
WATER OPTION 12

MUSTANG BAYOU AND PALMER PLANTATION INTERCONNECT 2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

N

500 0 1000

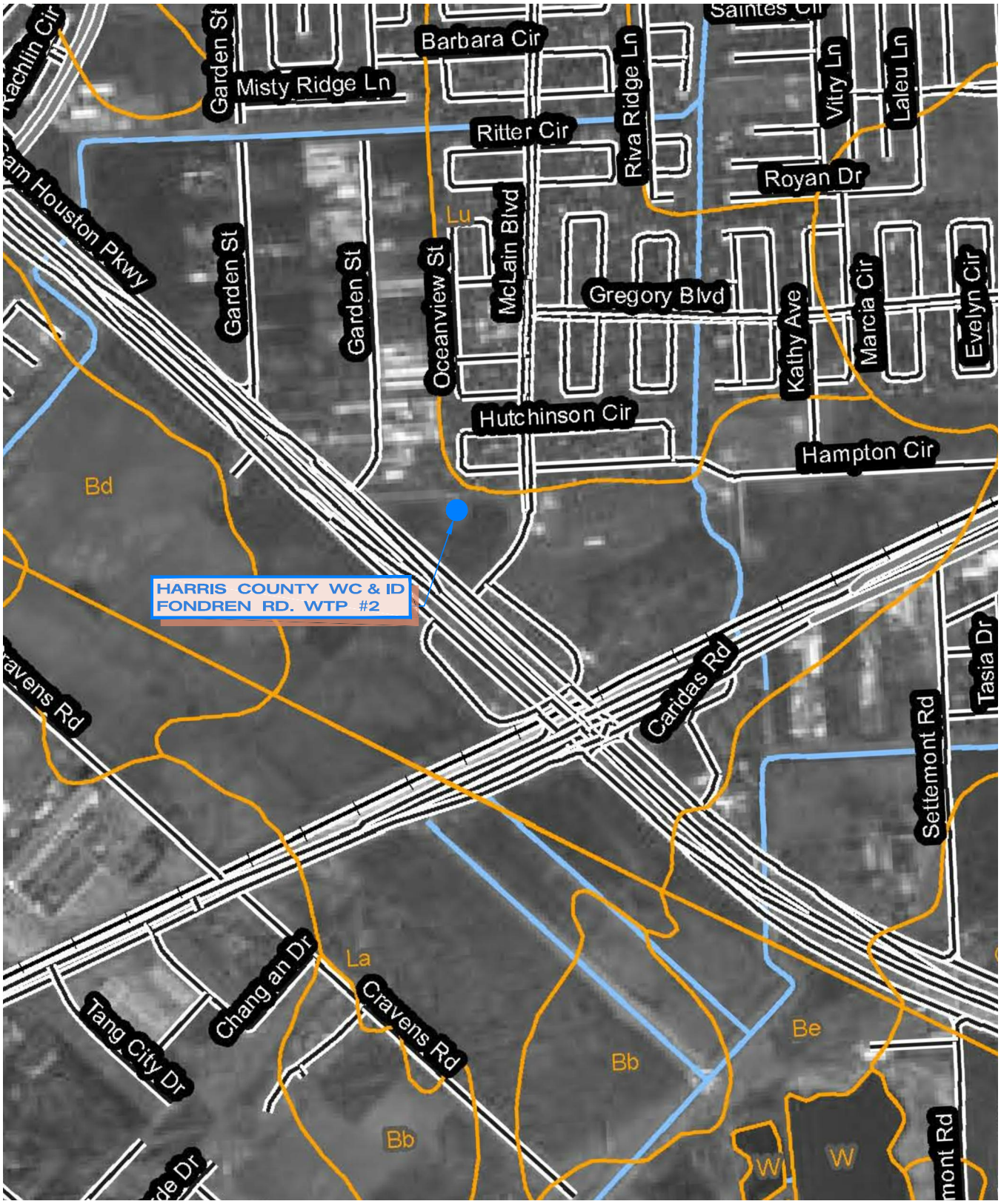
SCALE IN FEET

SOILS MAP
WATER OPTION 13

MUSTANG BAYOU AND QUAIL VALLEY INTERCONNECT 2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



LEGEND

PROPOSED NEW ELEVATED STORAGE TANK LOCATION

N

500 0 1000

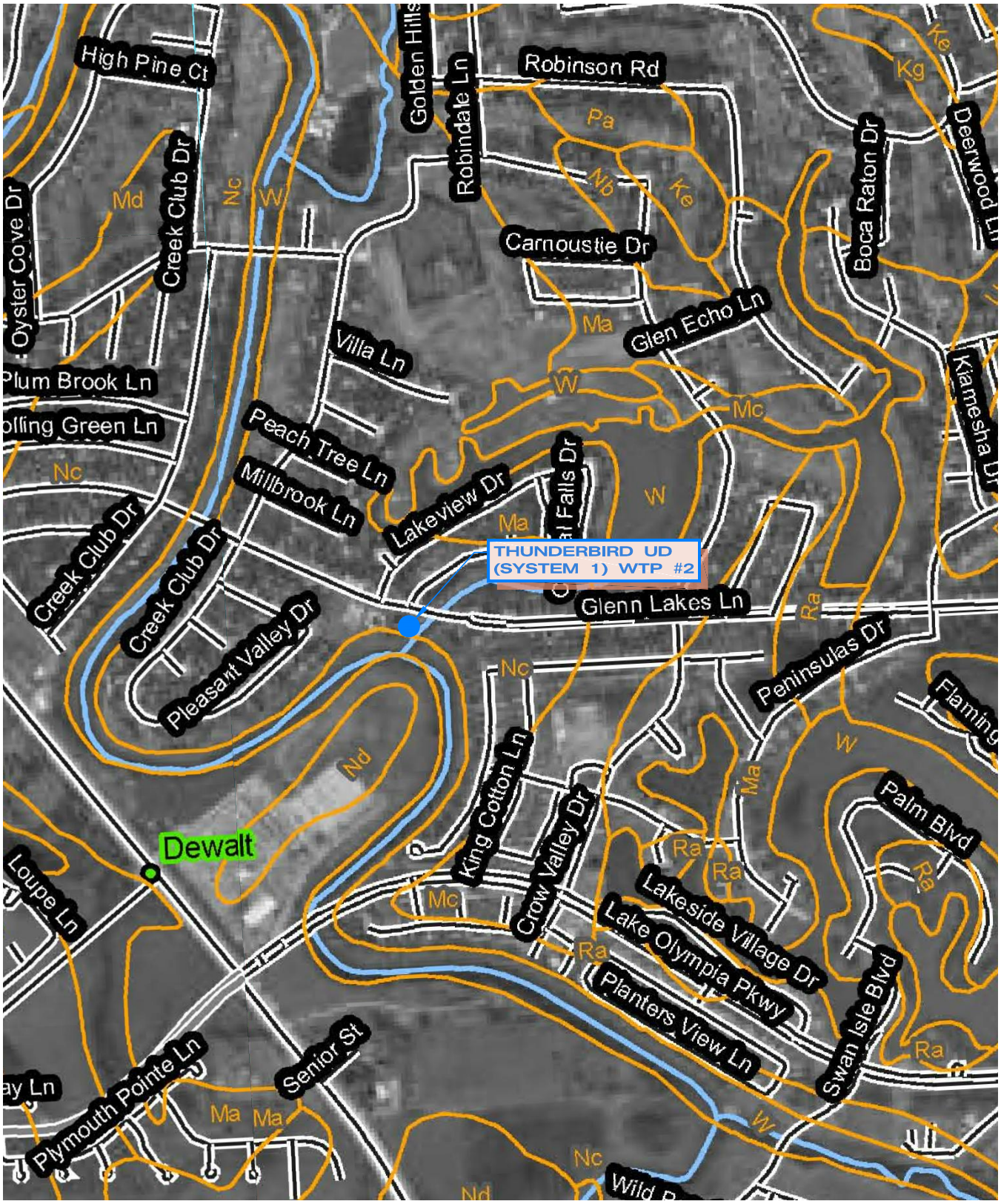
SCALE IN FEET

SOILS MAP

HARRIS COUNTY WC & ID
FONDREN RD. WTP #2
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/17/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



LEGEND

PROPOSED NEW ELEVATED STORAGE TANK LOCATION

N

500 0 1000

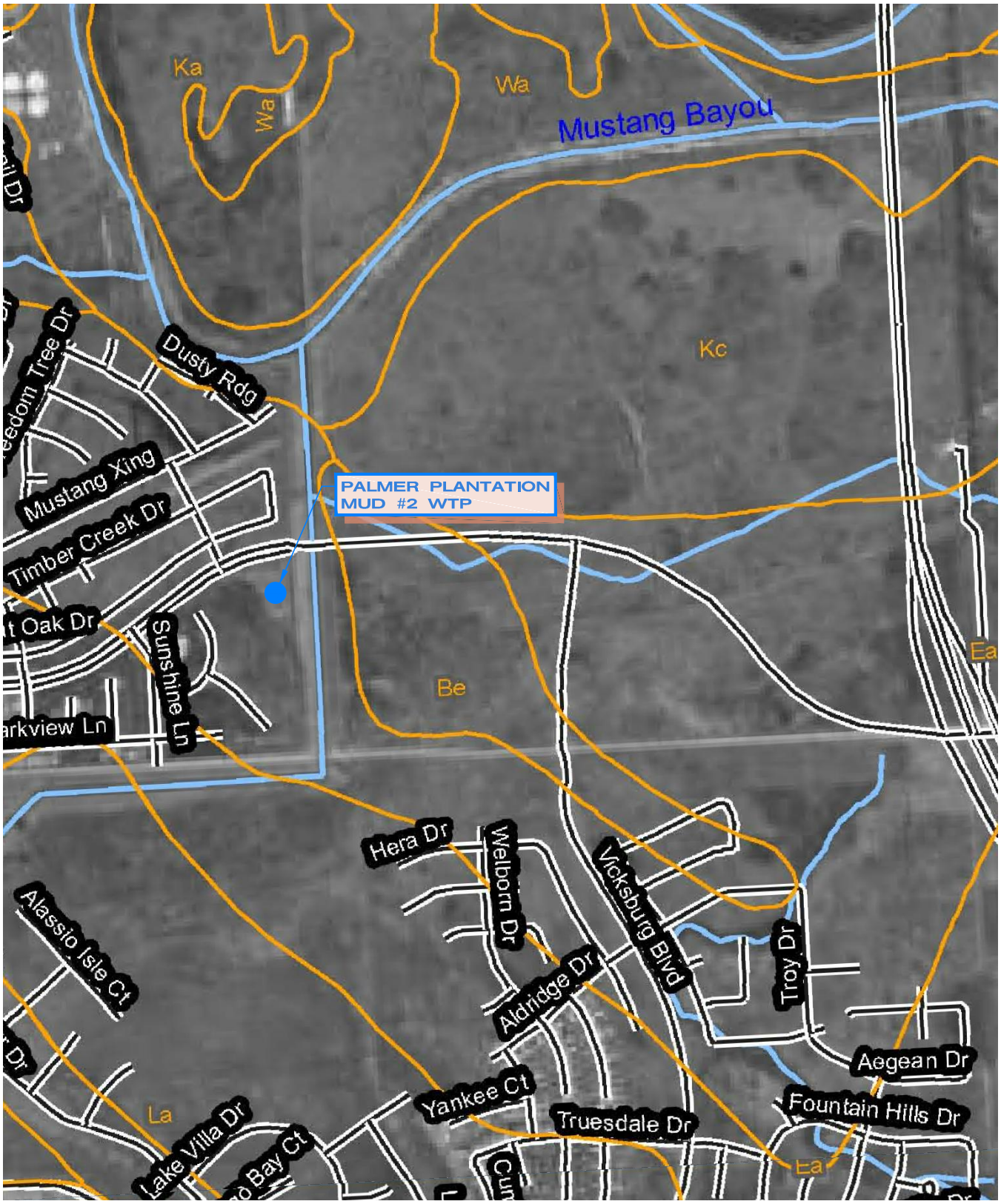
SCALE IN FEET

SOILS MAP

THUNDERBIRD UD
(SYSTEM 1) WTP #2
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/17/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

PROPOSED NEW ELEVATED STORAGE TAN□ LOCATION

N

500 0 1000

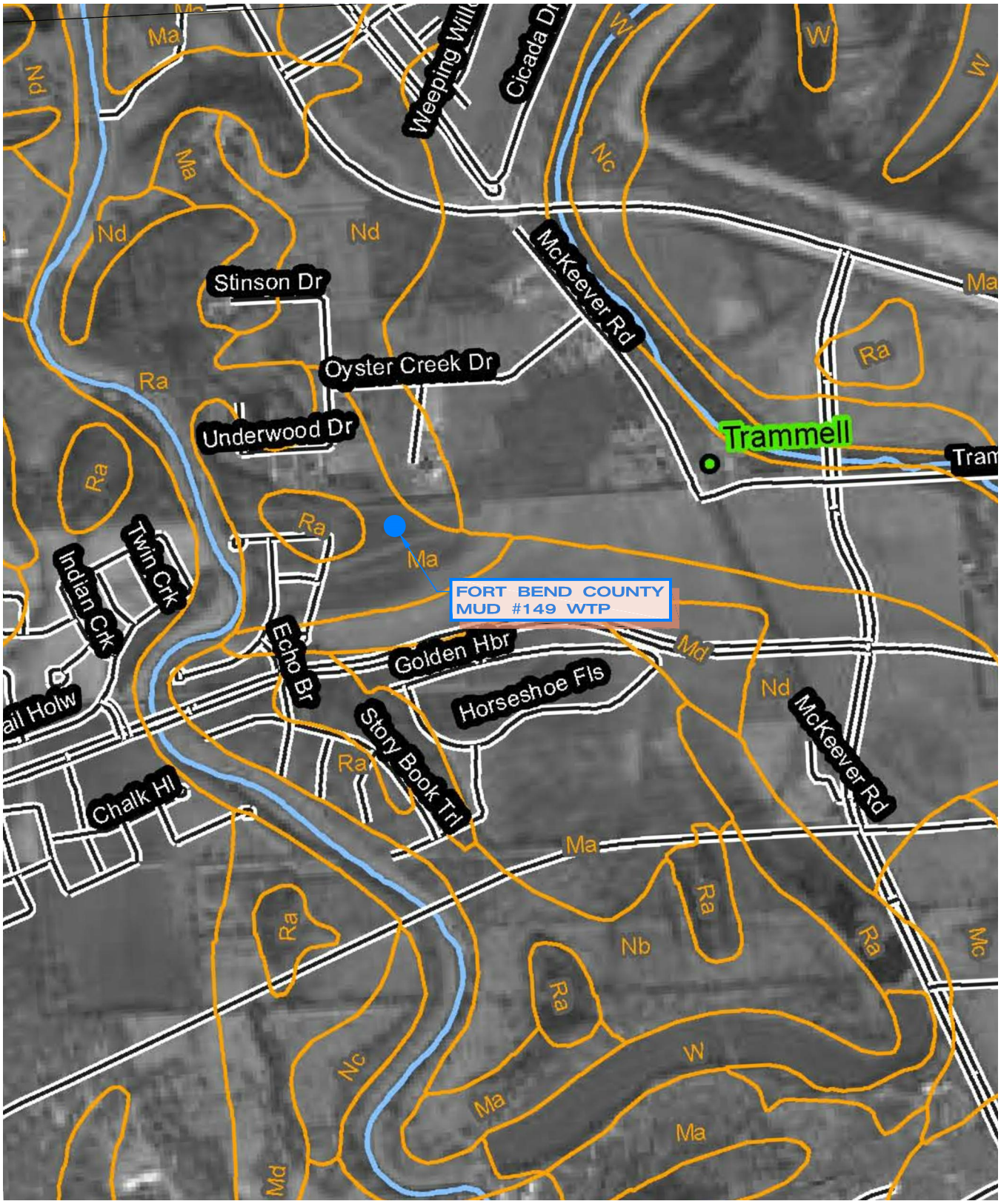
SCALE IN FEET

SOILS MAP

PALMER PLANTATION
WTP #2
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/17/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



LEGEND

PROPOSED NEW ELEVATED STORAGE TANK LOCATION

N

500 0 1000

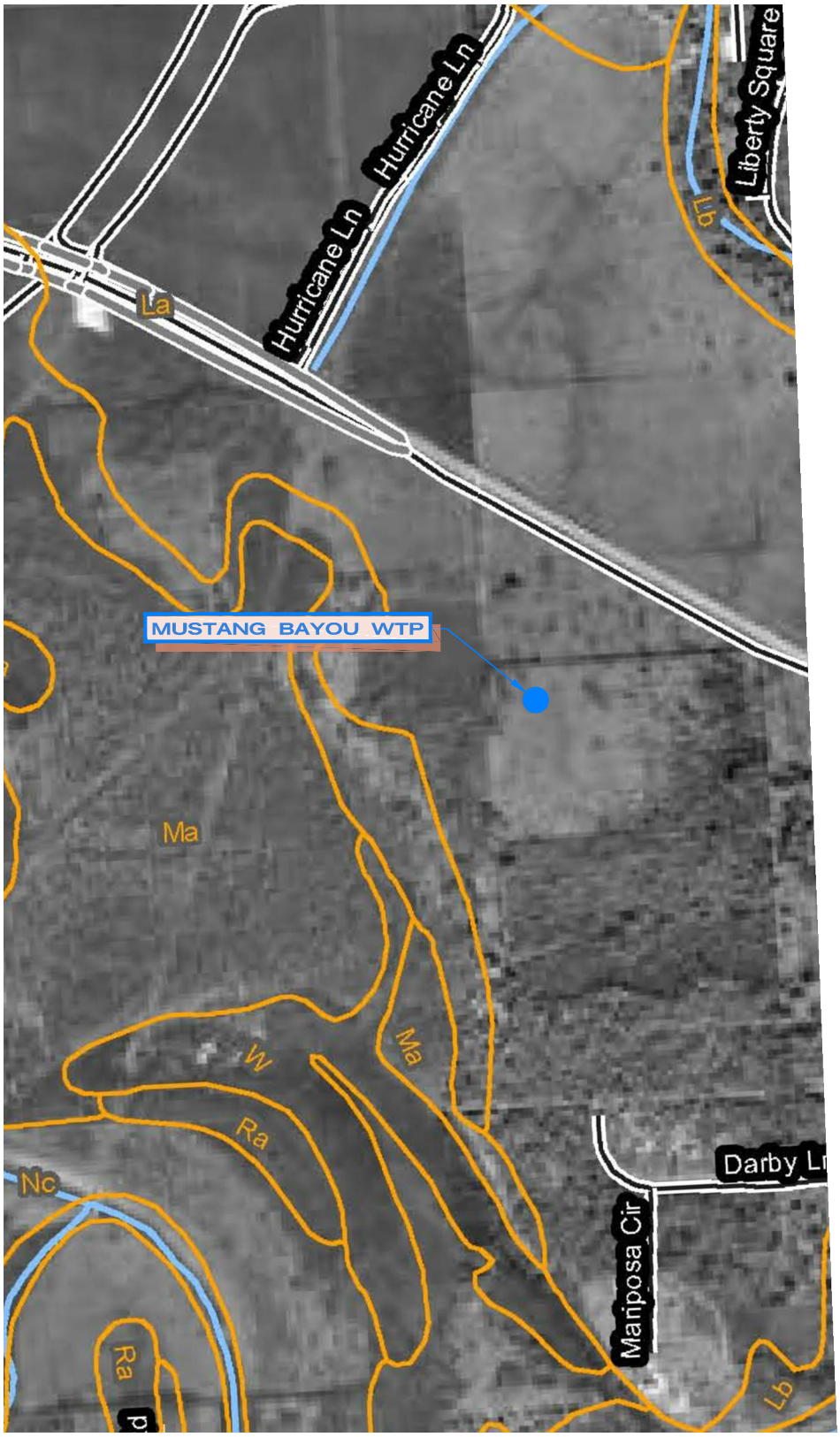
SCALE IN FEET

SOILS MAP

FORT BEND COUNTY
MUD #149 WTP
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/17/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

PROPOSED NEW ELEVATED STORAGE TANK LOCATION

N

500 0 1000

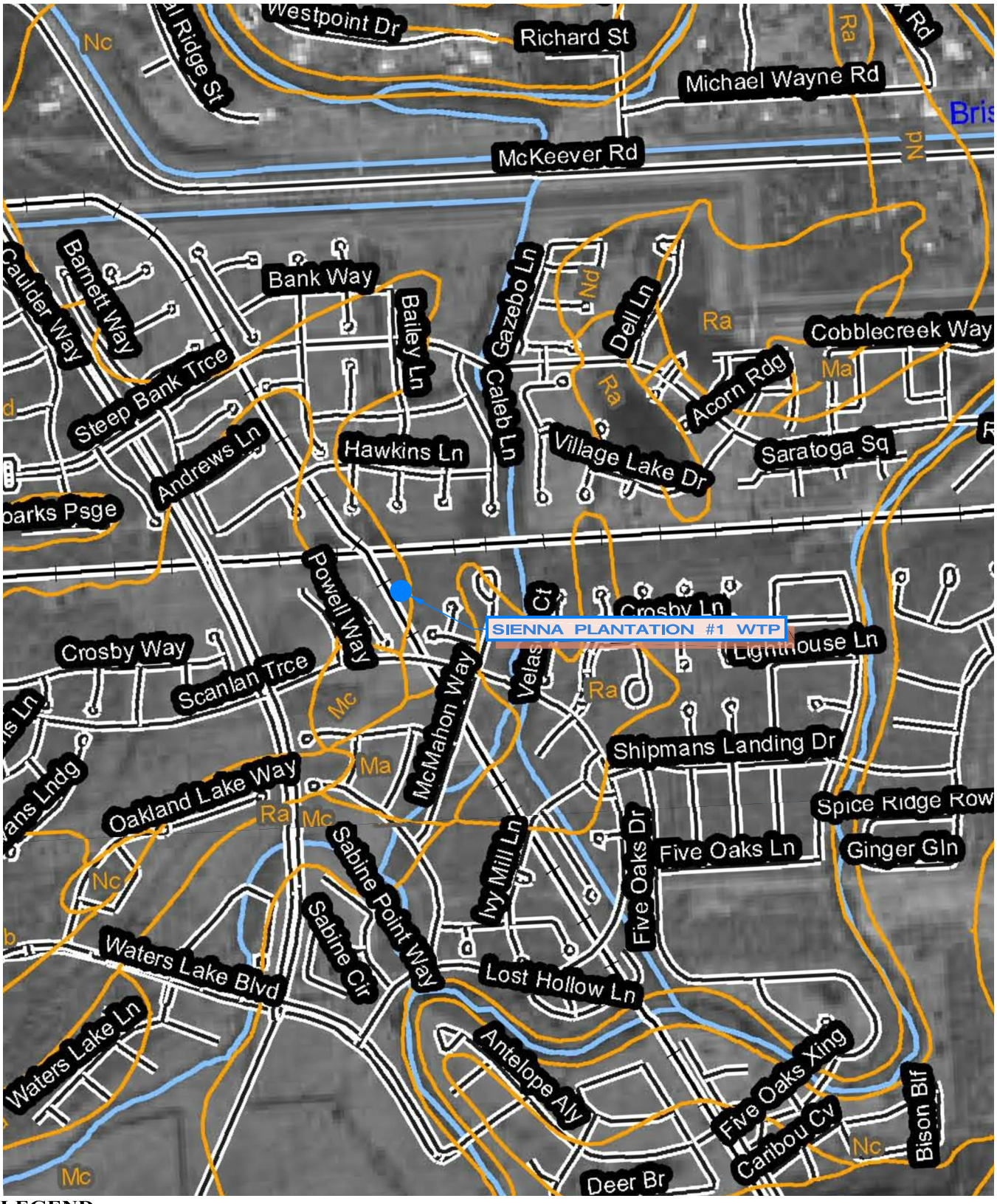
SCALE IN FEET

SOILS MAP

MUSTANG BAYOU WTP
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/17/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



LEGEND

PROPOSED NEW ELEVATED STORAGE TANK LOCATION

N

500 0 1000

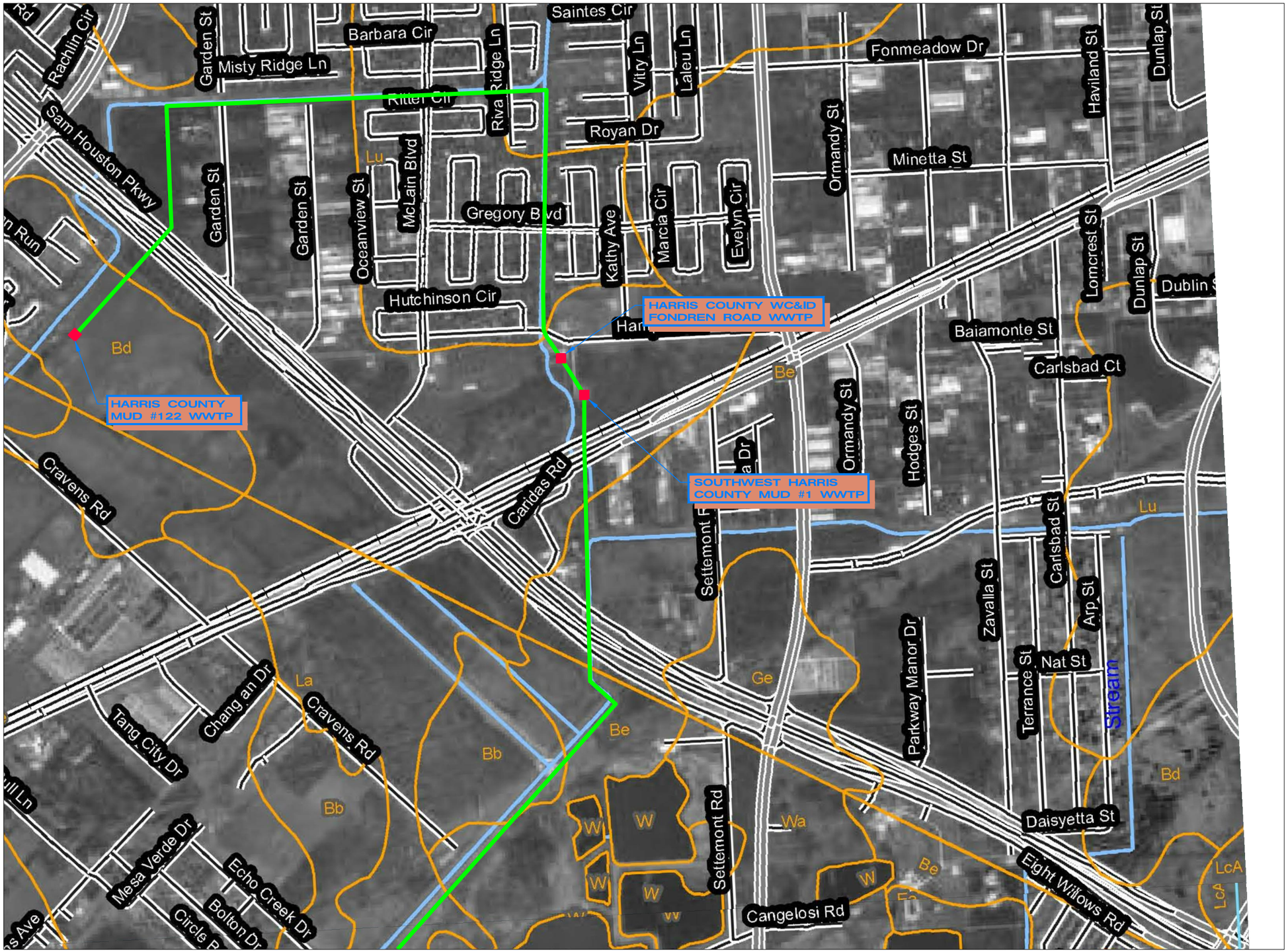
SCALE IN FEET

SOILS MAP

SIENNA PLANTATION #1 WTP
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/17/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

KEY MAP

SOILS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

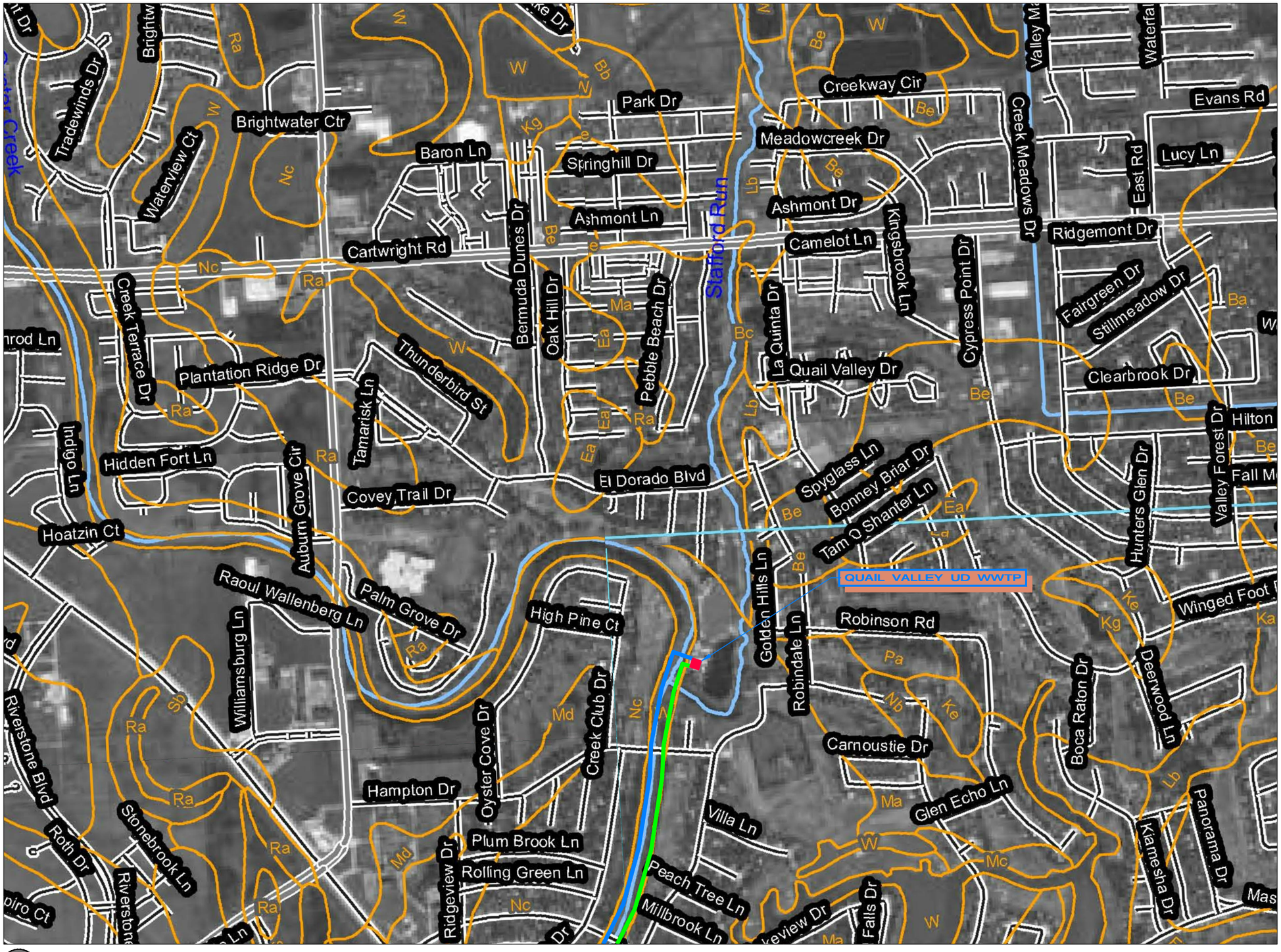
KEY MAP

SOILS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

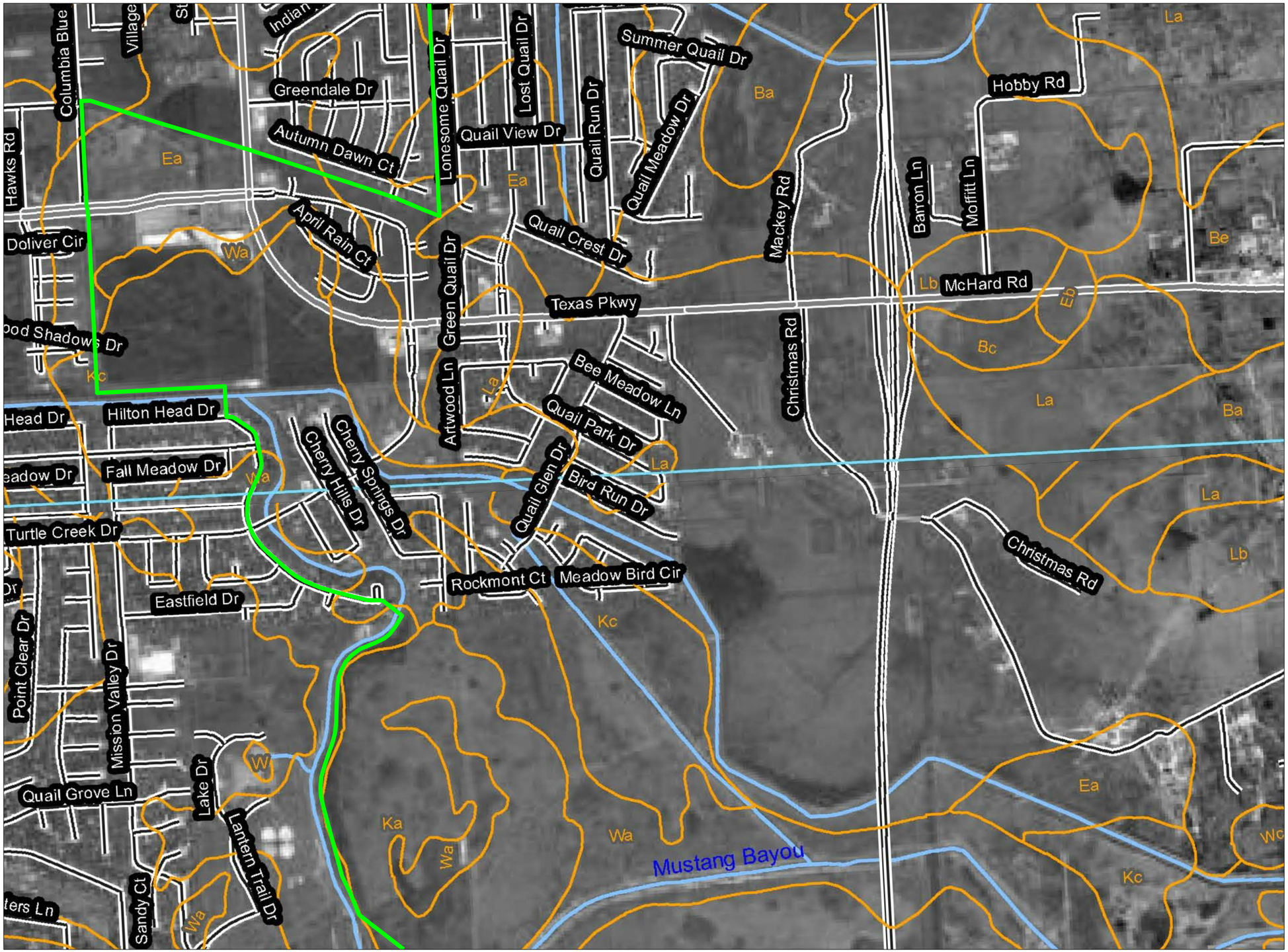
KEY MAP

SOILS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

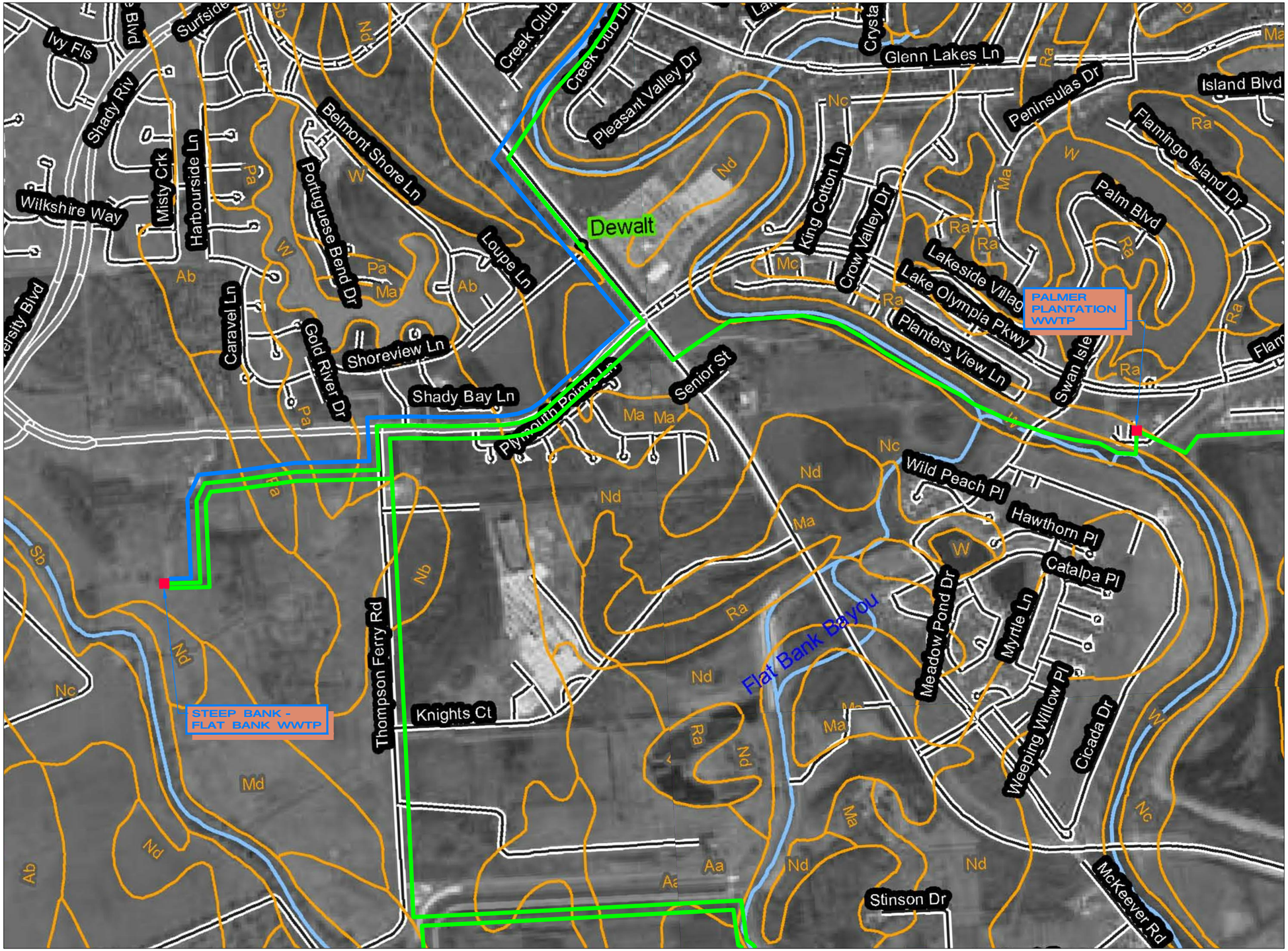
KEY MAP

SOILS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

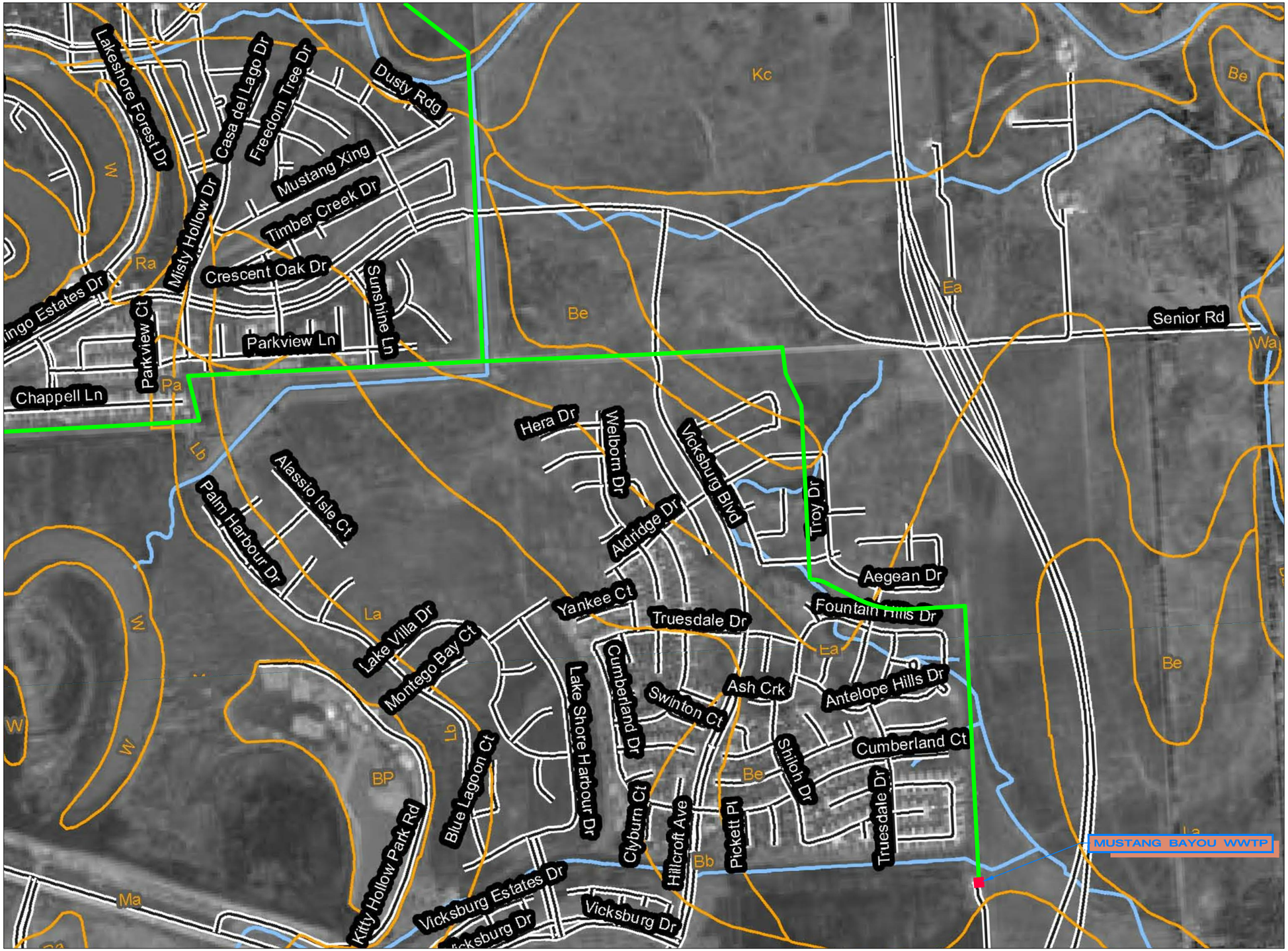
KEY MAP

SOILS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

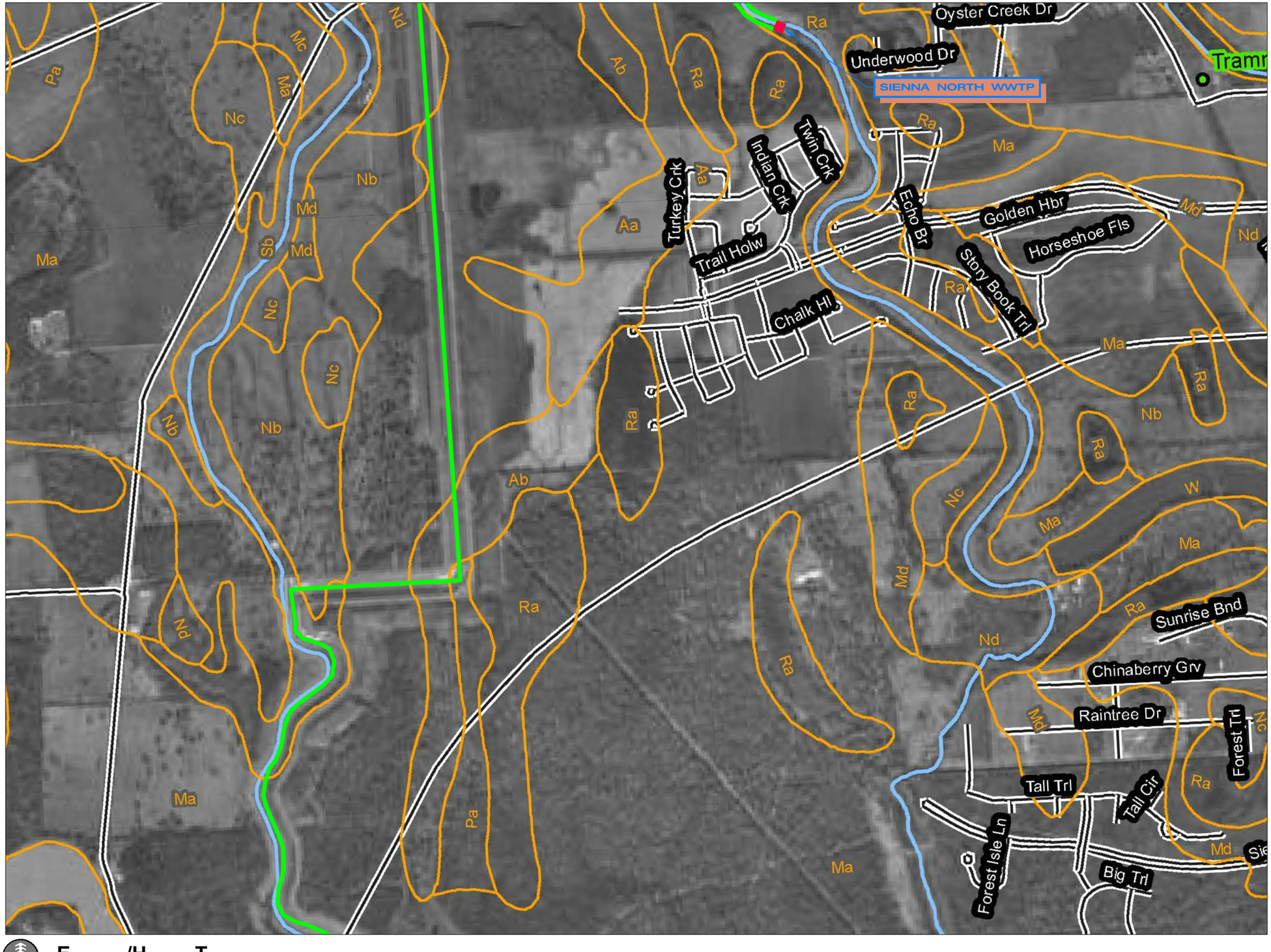
KEY MAP

SOILS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

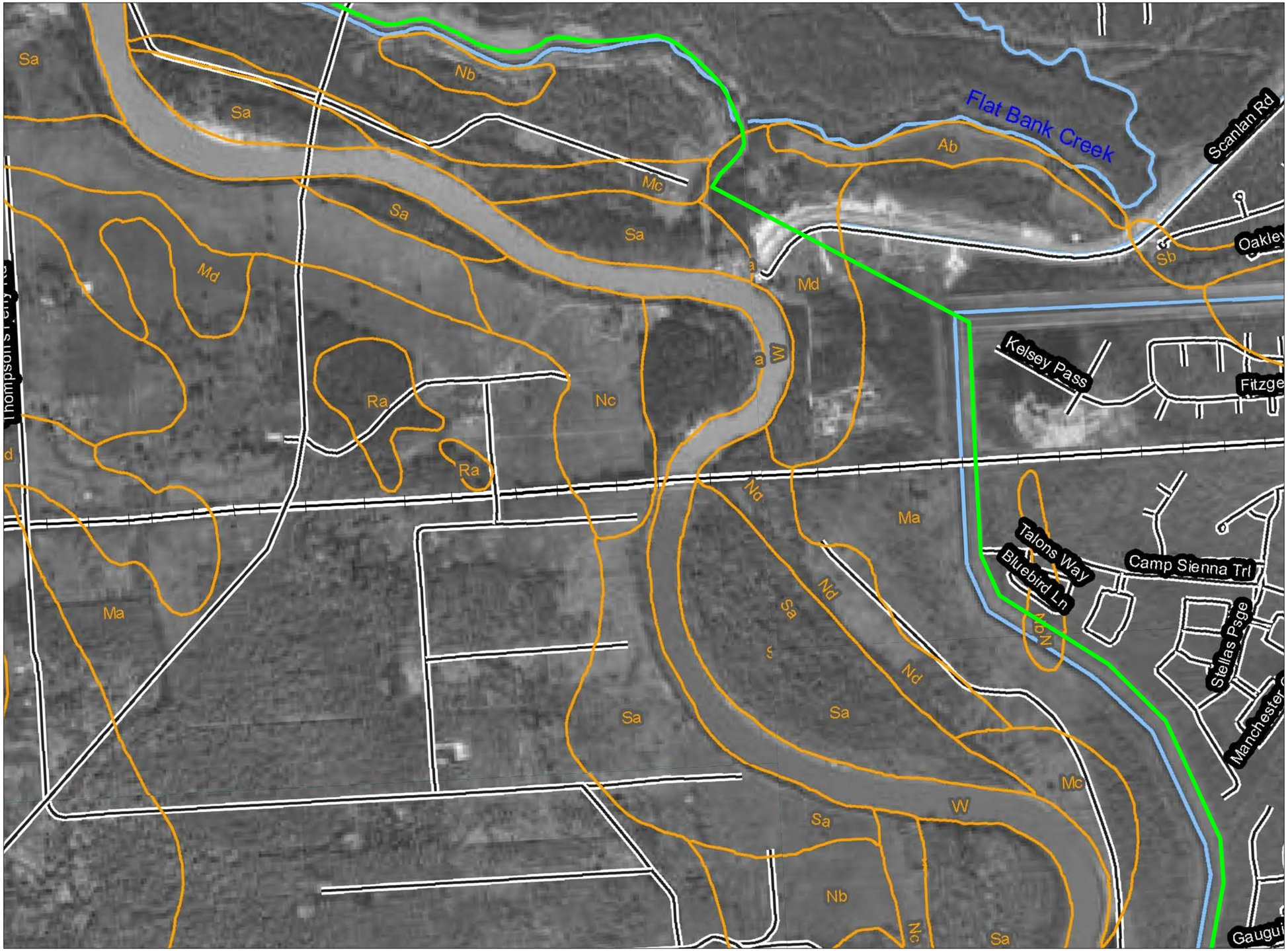
KEY MAP

SOILS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

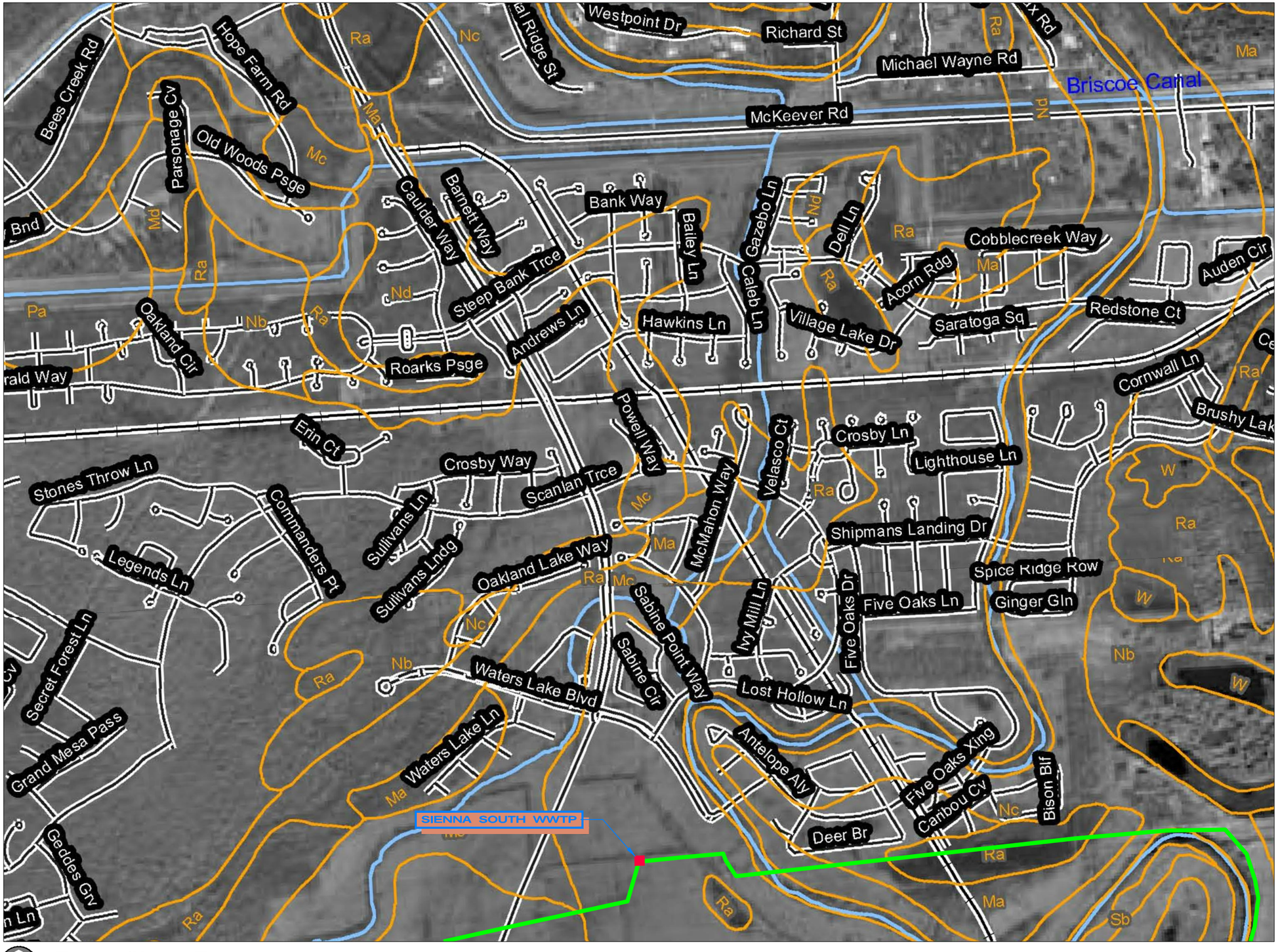
KEY MAP

SOILS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

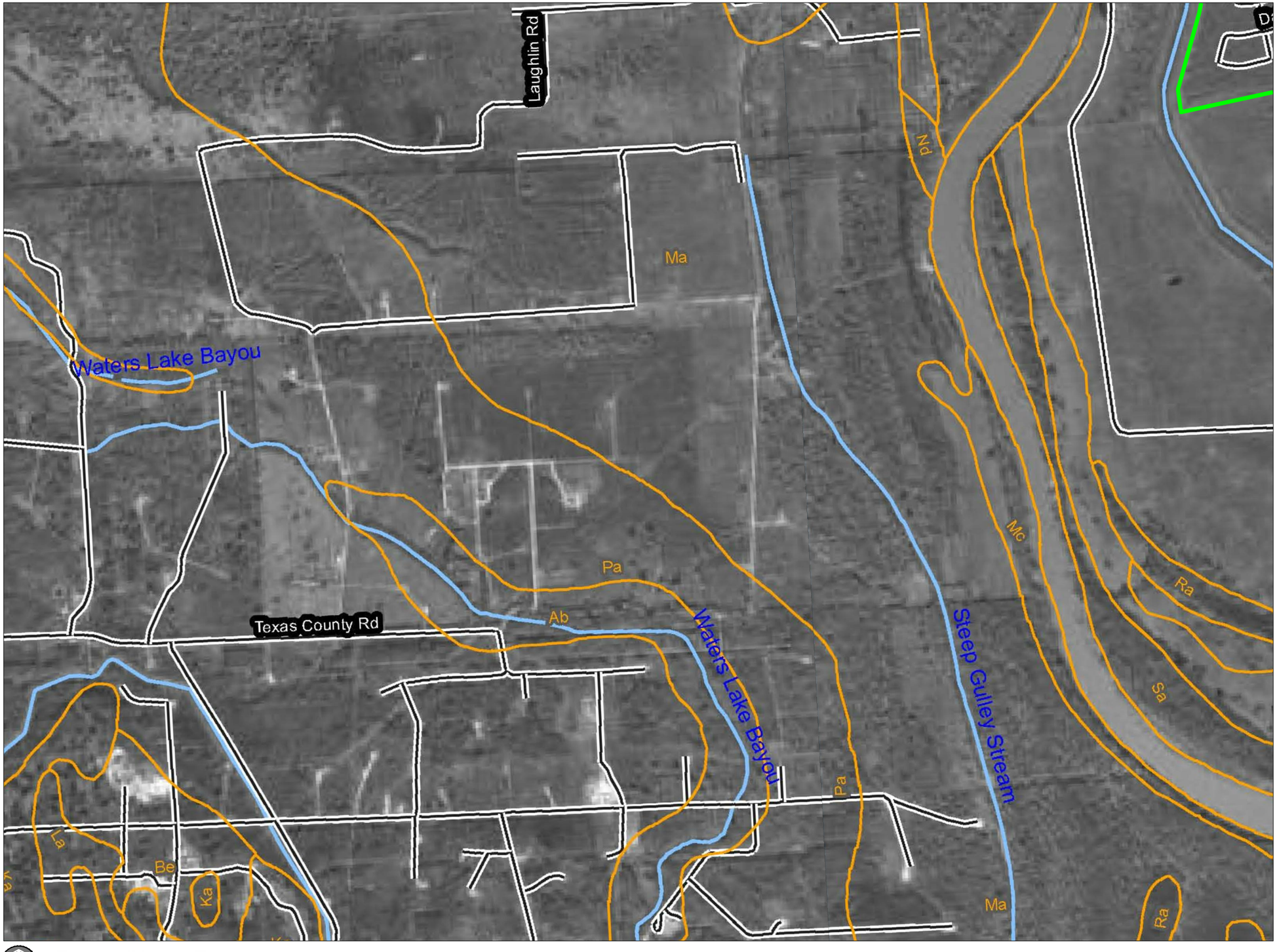
KEY MAP

SOILS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



N

500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

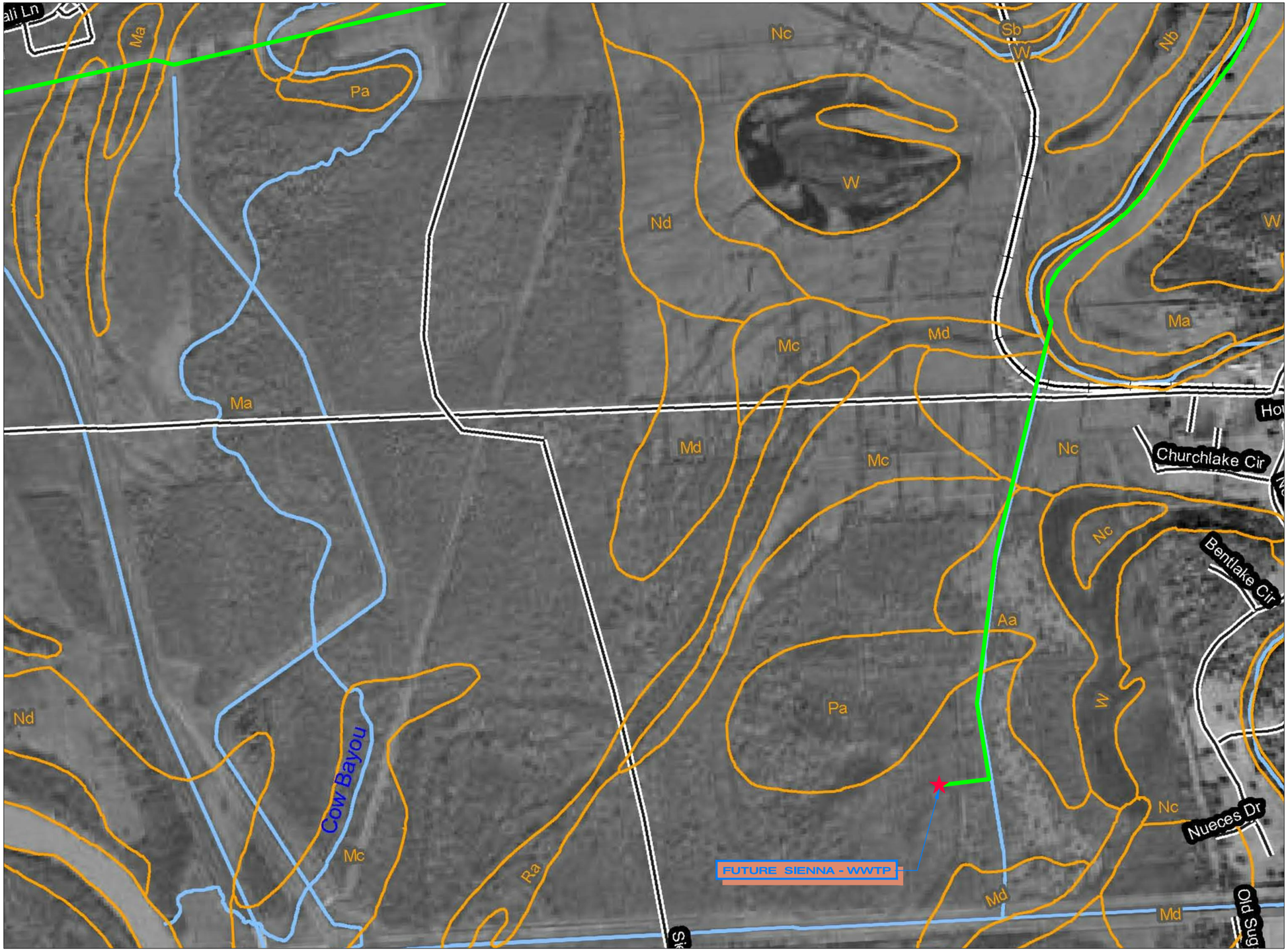
KEY MAP

SOILS MAP

2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



N

500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

KEY MAP

SOILS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 01/27/2012

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151

Soil Types & Soils Suitability Table

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)
Aa	Asa fine sandy loam	Somewhat limited	Asa (100%)	Cutbanks cave (0.10)
Ab	Asa silty clay loam	Somewhat limited	Asa (100%)	Cutbanks cave (0.10)
Ba	Bacliff clay, 0 to 1 percent slopes	Very limited	Bacliff (85%)	Depth to saturated zone (1.00)
				Cutbanks cave (1.00)
				Too clayey (0.50)
Bb	Bernard clay loam, 0 to 1 percent slopes	Very limited	Bernard (95%)	Depth to saturated zone (1.00)
				Too clayey (0.28)
				Cutbanks cave (0.10)
Bc	Bernard-Edna clay loam, 1 to 4 percent slopes	Very limited	Bernard (65%)	Depth to saturated zone (1.00)
				Too clayey (0.28)
				Cutbanks cave (0.10)
Bd	Bernard clay loam	Very limited	Bernard (90%)	Depth to saturated zone (1.00)
				Too clayey (0.28)
				Cutbanks cave (0.10)
Be	Bernard-Edna complex 0 to 1 percent slopes	Very limited	Bernard (50%)	Depth to saturated zone (1.00)
				Too clayey (0.28)
				Cutbanks cave (0.10)
BP	Pits, borrow	Not rated	Pits, borrow (100%)	
Ea	Edna fine sandy loam, 0 to 1 percent slopes	Somewhat limited	Edna (95%)	Too clayey (0.13)
				Cutbanks cave (0.10)
Eb	Edna fine sandy loam, 1 to 4 percent slopes	Somewhat limited	Edna (100%)	Too clayey (0.13)
				Cutbanks cave (0.10)
Ge	Gessner loam	Very limited	Gessner (85%)	Ponding (1.00)
				Depth to saturated zone (1.00)
				Cutbanks cave (0.10)

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)
Ka	Katy fine sandy loam, 0 to 1 percent slopes	Somewhat limited	Kaman (90%)	Cutbanks cave (0.10)
Kc	Katy-Waller complex	Somewhat limited	Katy (65%)	Cutbanks cave (0.10)
La	Lake Charles clay, 0 to 1 percent slopes	Very limited	Lake charles (95%)	Cutbanks cave (1.00)
				Too clayey (0.50)
Lb	Lake Charles clay, 1 to 4 percent slopes	Very limited	Lake charles (100%)	Cutbanks cave (1.00)
				Too clayey (0.50)
LcA	Lake Charles clay, 0 to 1 percent slopes	Very limited	Lake charles (90%)	Cutbanks cave (1.00)
				Too clayey (0.50)
Lu	Lake Charles-Urban land complex	Very limited	Lake charles (50%)	Cutbanks cave (1.00)
				Too clayey (0.50)
Ma	Brazoria clay, 0 to 1 percent slopes, rarely flooded	Very limited	Brazoria (95%)	Too clayey (1.00)
				Cutbanks cave (1.00)
Mc	Clemville silt loam, 0 to 1 percent slopes, rarely flooded	Somewhat limited	Clemville (95%)	Cutbanks cave (0.10)
				Too clayey (0.03)
Md	Clemville silty clay loam, 0 to 1 percent slopes, rarely flooded	Somewhat limited	Clemville (95%)	Cutbanks cave (0.10)
				Too clayey (0.03)
Nb	Belk clay	Very limited	Belk (100%)	Cutbanks cave (1.00)
				Too clayey (0.72)
Nc	Norwood silt loam	Somewhat limited	Norwood (100%)	Cutbanks cave (0.10)
Nd	Norwood silty clay loam	Somewhat limited	Norwood (100%)	Cutbanks cave (0.10)
Pa	Pledger clay	Very limited	Pledger (95%)	Too clayey (1.00)
				Cutbanks cave (1.00)
Ra	Sumpf clay	Very limited	Sumpf (95%)	Ponding (1.00)
				Depth to saturated zone (1.00)
				Too clayey (1.00)
				Cutbanks cave (1.00)
				Flooding (0.80)

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)
Sa	Sandy alluvial land	Very limited	Alluvial land, sandy (95%)	Cutbanks cave (1.00)
				Depth to saturated zone (0.95)
				Flooding (0.60)
Sb	Sloping alluvial land	Somewhat limited	Alluvial land, sloping (100%)	Slope (0.37)
				Cutbanks cave (0.10)
W	Water	Not rated	Water (100%)	
Wa	Waller soils	Very limited	Waller (95%)	Ponding (1.00)
				Depth to saturated zone (1.00)
				Cutbanks cave (0.10)

Information excerpted from http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

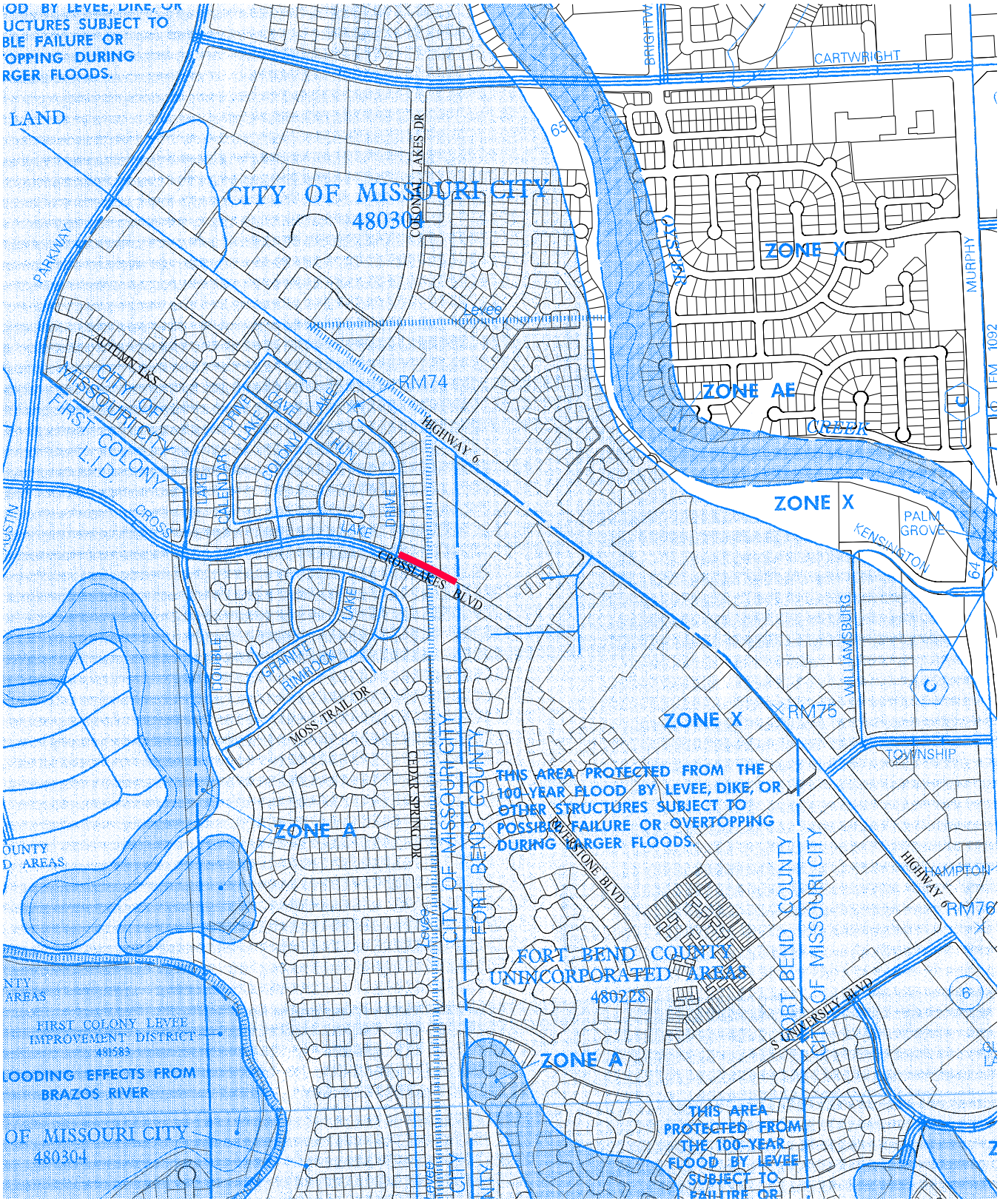
Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for graves, utility lines, open ditches, or other purposes. The ratings are based on the soil properties that influence the ease of digging and the resistance to sloughing. Depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, the amount of large stones, and dense layers influence the ease of digging, filling, and compacting. Depth to the seasonal high water table, flooding, and ponding may restrict the period when excavations can be made. Slope influences the ease of using machinery. Soil texture, depth to the water table, and linear extensibility (shrink-swell potential) influence the resistance to sloughing.

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the specified use. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

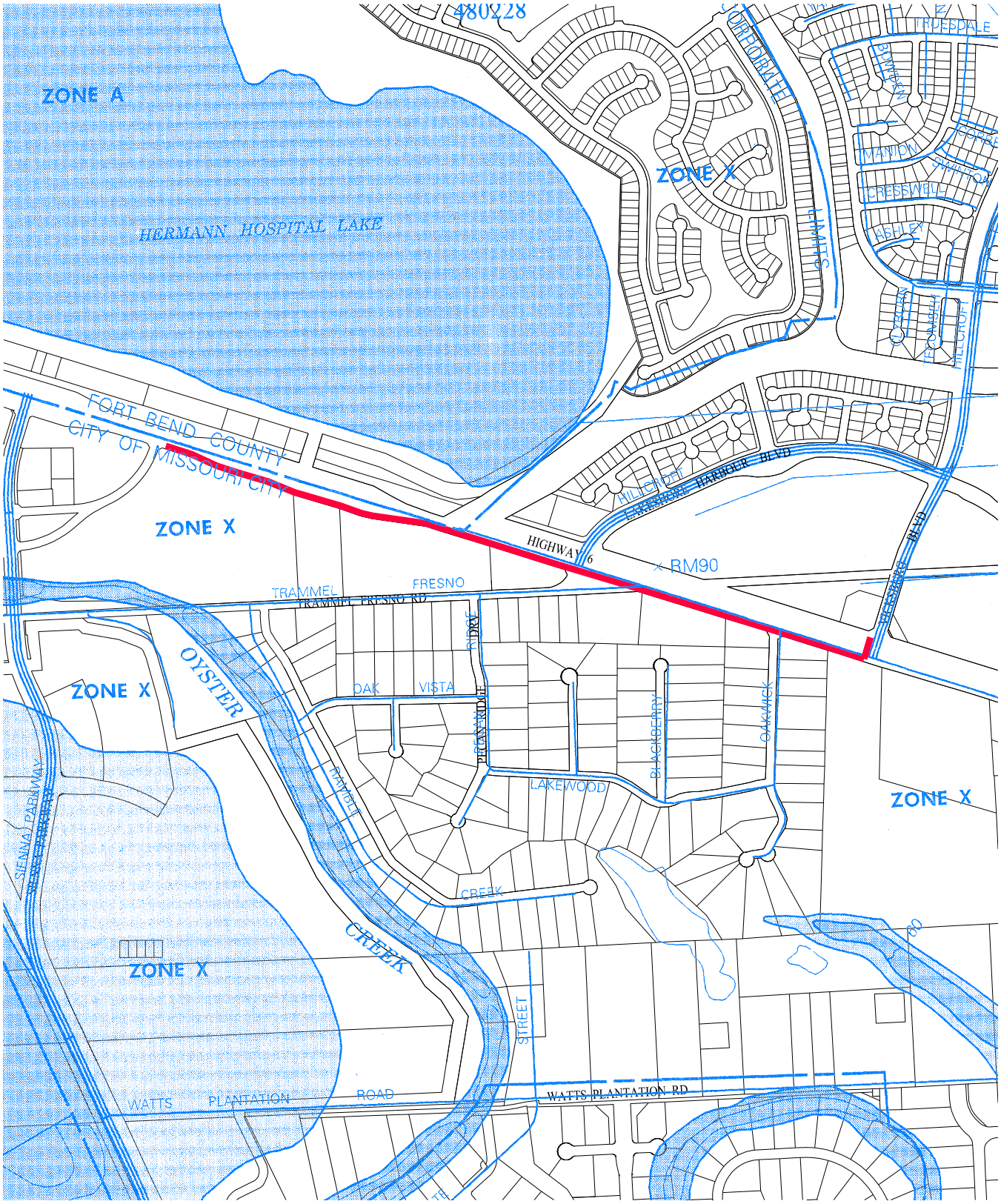
SCALE IN FEET

FLOOD MAP
WATER OPTION 1

FIRST COLONY MUD #9 AND
FORT BEND COUNTY MUD #115
INTERCONNECT
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

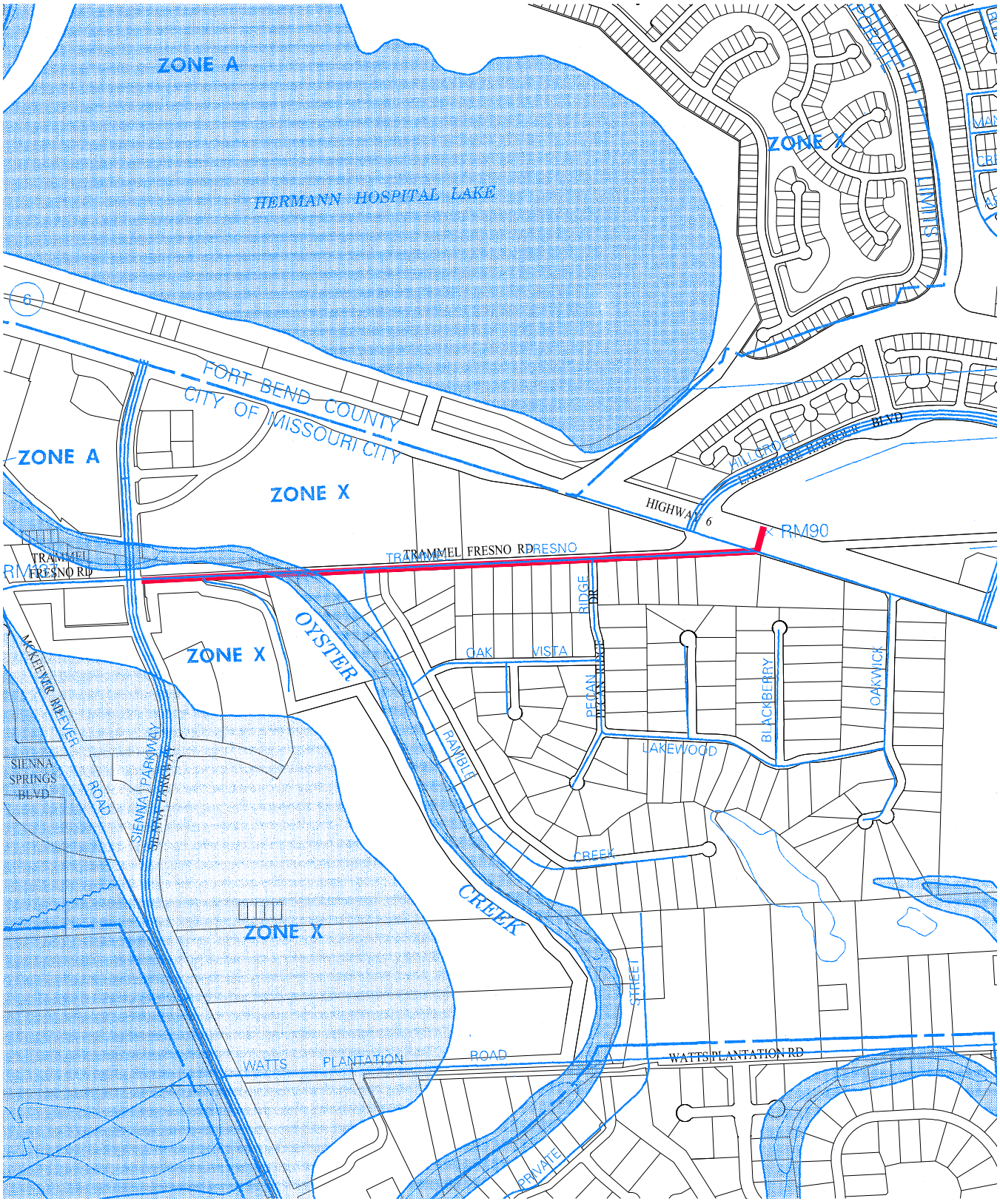
SCALE IN FEET

FLOOD MAP
WATER OPTION 2

MUSTANG BAYOU AND SIENNA PLANTATION INTERCONNECT NO. 2
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

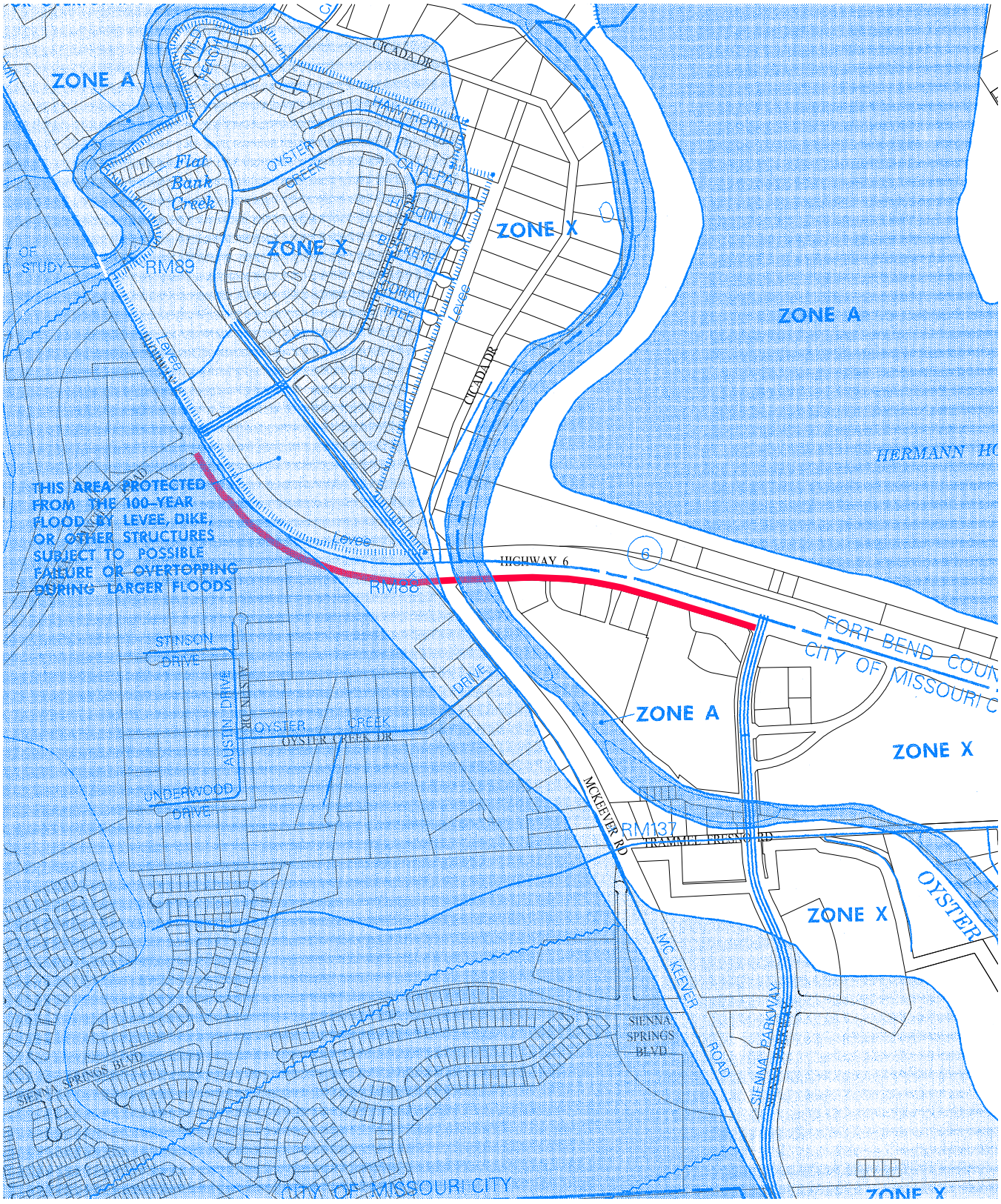
SCALE IN FEET

FLOOD MAP
WATER OPTION 3

MUSTANG BAYOU AND SIENNA PLANTATION INTERCONNECT NO. 3
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

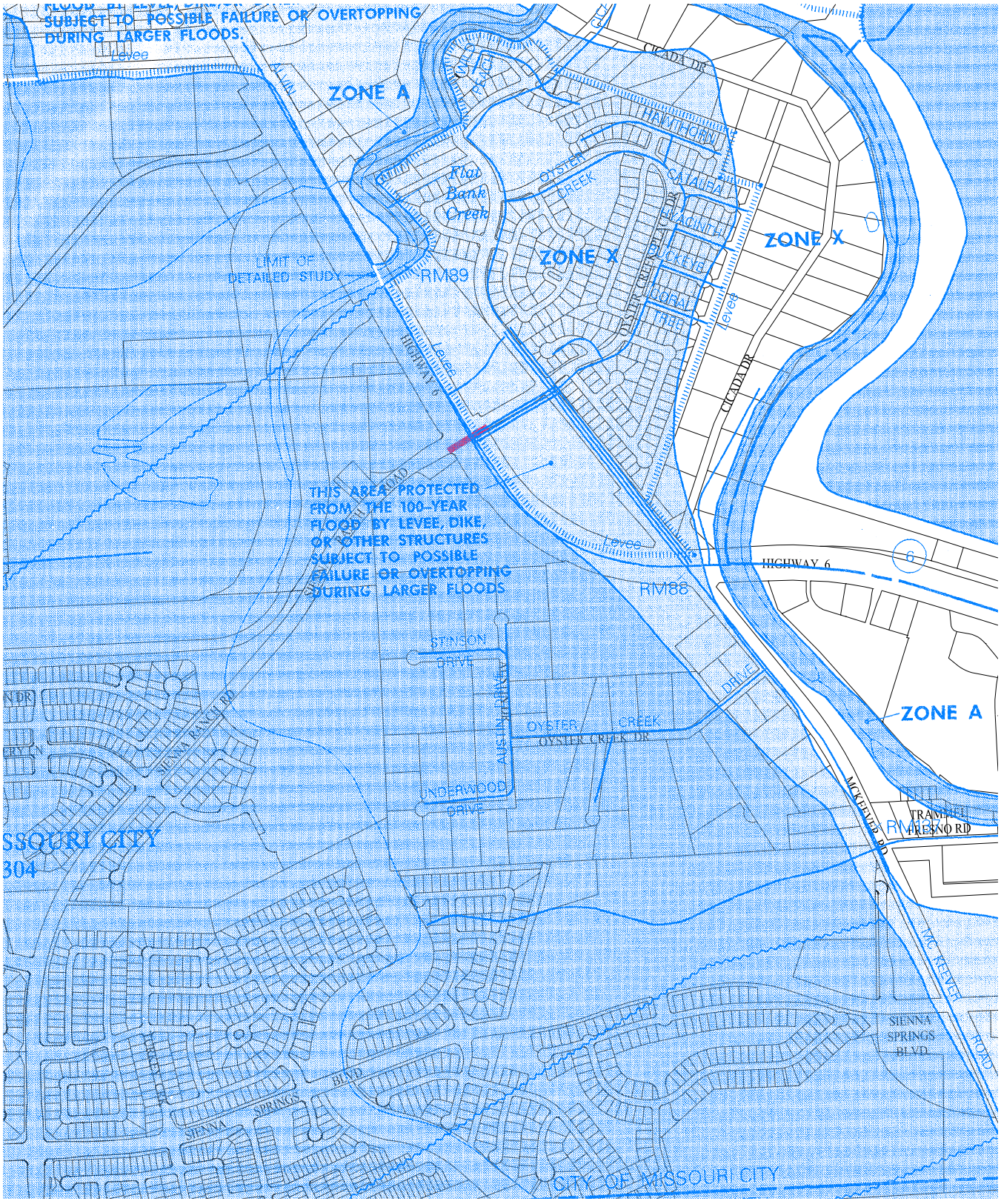
SCALE IN FEET

FLOOD MAP
WATER OPTION 4

SIENNA PLANTATION
INTERNAL INTERCONNECT
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

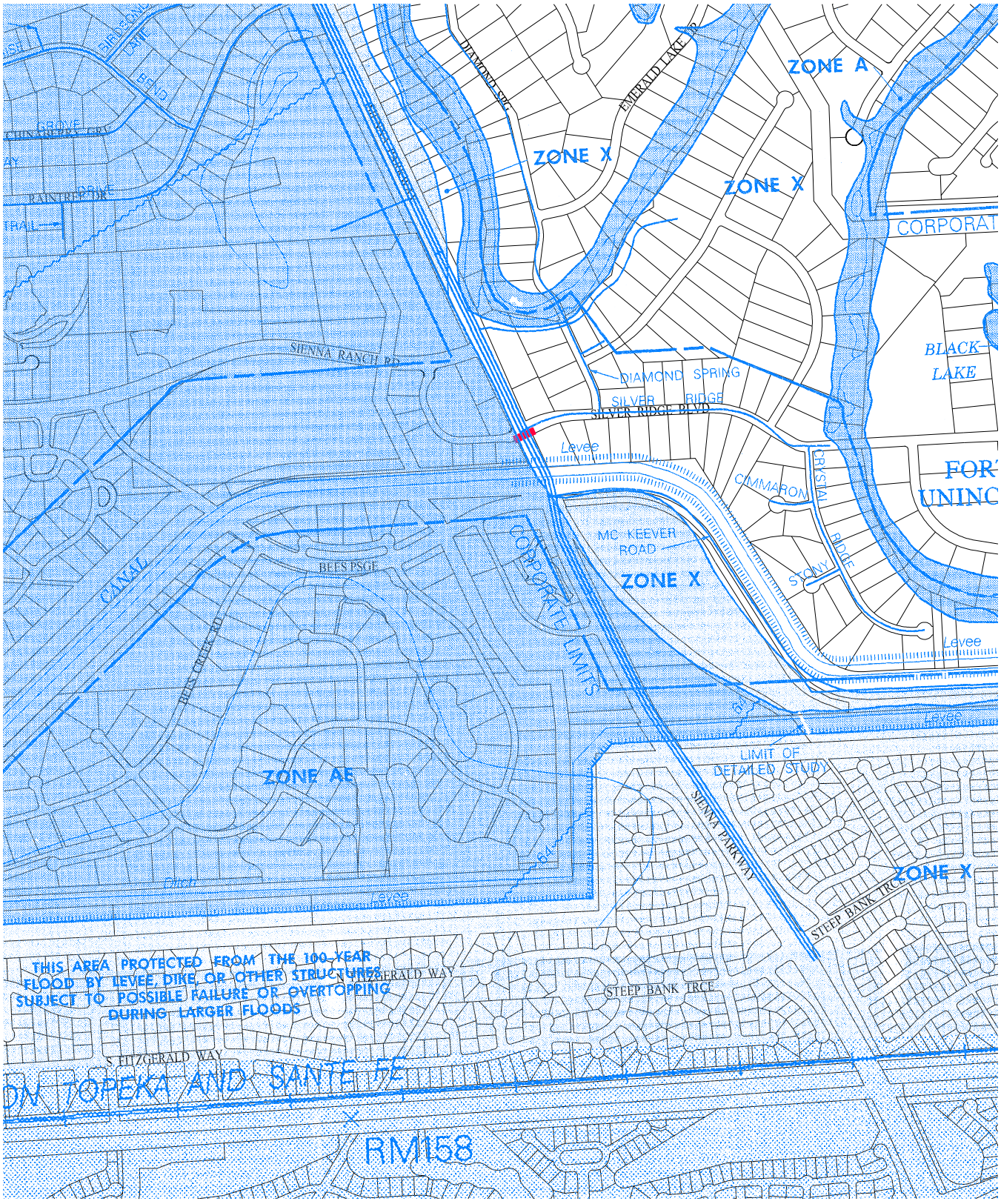
SCALE IN FEET

FLOOD MAP
WATER OPTION 5

SIENNA PLANTATION AND
PALMER PLANTATION
INTERCONNECT NO. 1
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

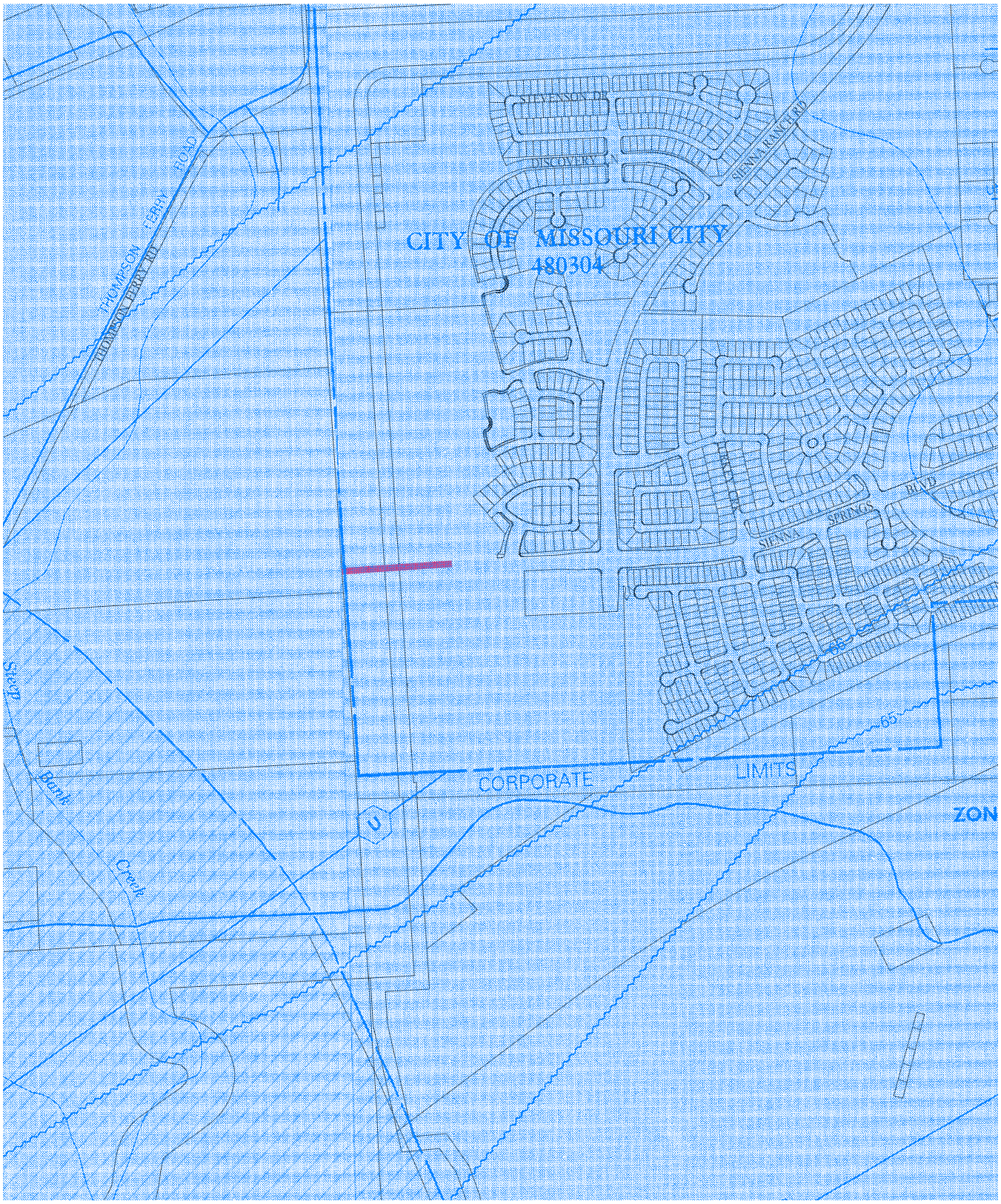
SCALE IN FEET

FLOOD MAP
WATER OPTION 6

SILVER RIDGE DEVELOPMENT AND SIENNA PLANTATION INTERCONNECT NO. 1
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

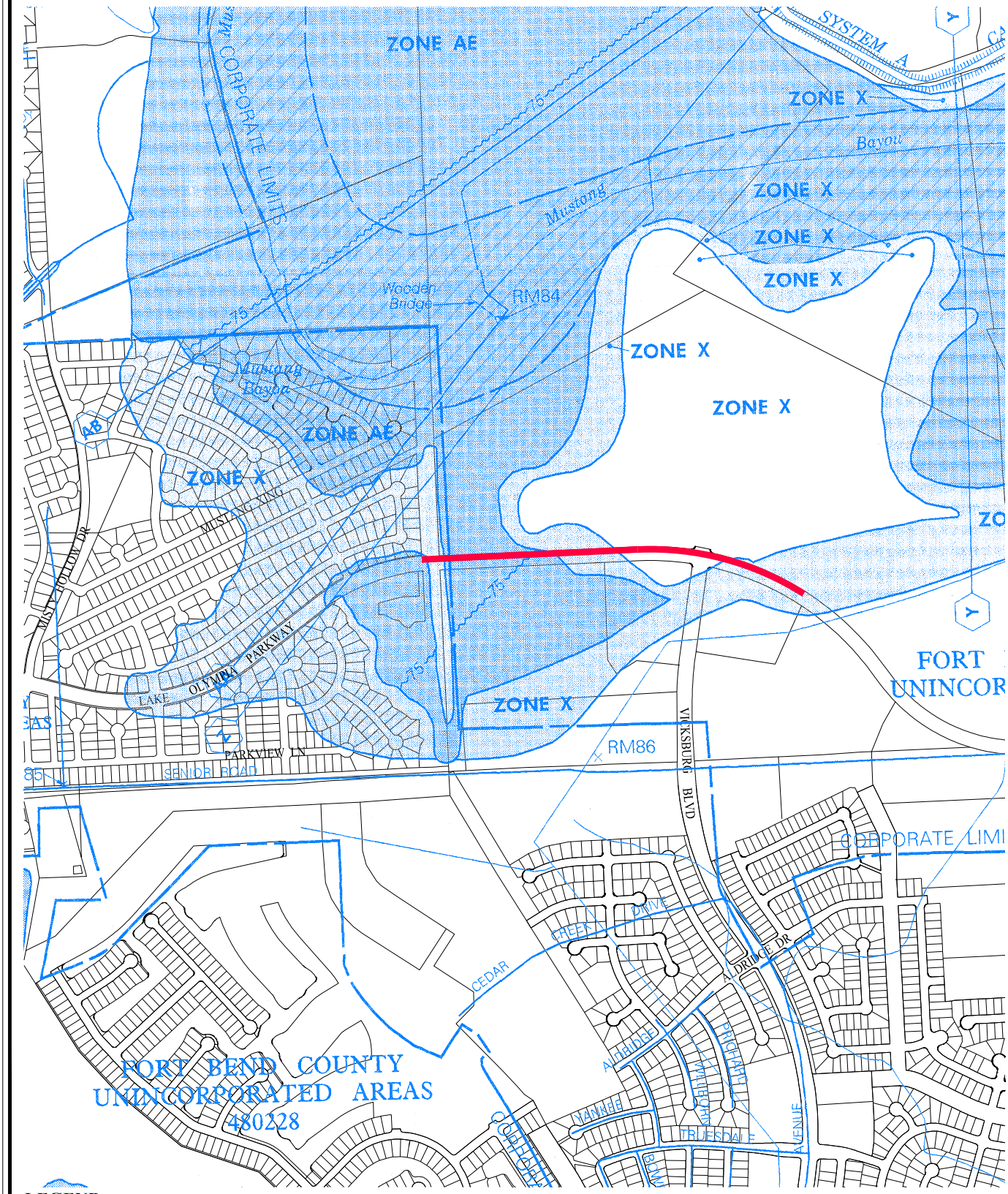
SCALE IN FEET

FLOOD MAP
WATER OPTION 7

FORT BEND COUNTY MUD #149 AND SIENNA PLANTATION INTERCONNECT NO. 1 2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

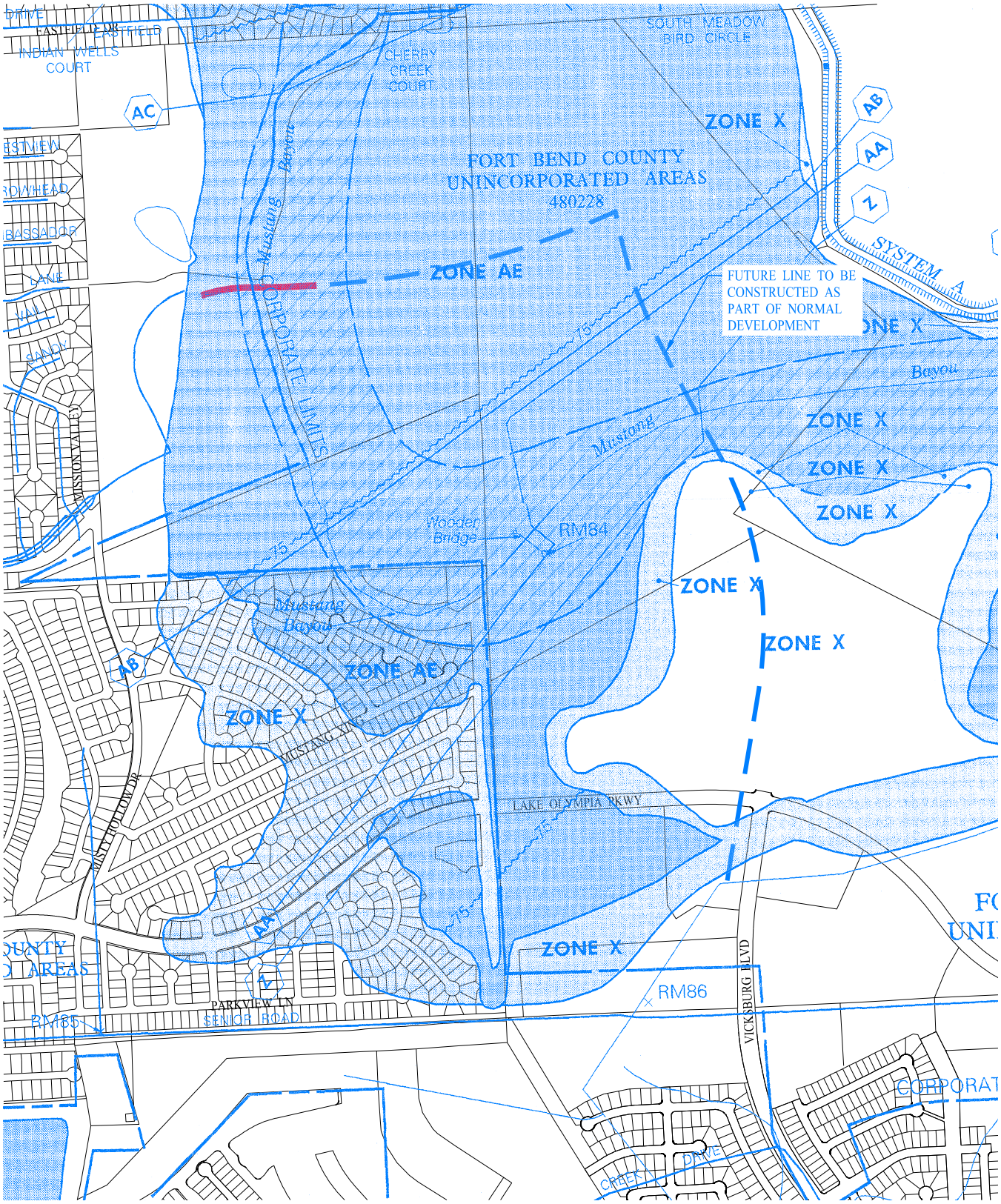
SCALE IN FEET

FLOOD MAP
WATER OPTION 12

MUSTANG BAYOU AND PALMER PLANTATION INTERCONNECT
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

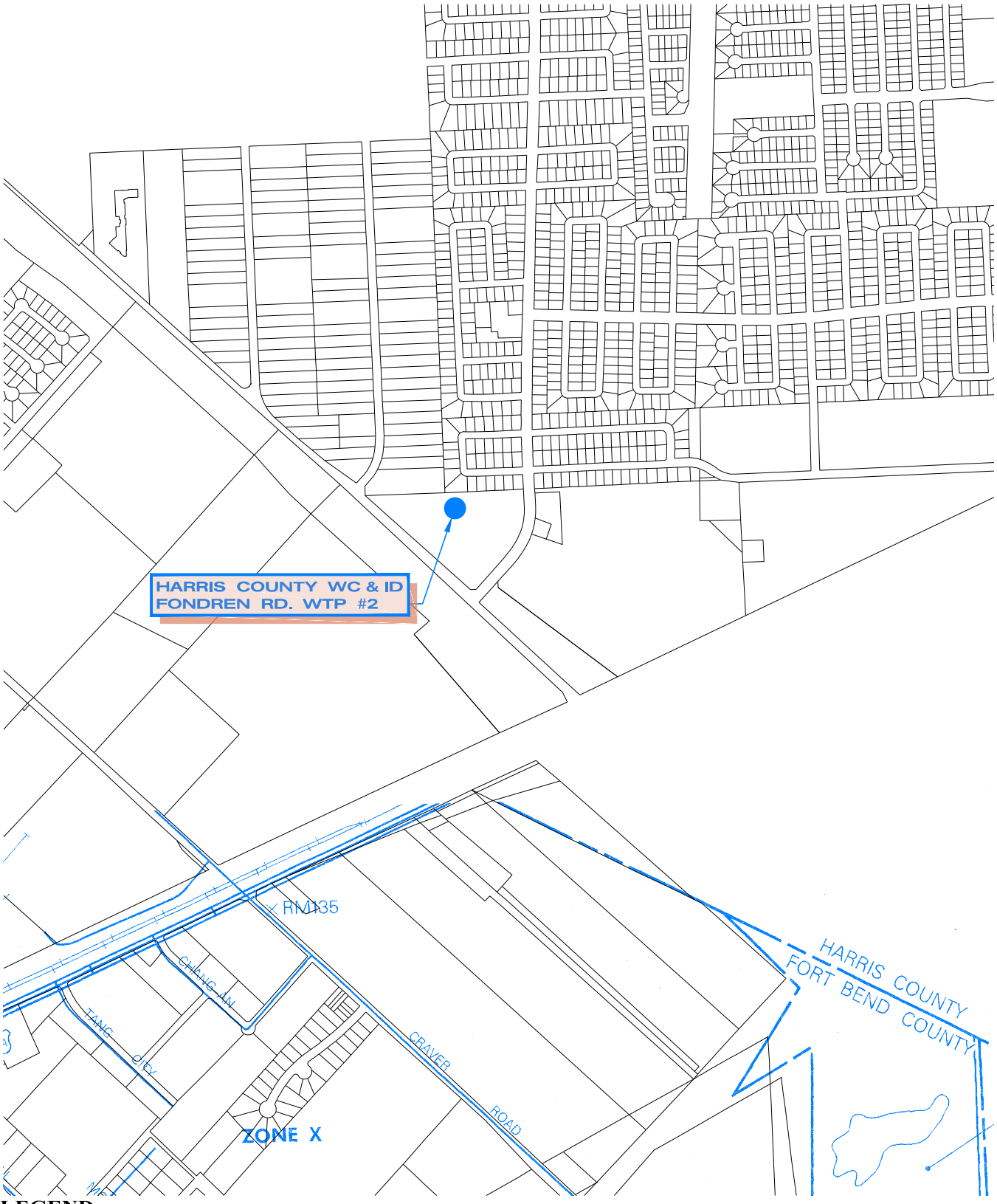
SCALE IN FEET

FLOOD MAP
WATER OPTION 13

MUSTANG BAYOU AND QUAIL VALLEY INTERCONNECT 2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



LEGEND

PROPOSED NEW ELEVATED STORAGE TANK LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

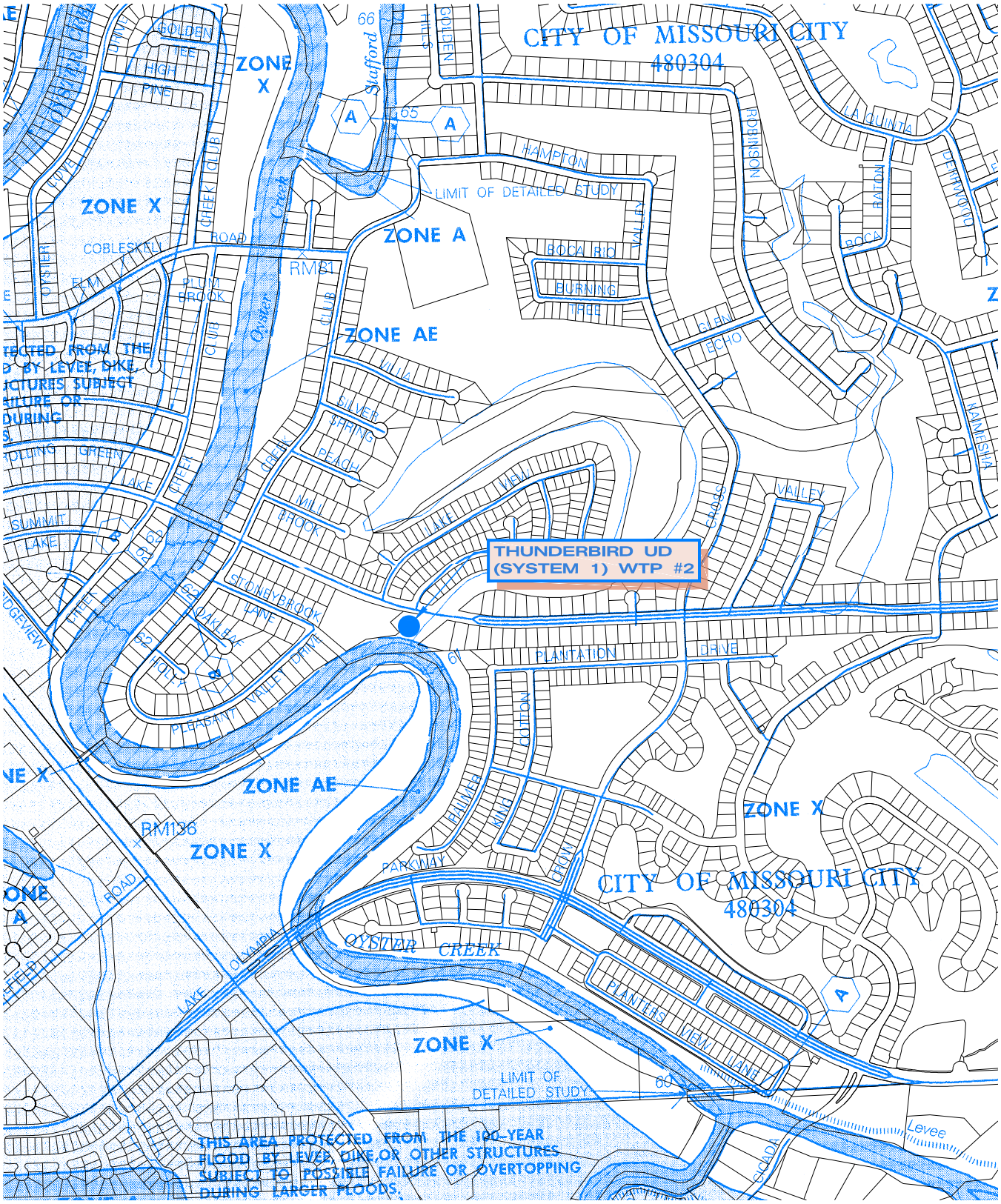
SCALE IN FEET

FLOOD MAP

HARRIS COUNTY WC & ID
FONDREN RD. WTP #2
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/14/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

PROPOSED NEW ELEVATED STORAGE TANK LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

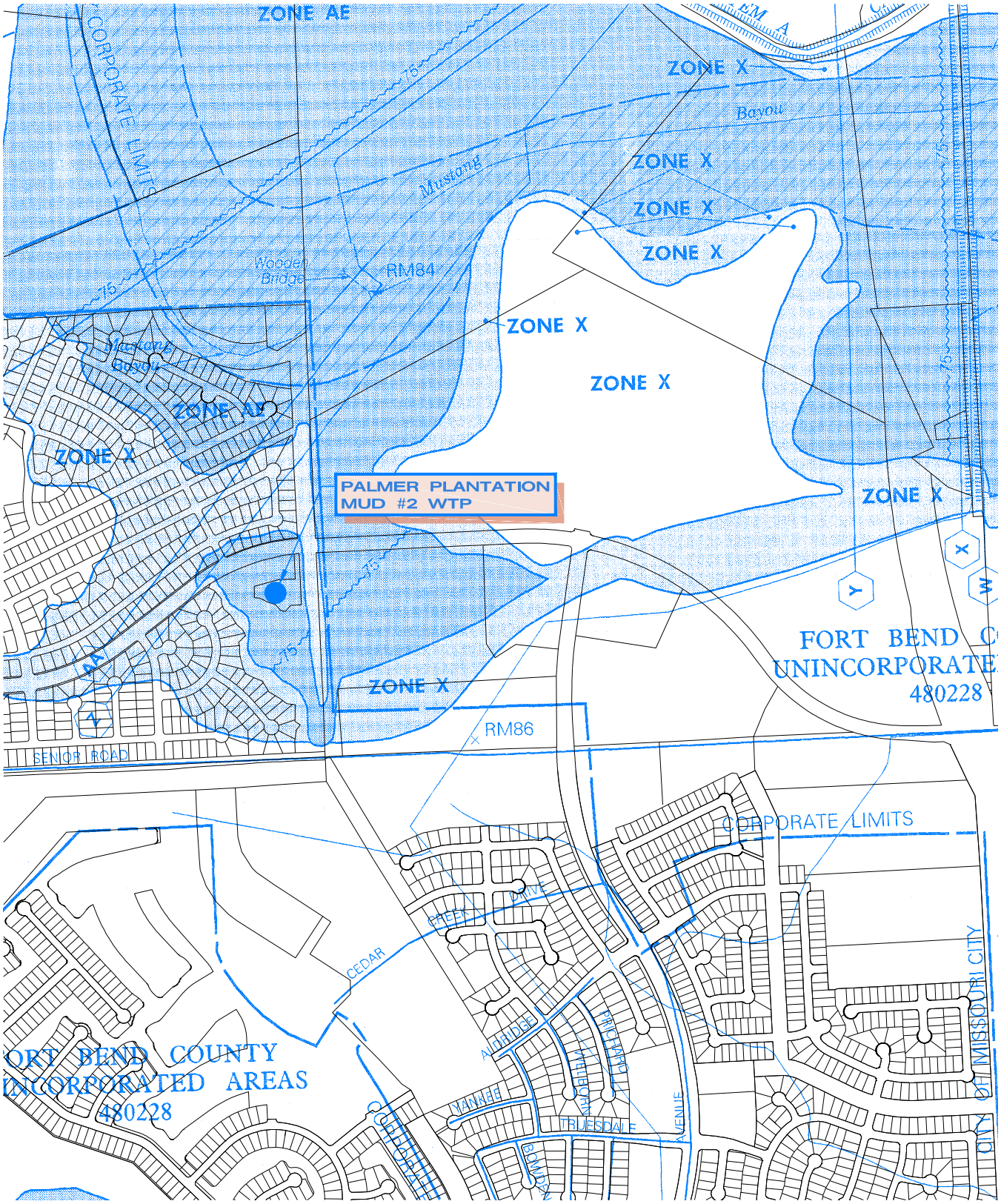
SCALE IN FEET

FLOOD MAP

THUNDERBIRD UD
(SYSTEM 1) WTP #2
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/14/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



LEGEND

PROPOSED NEW ELEVATED STORAGE TAN□ LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

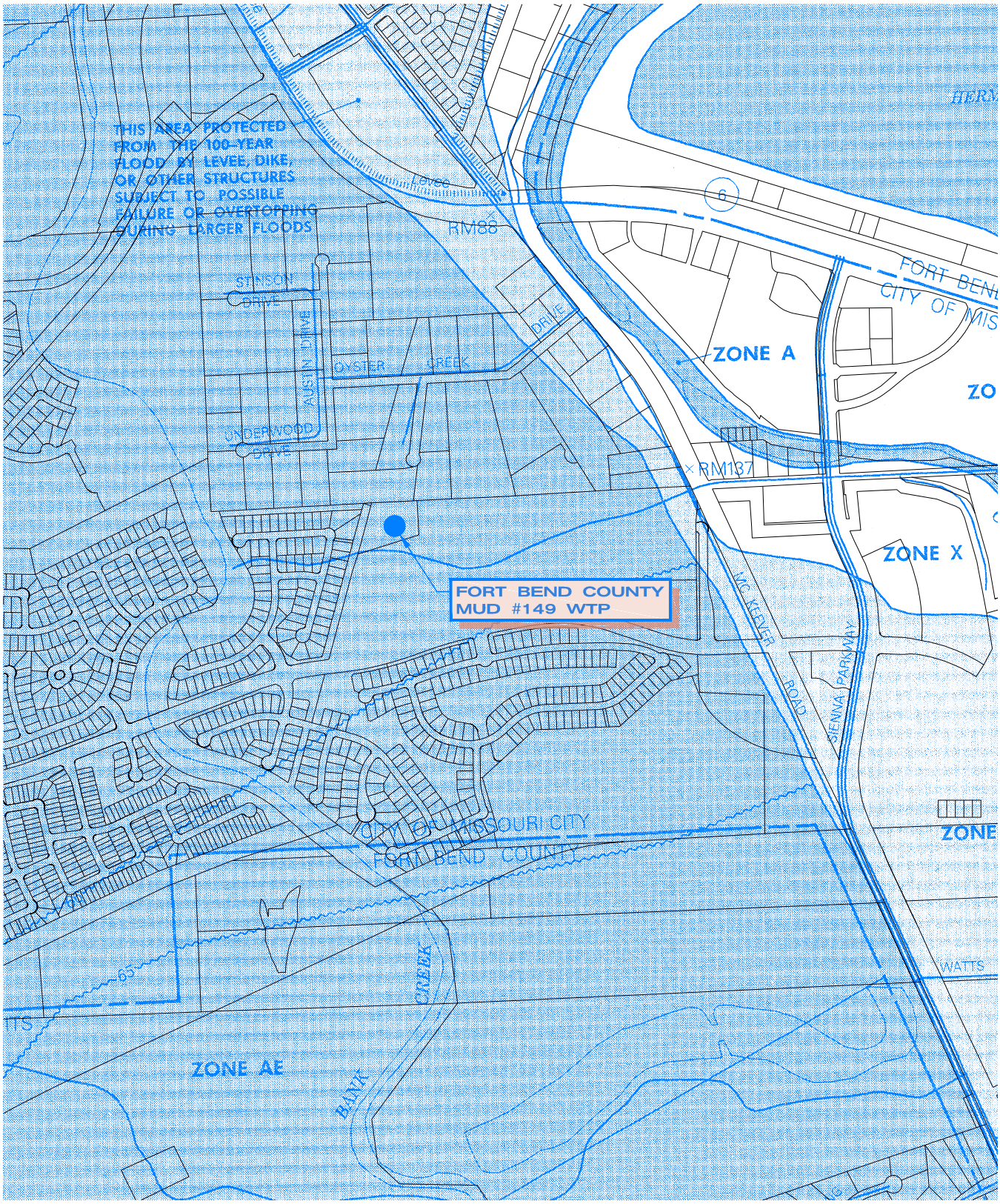
SCALE IN FEET

FLOOD MAP

PALMER PLANTATION
WTP #2
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/14/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



LEGEND

● PROPOSED NEW ELEVATED STORAGE TANK LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

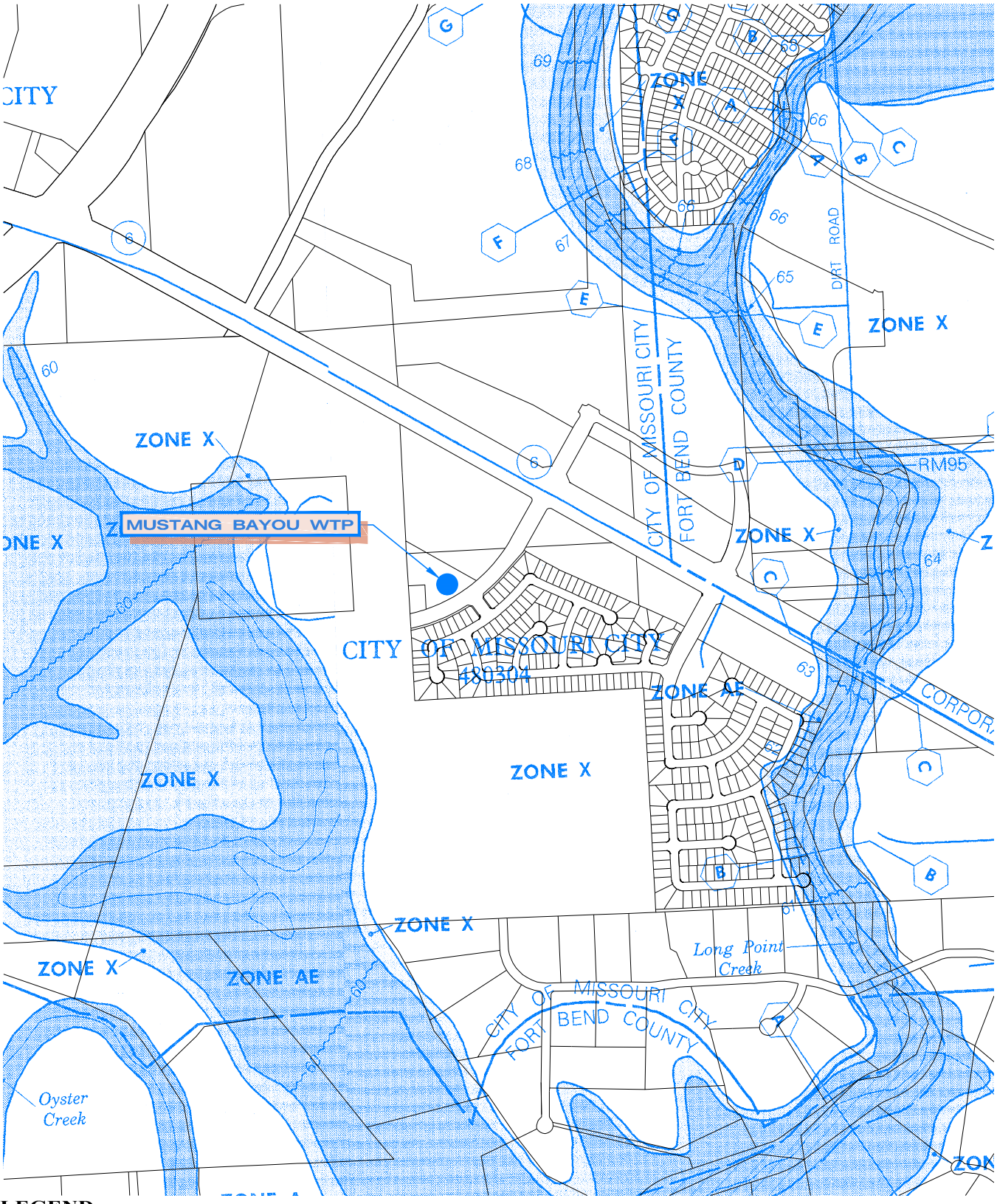
SCALE IN FEET

FLOOD MAP

FORT BEND COUNTY
MUD #149 WTP
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/14/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



LEGEND

PROPOSED NEW ELEVATED STORAGE TANK LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

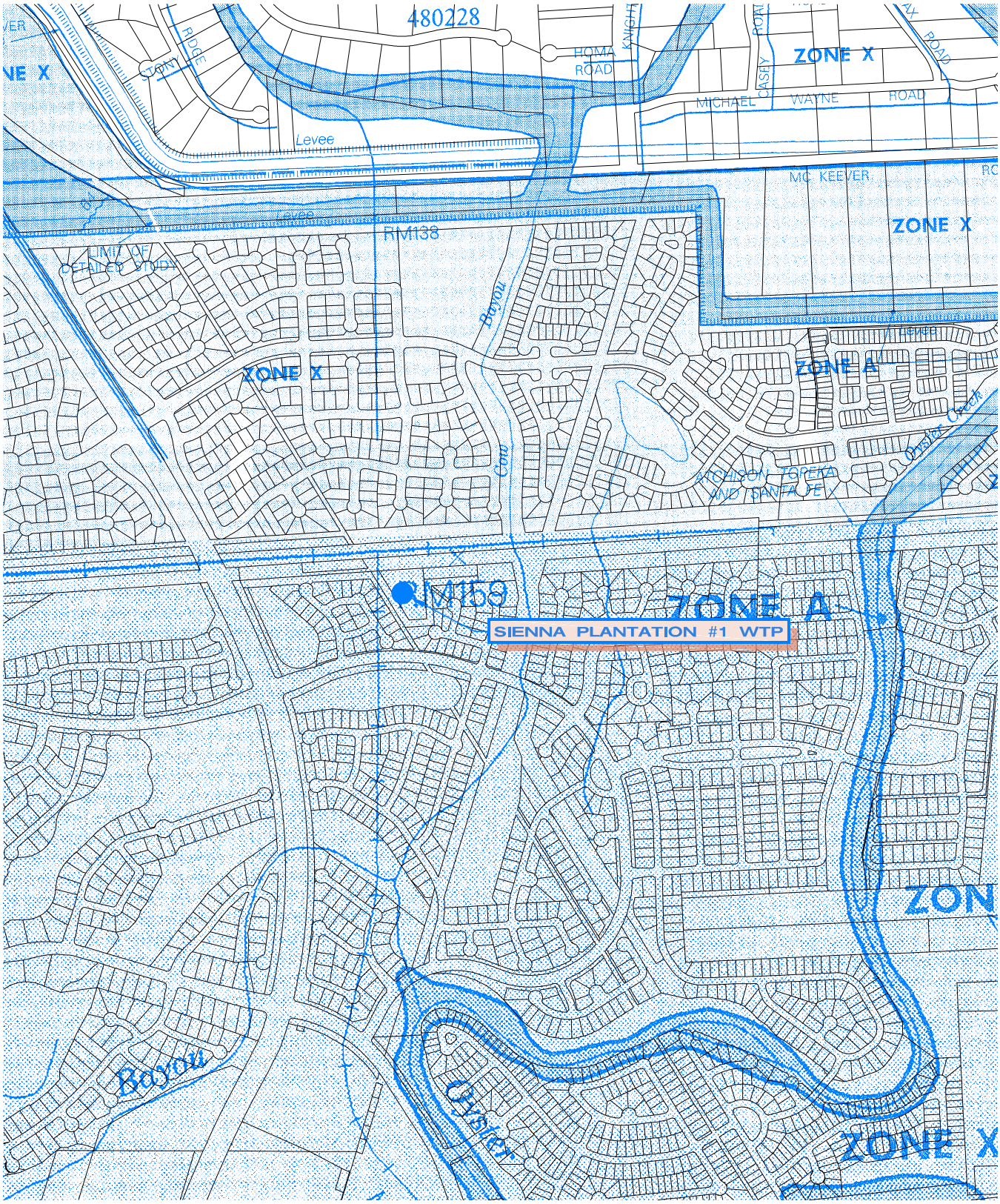
SCALE IN FEET

FLOOD MAP

MUSTANG BAYOU WTP
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/14/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



LEGEND

PROPOSED NEW ELEVATED STORAGE TANK LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

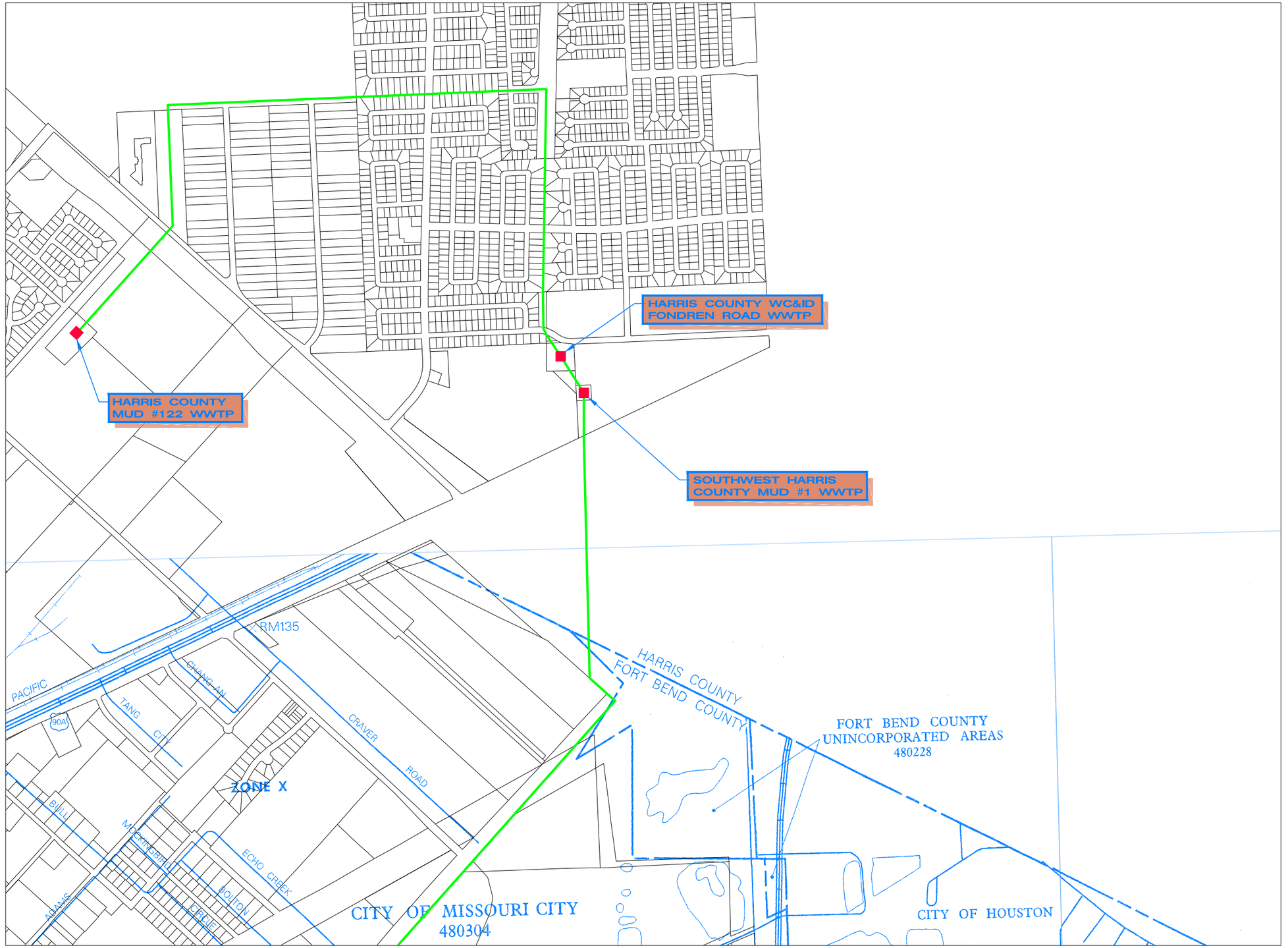
SCALE IN FEET

FLOOD MAP

SIENNA PLANTATION #1 WTP
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/14/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



N

500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

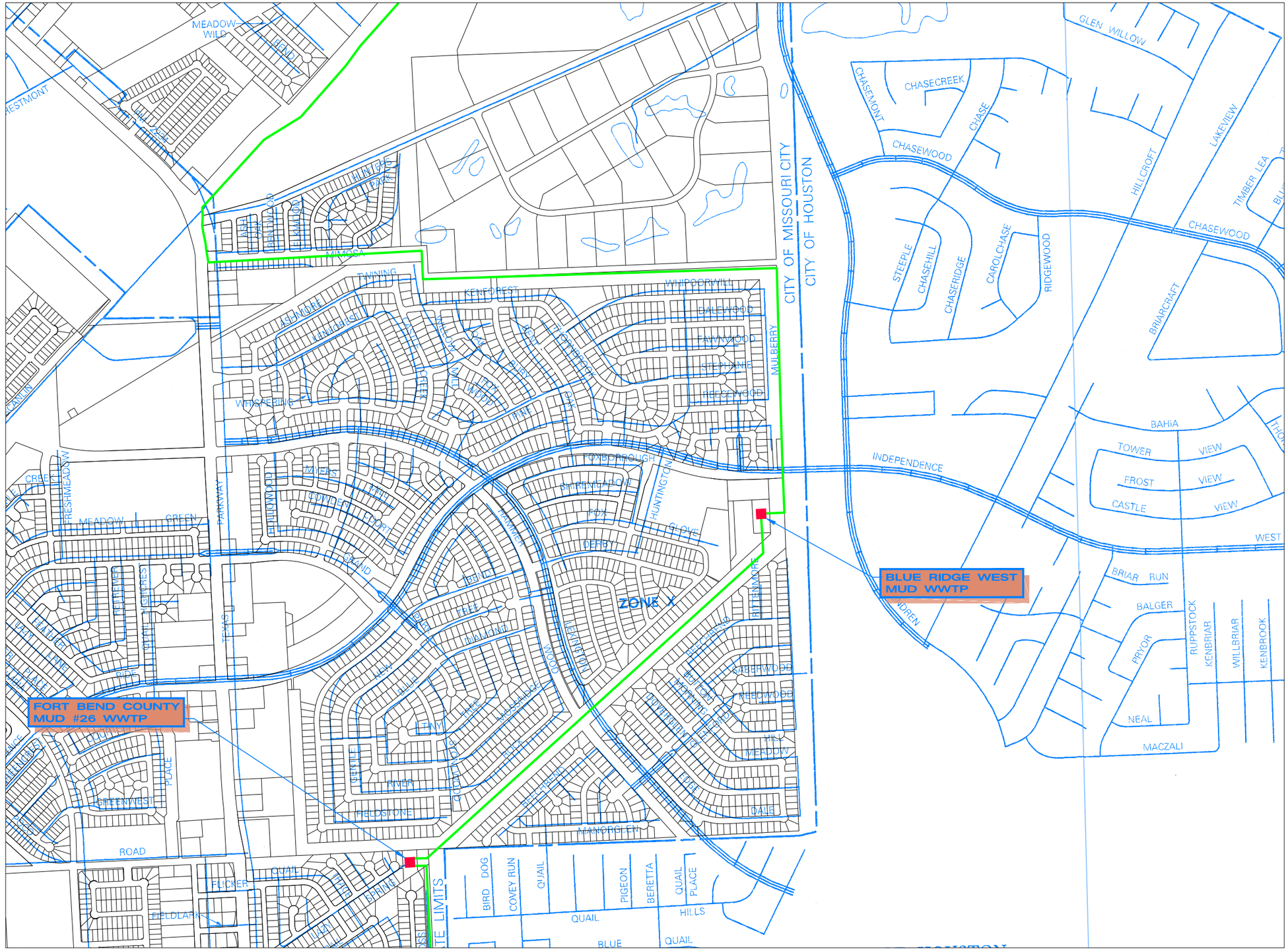
KEY MAP

FLOOD MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

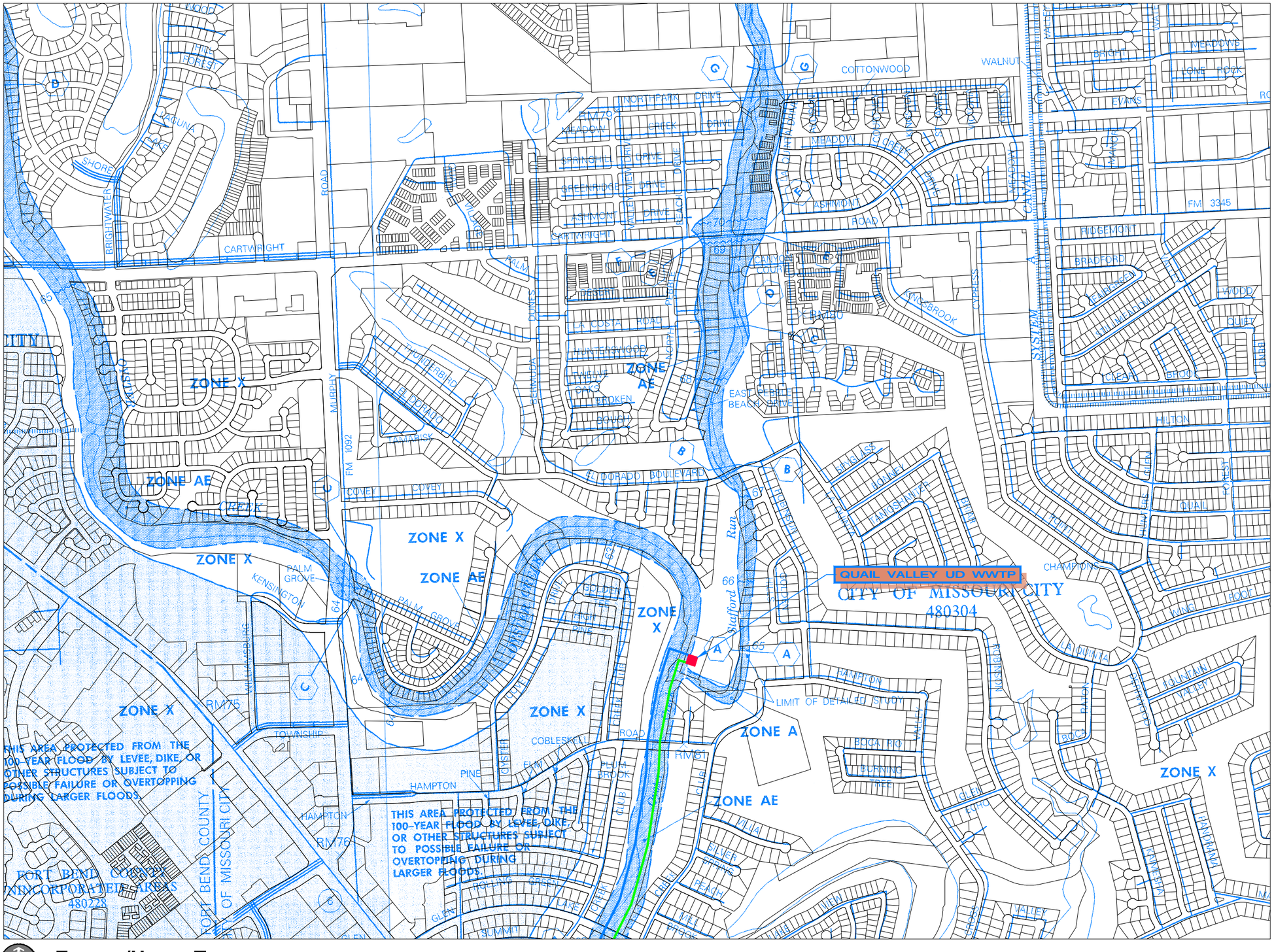
KEY MAP

FLOOD MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

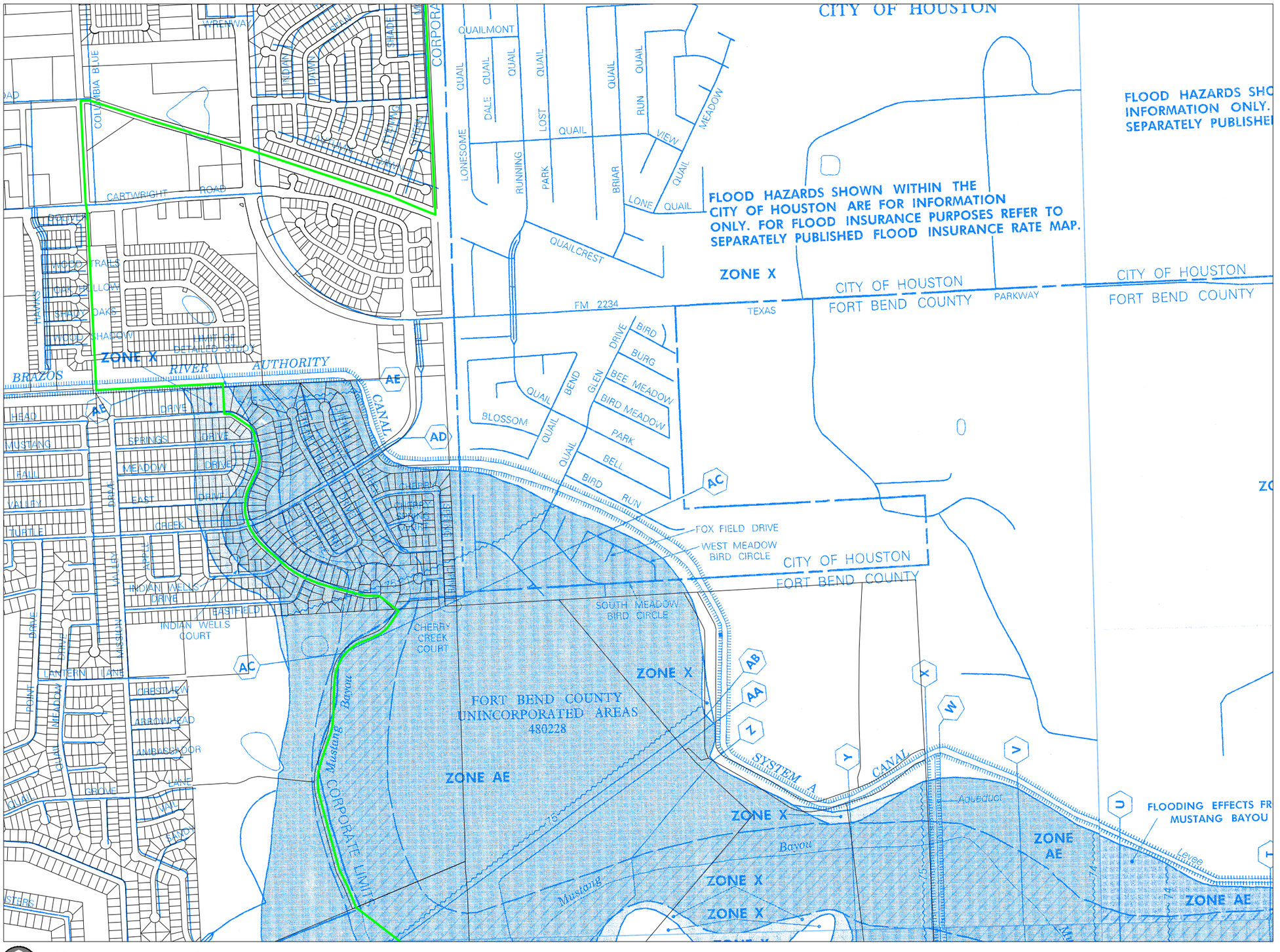
KEY MAP

FLOOD MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

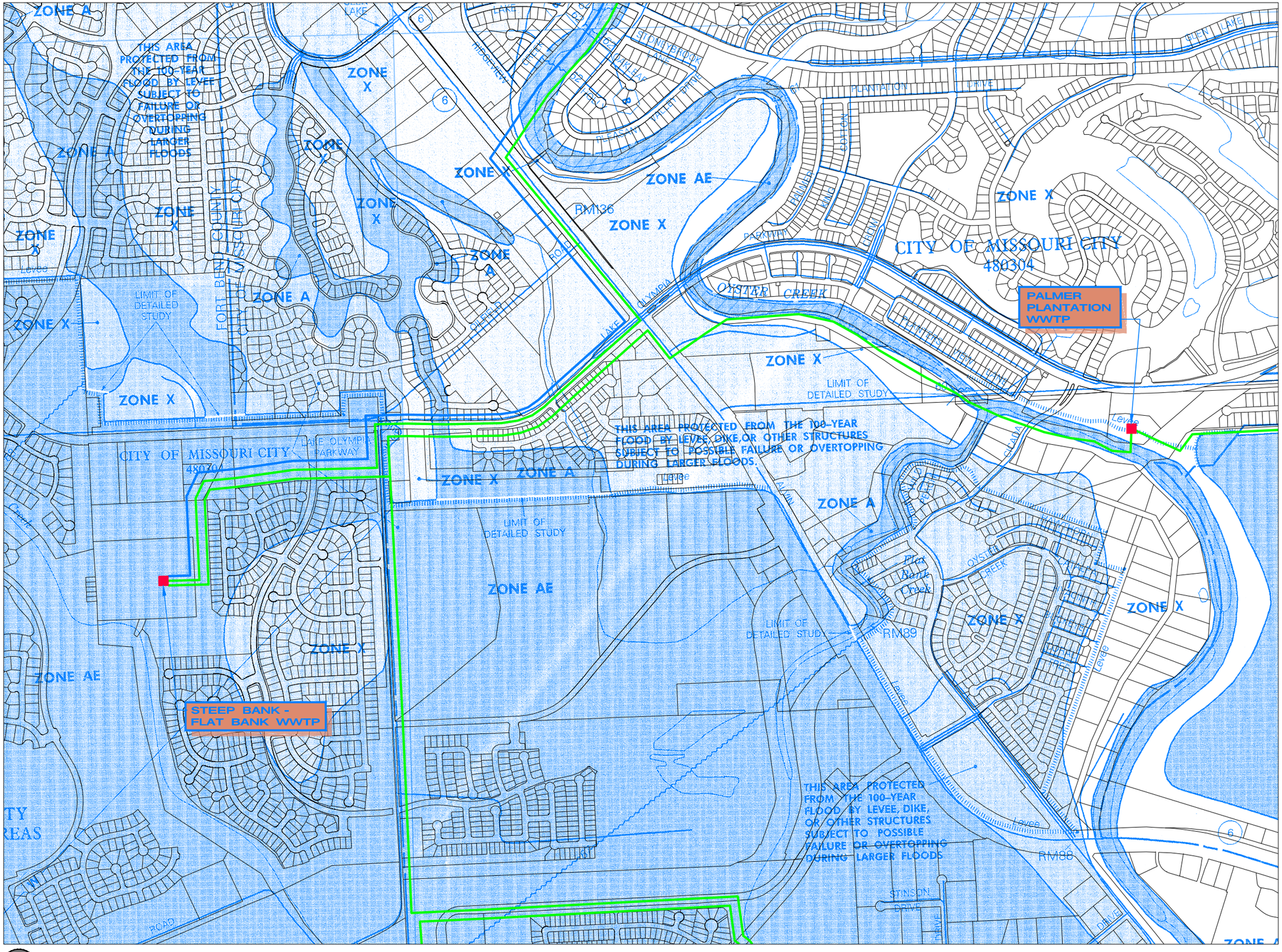
KEY MAP

FLOOD MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

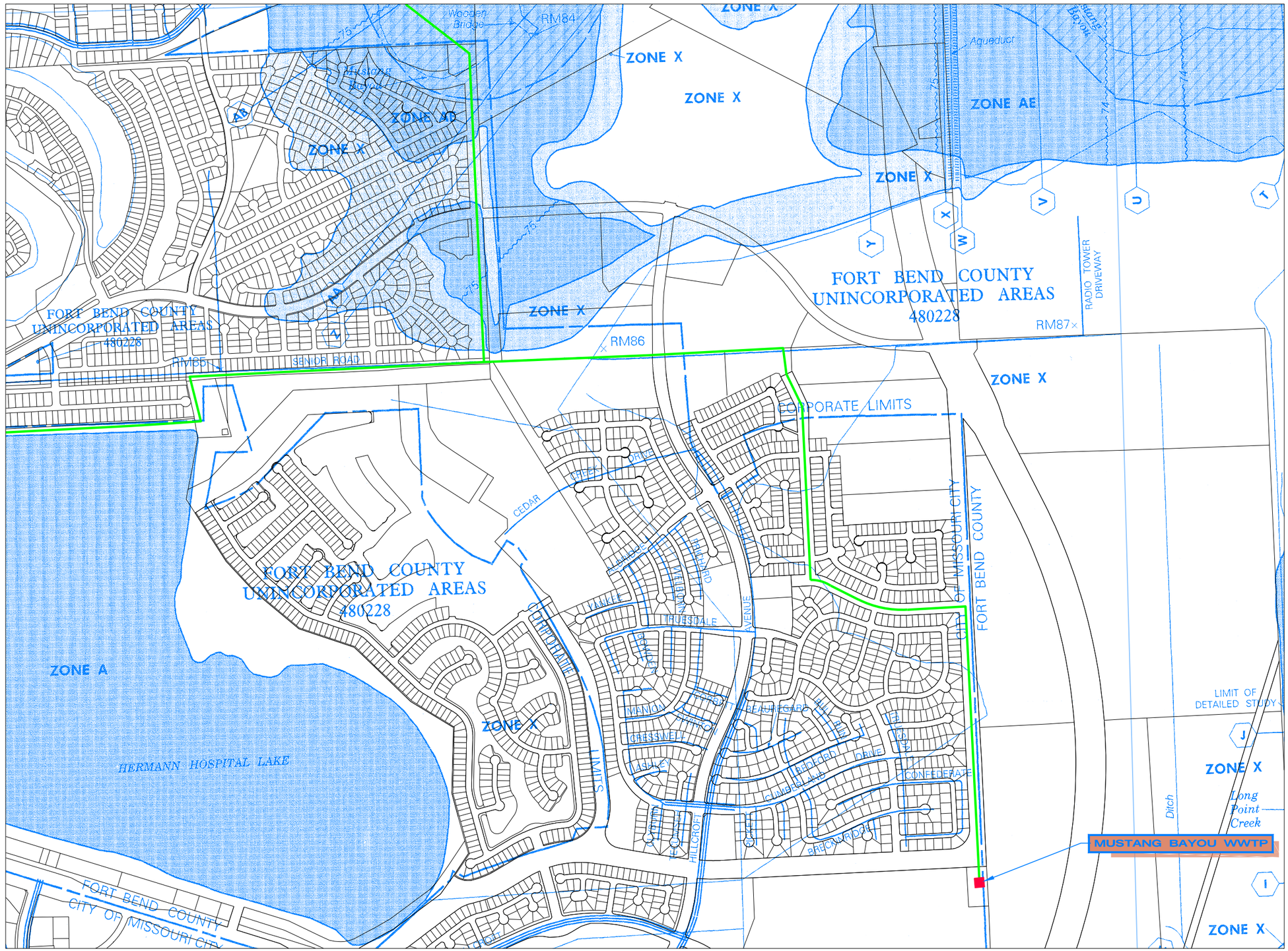
KEY MAP

FLOOD MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

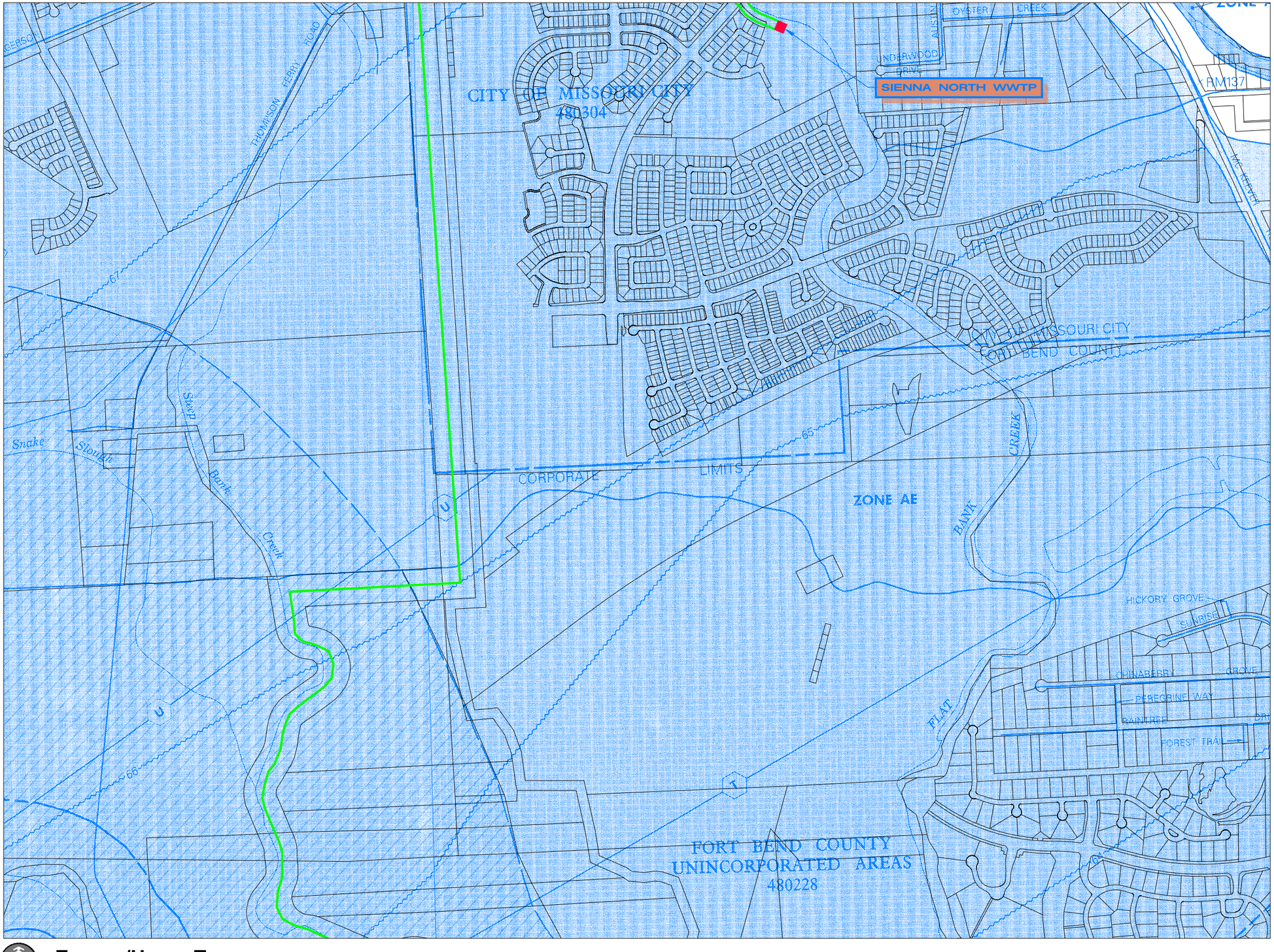
KEY MAP

FLOOD MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

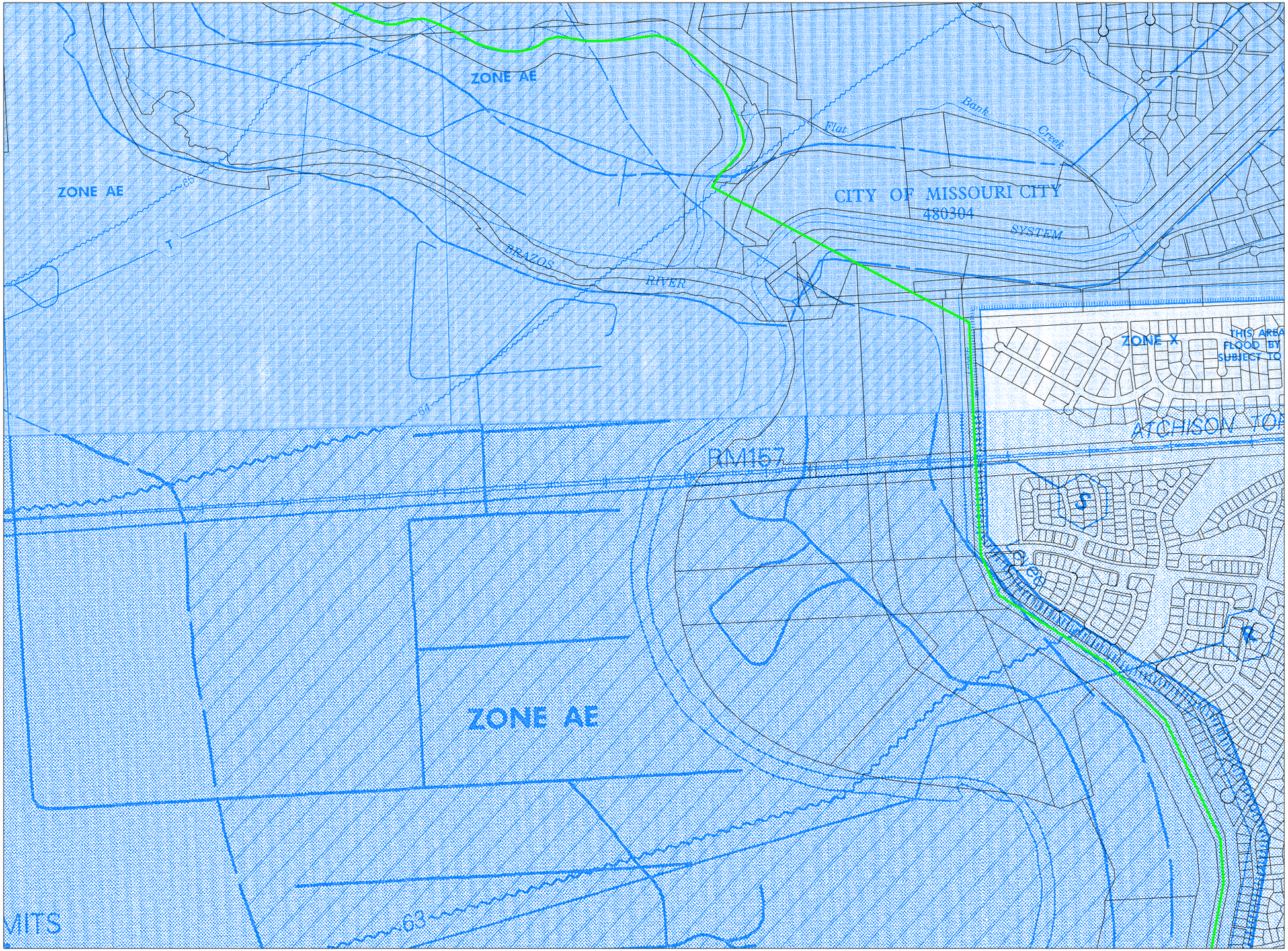
KEY MAP

FLOOD MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

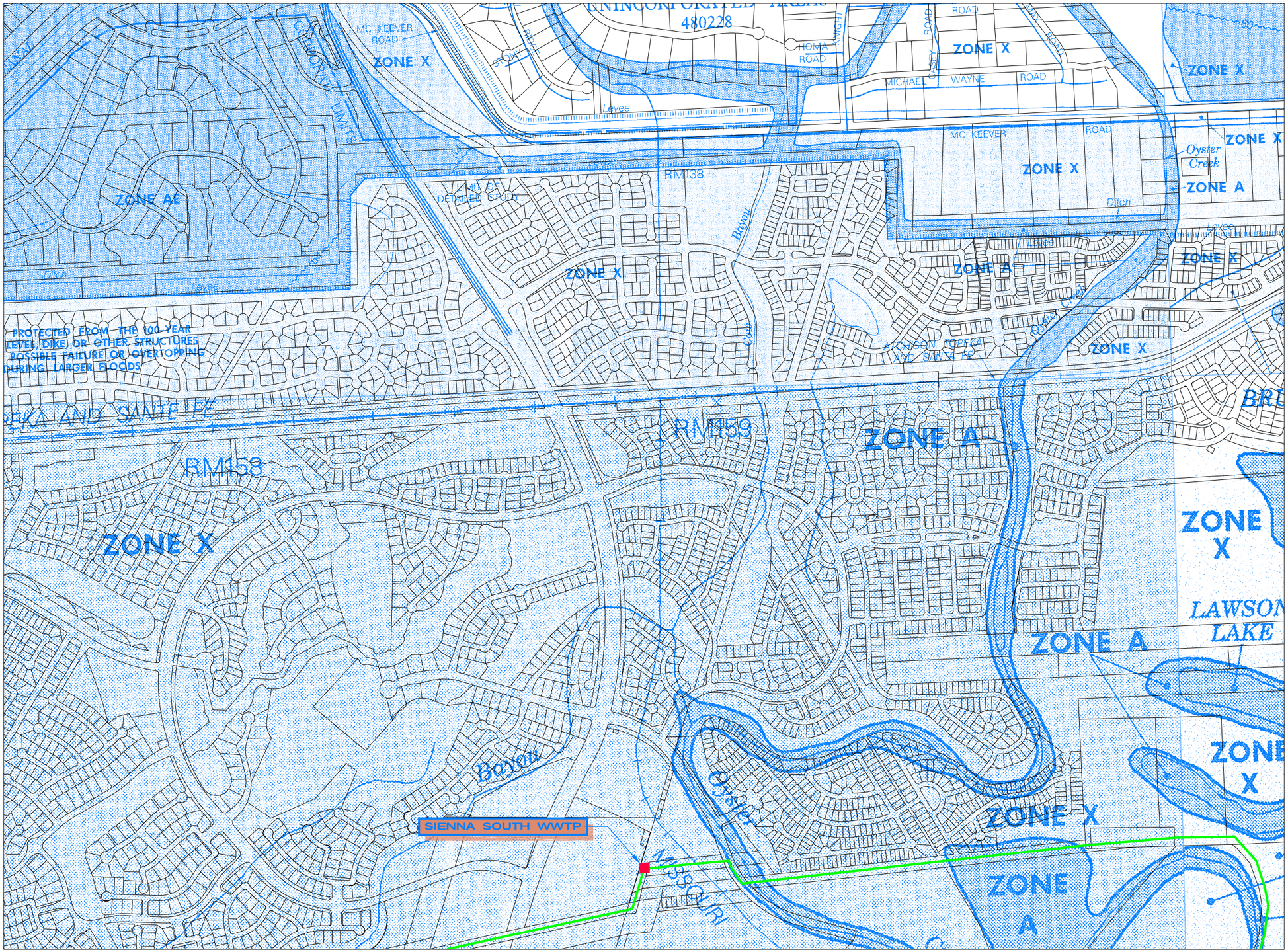
KEY MAP

FLOOD MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

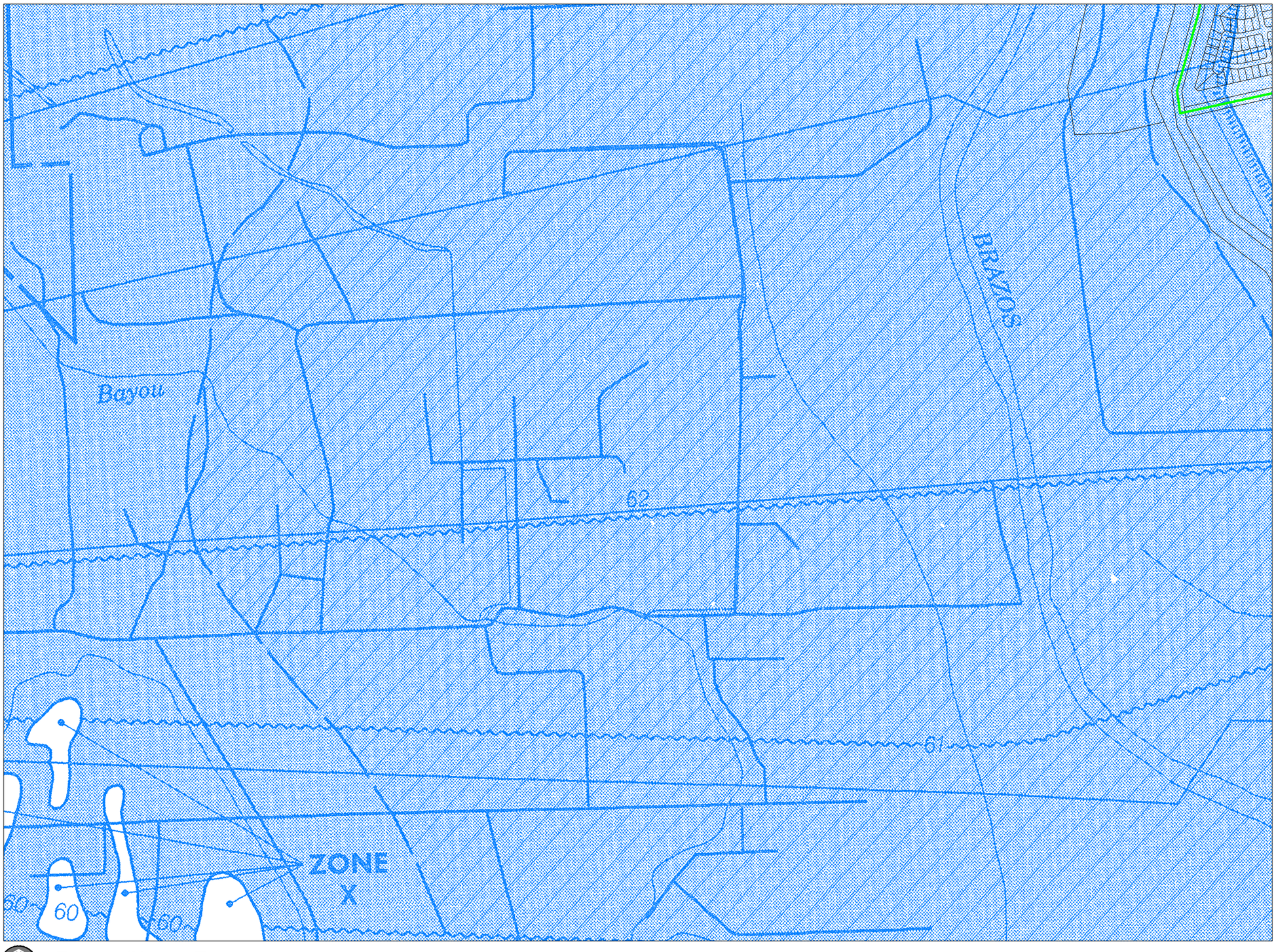
KEY MAP

FLOOD MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



N

500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

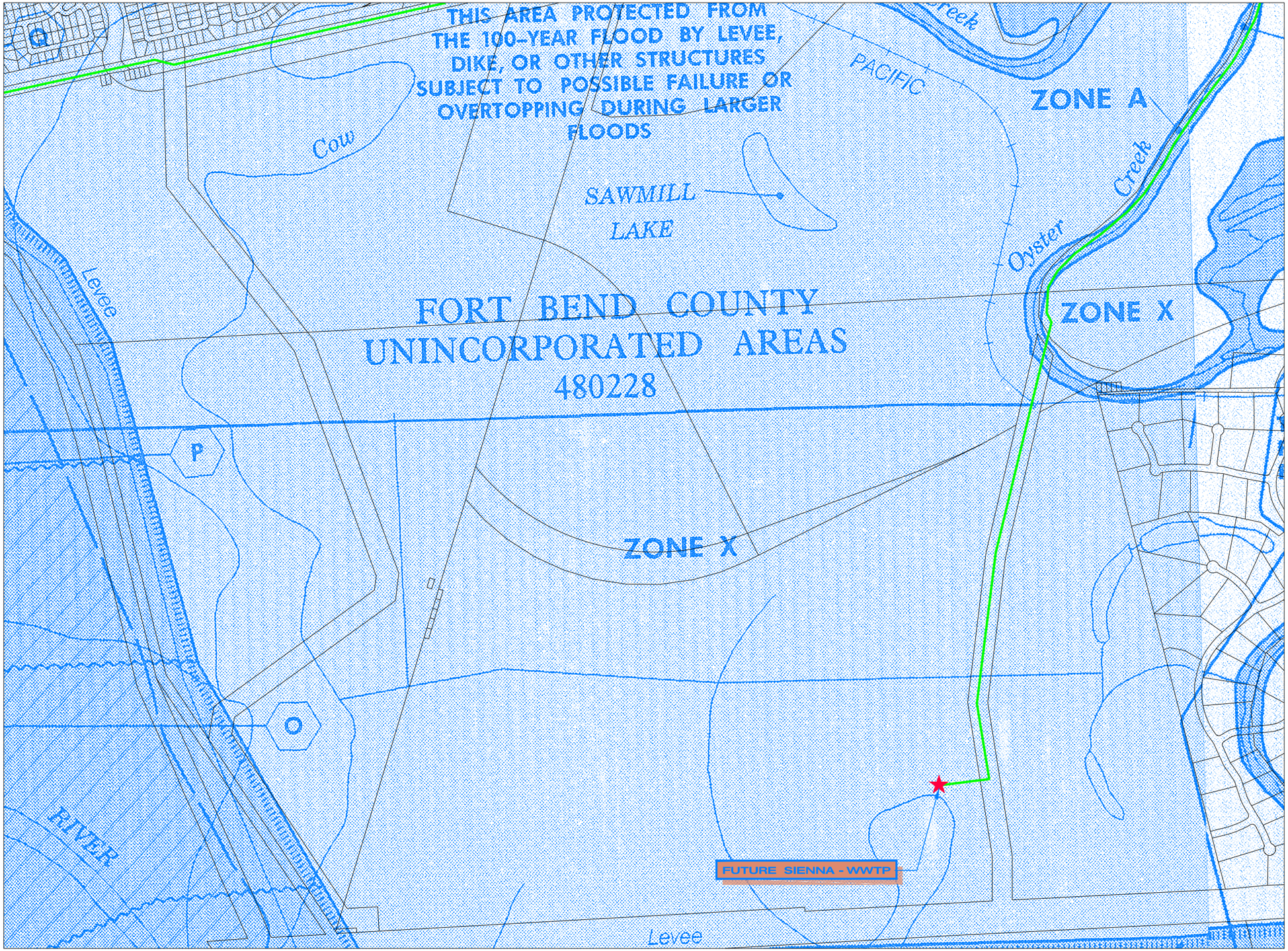
KEY MAP

FLOOD MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

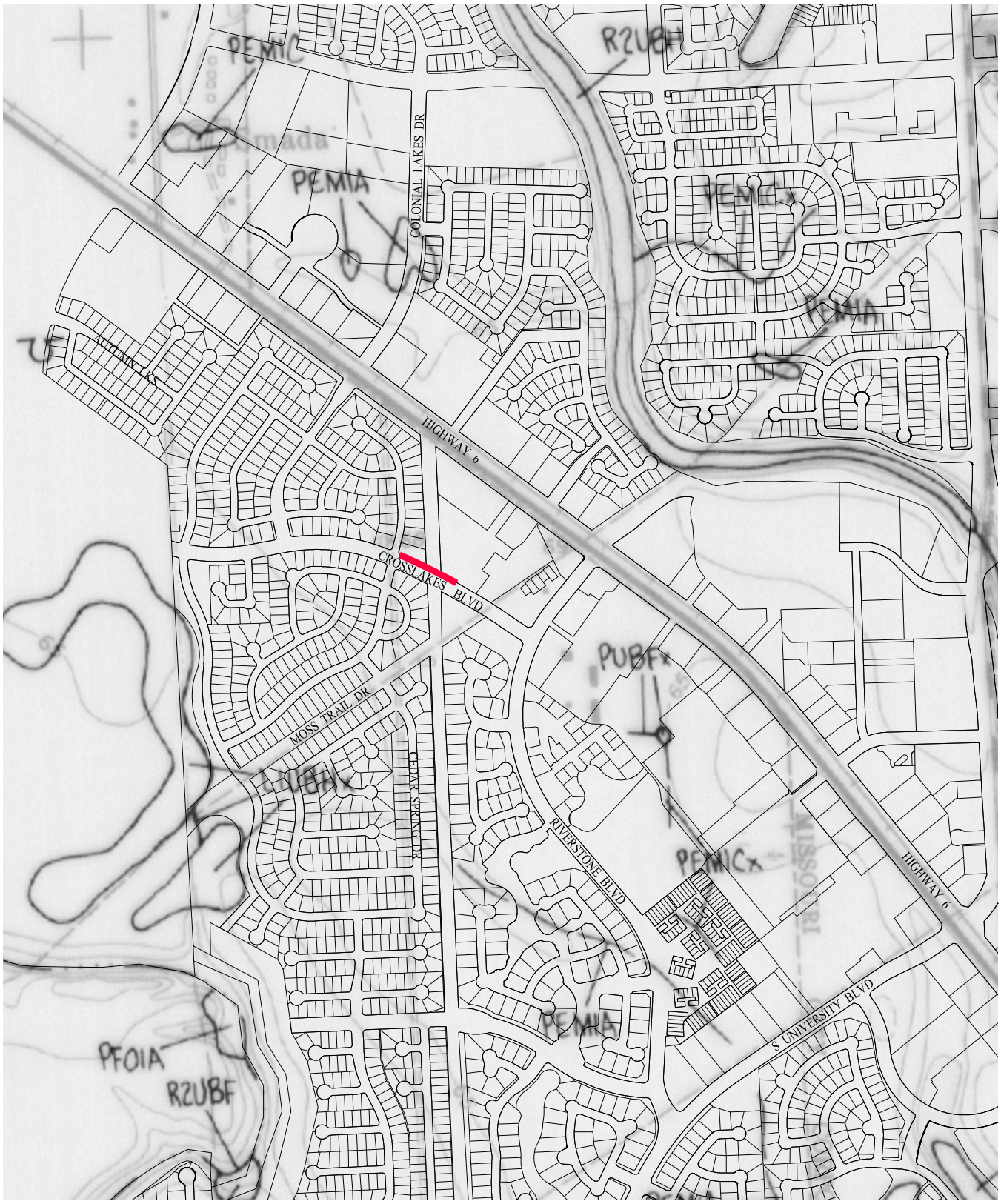
KEY MAP

FLOOD MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 01/27/2012

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

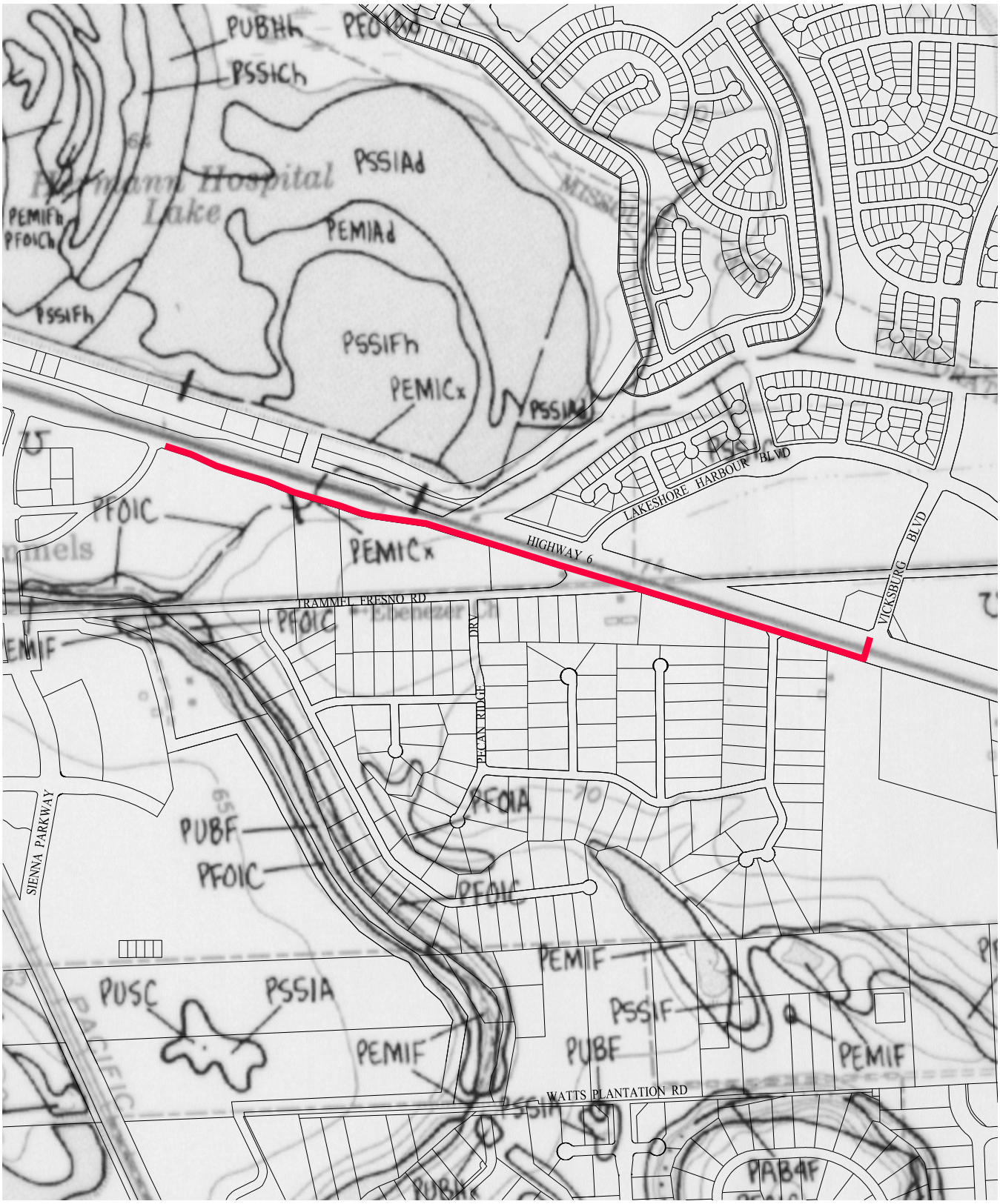
SCALE IN FEET

WETLANDS MAP
WATER OPTION 1

FIRST COLONY MUD #9 AND
FORT BEND COUNTY MUD #115
INTERCONNECT
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

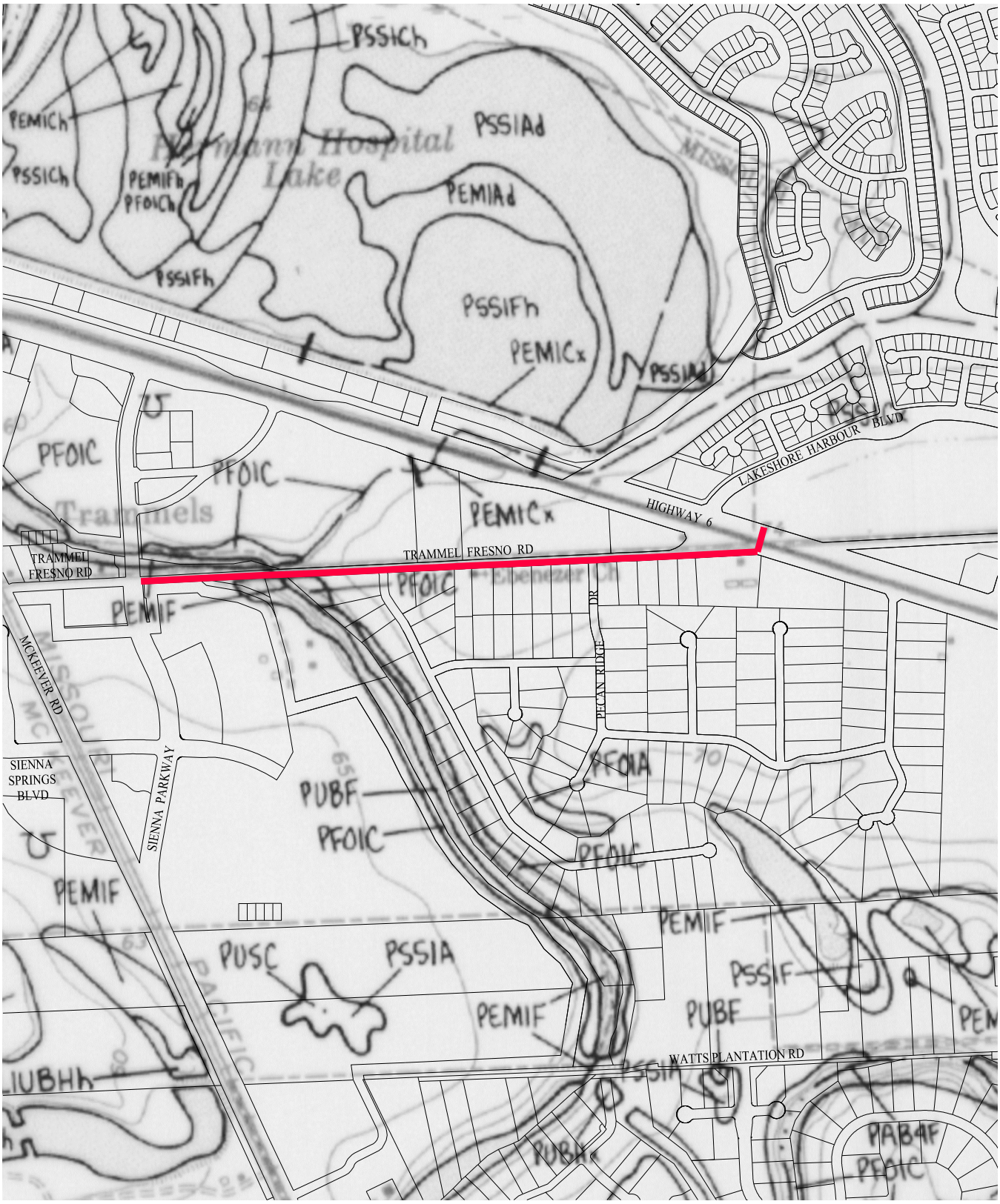
SCALE IN FEET

WETLANDS MAP
WATER OPTION 2

MUSTANG BAYOU AND SIENNA PLANTATION INTERCONNECT NO. 2
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

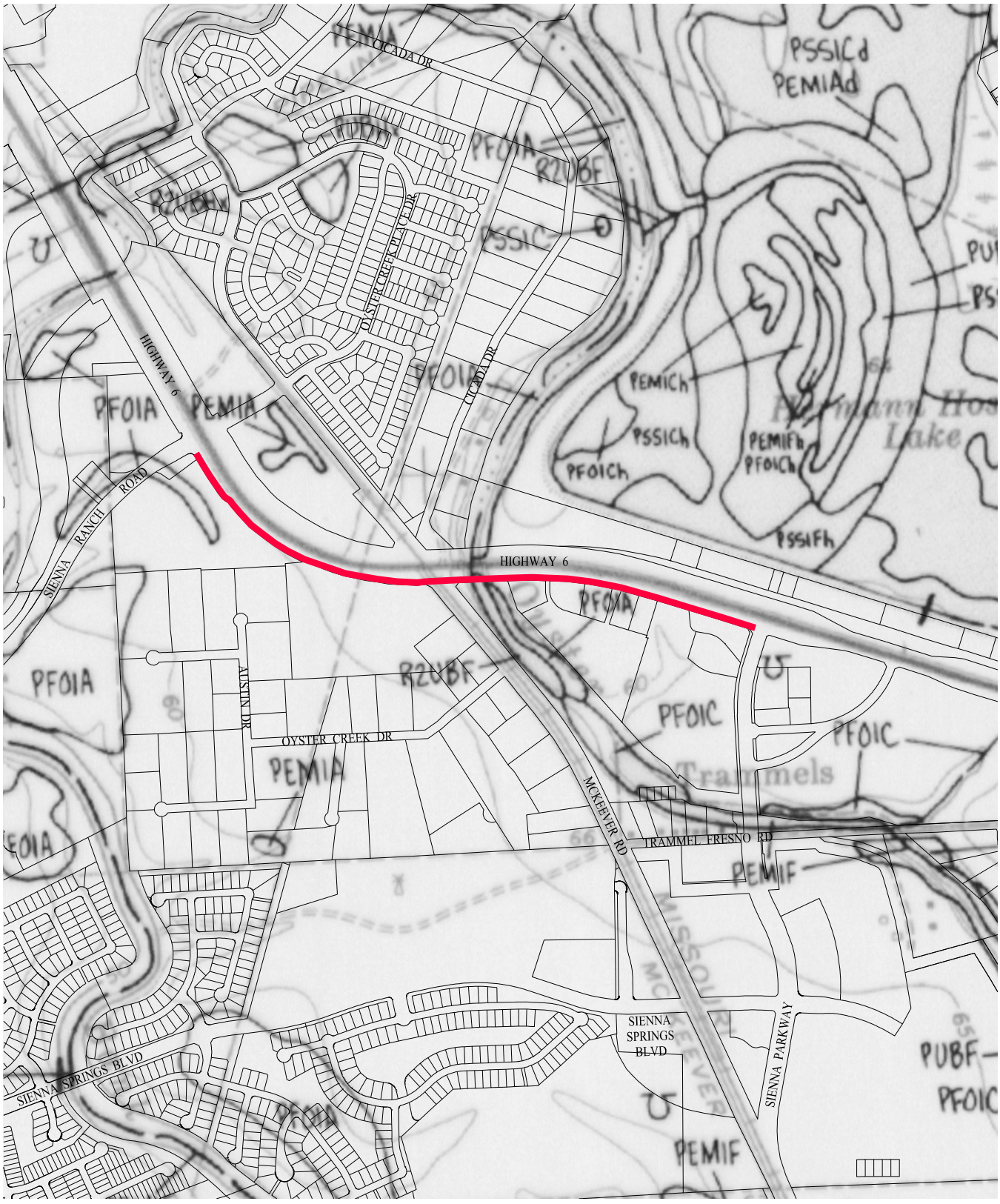
SCALE IN FEET

WETLANDS MAP
WATER OPTION 3

MUSTANG BAYOU AND SIENNA PLANTATION INTERCONNECT NO. 3
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

SCALE IN FEET

WETLANDS MAP
WATER OPTION 4

SIENNA PLANTATION
INTERNAL INTERCONNECT
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151

LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

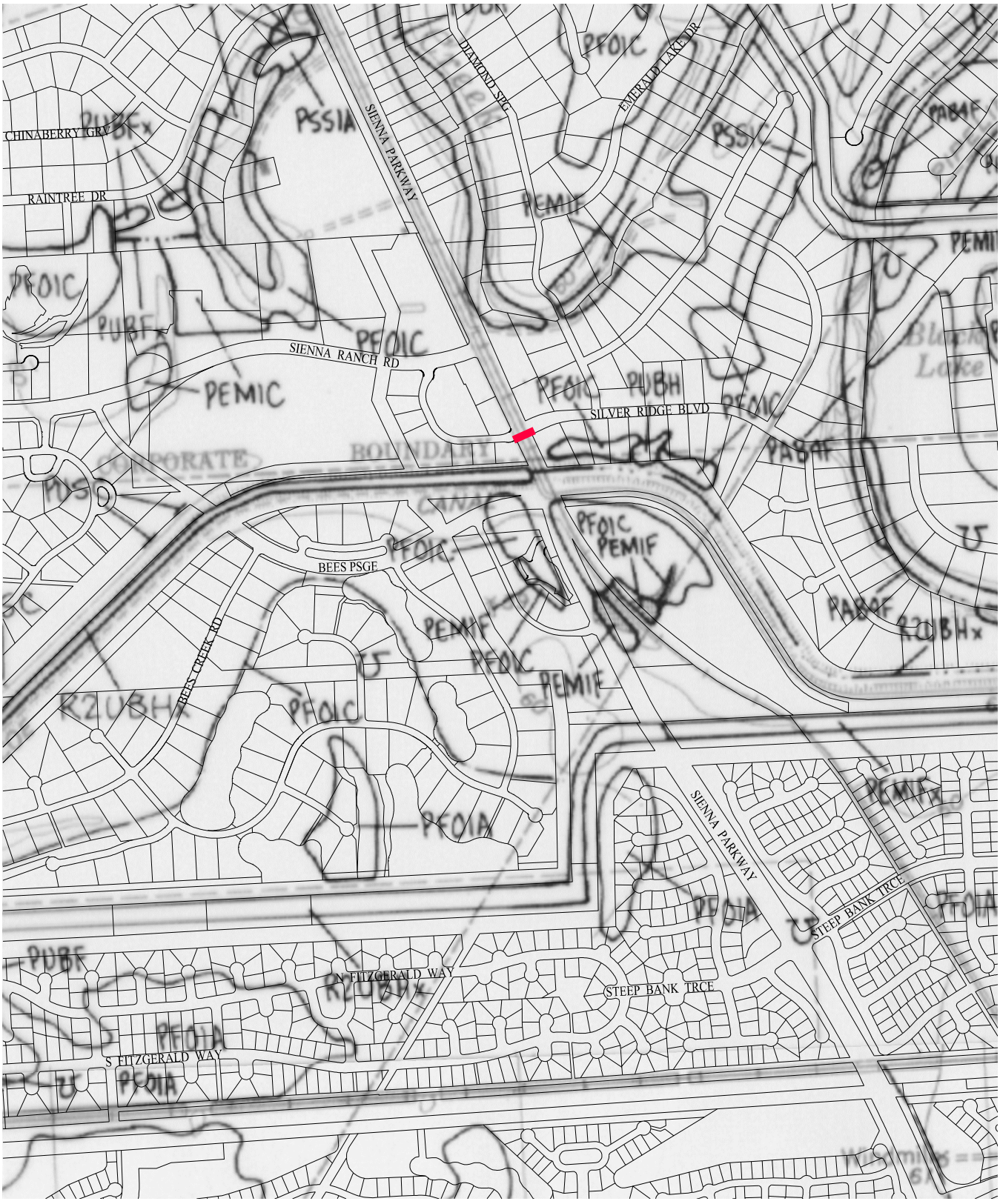
SCALE IN FEET

WETLANDS MAP
WATER OPTION 5

SIENNA PLANTATION AND PALMER PLANTATION INTERCONNECT NO. 1
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

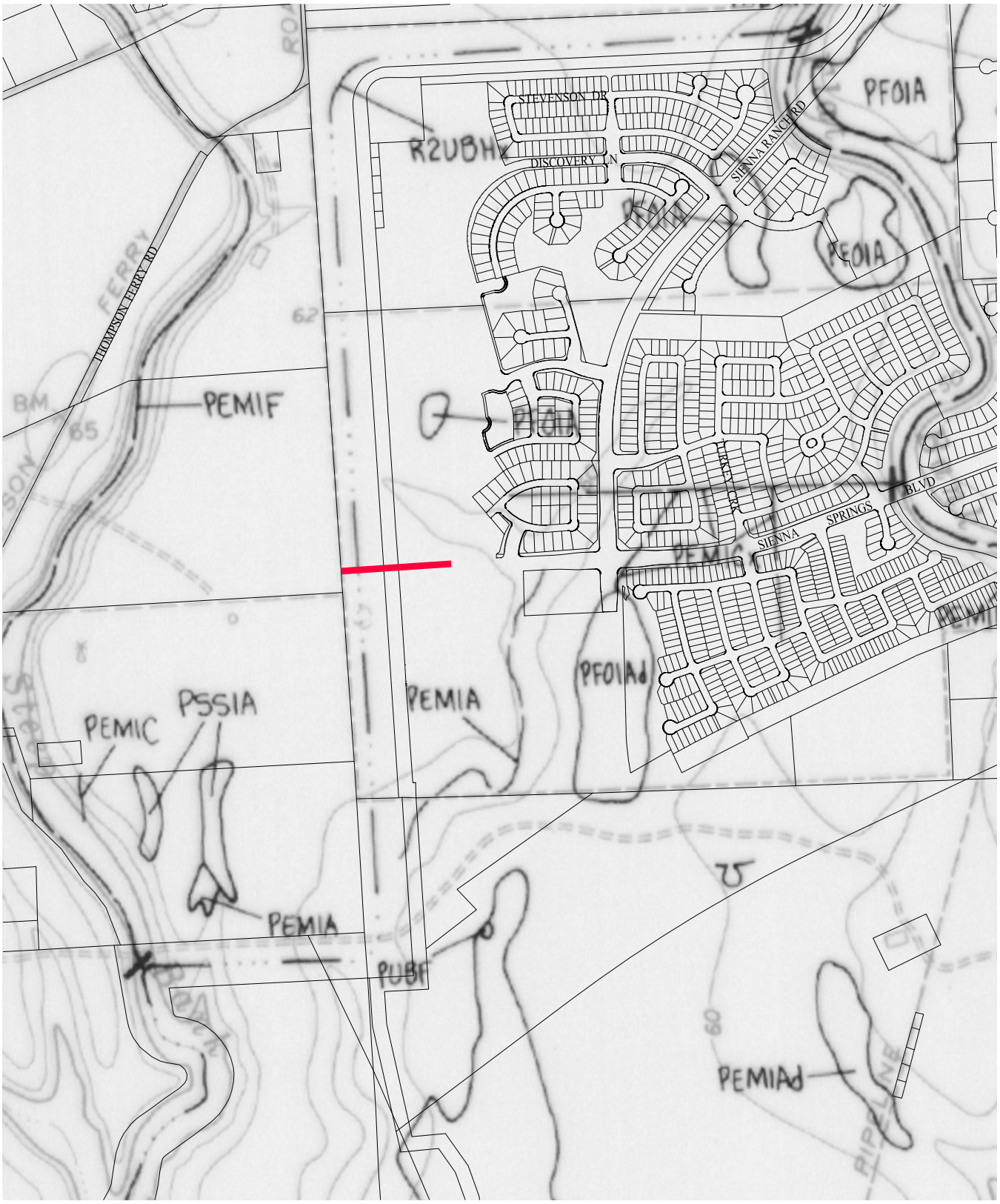
SCALE IN FEET

WETLANDS MAP
WATER OPTION 6

SILVER RIDGE DEVELOPMENT AND SIENNA PLANTATION INTERCONNECT NO. 1
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

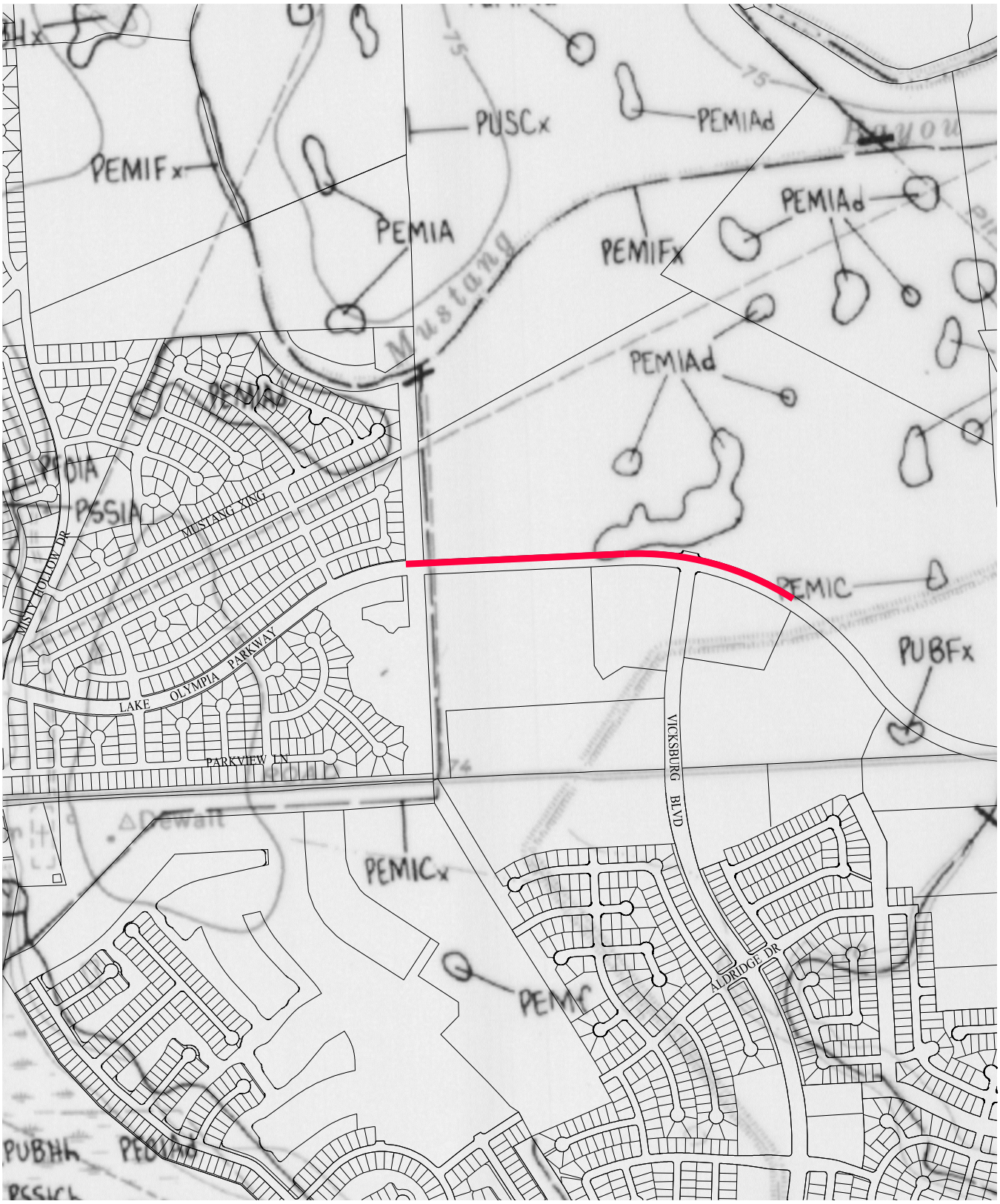
SCALE IN FEET

WETLANDS MAP
WATER OPTION 7

FORT BEND COUNTY MUD #149 AND SIENNA PLANTATION INTERCONNECT NO. 1 2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

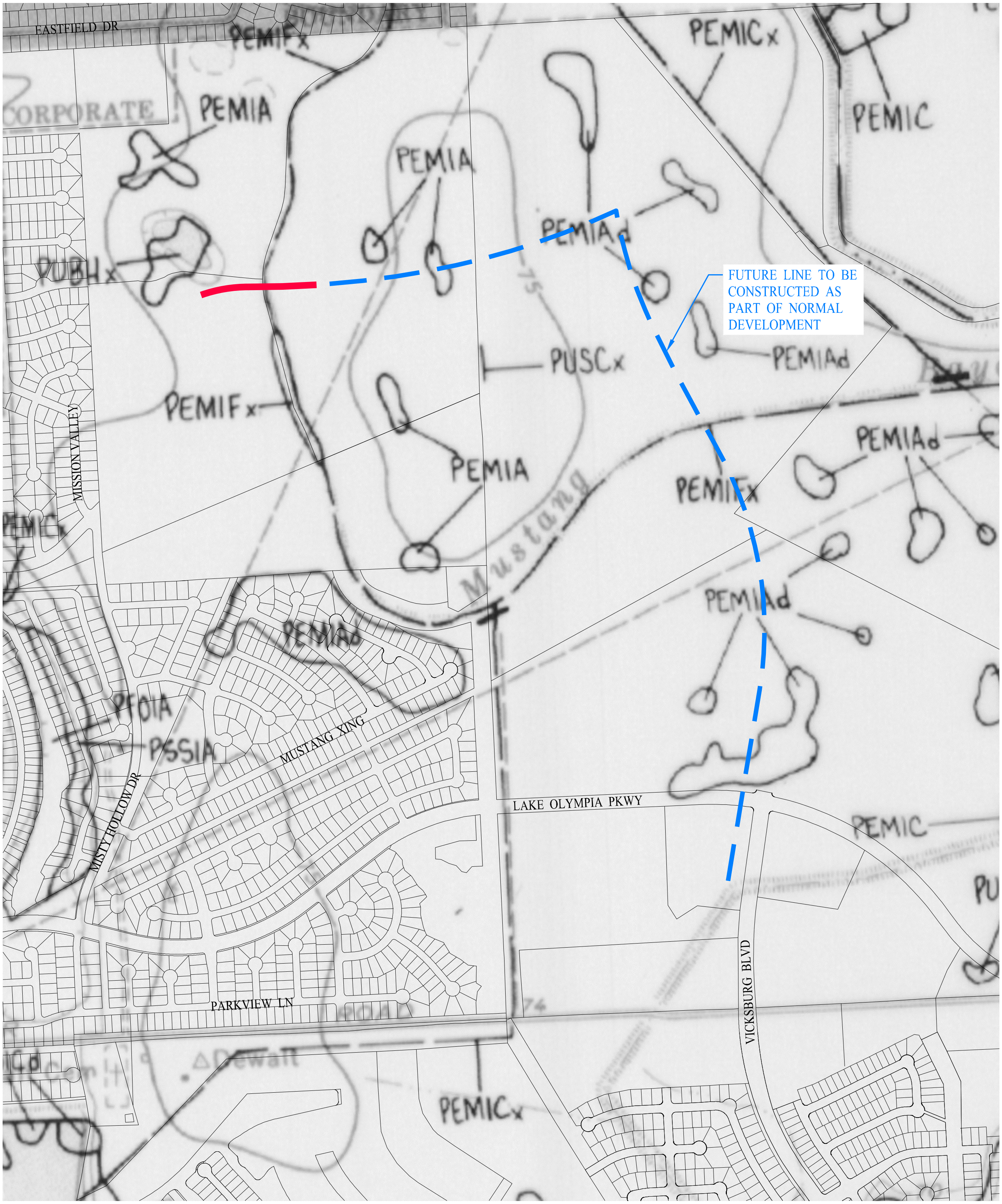
SCALE IN FEET

WETLANDS MAP
WATER OPTION 12

MUSTANG BAYOU AND PALMER PLANTATION INTERCONNECT 2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

PROPOSED WATER LINE

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

SCALE IN FEET

WETLANDS MAP
WATER OPTION 13

MUSTANG BAYOU AND QUAIL VALLEY INTERCONNECT
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 08/23/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151

LEGEND

PROPOSED NEW ELEVATED STORAGE TAN□ LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

SCALE IN FEET

WETLANDS MAP

HARRIS COUNTY WC & ID
FONDREN RD. WTP #2
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/14/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

LEGEND

PROPOSED NEW ELEVATED STORAGE TANK LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

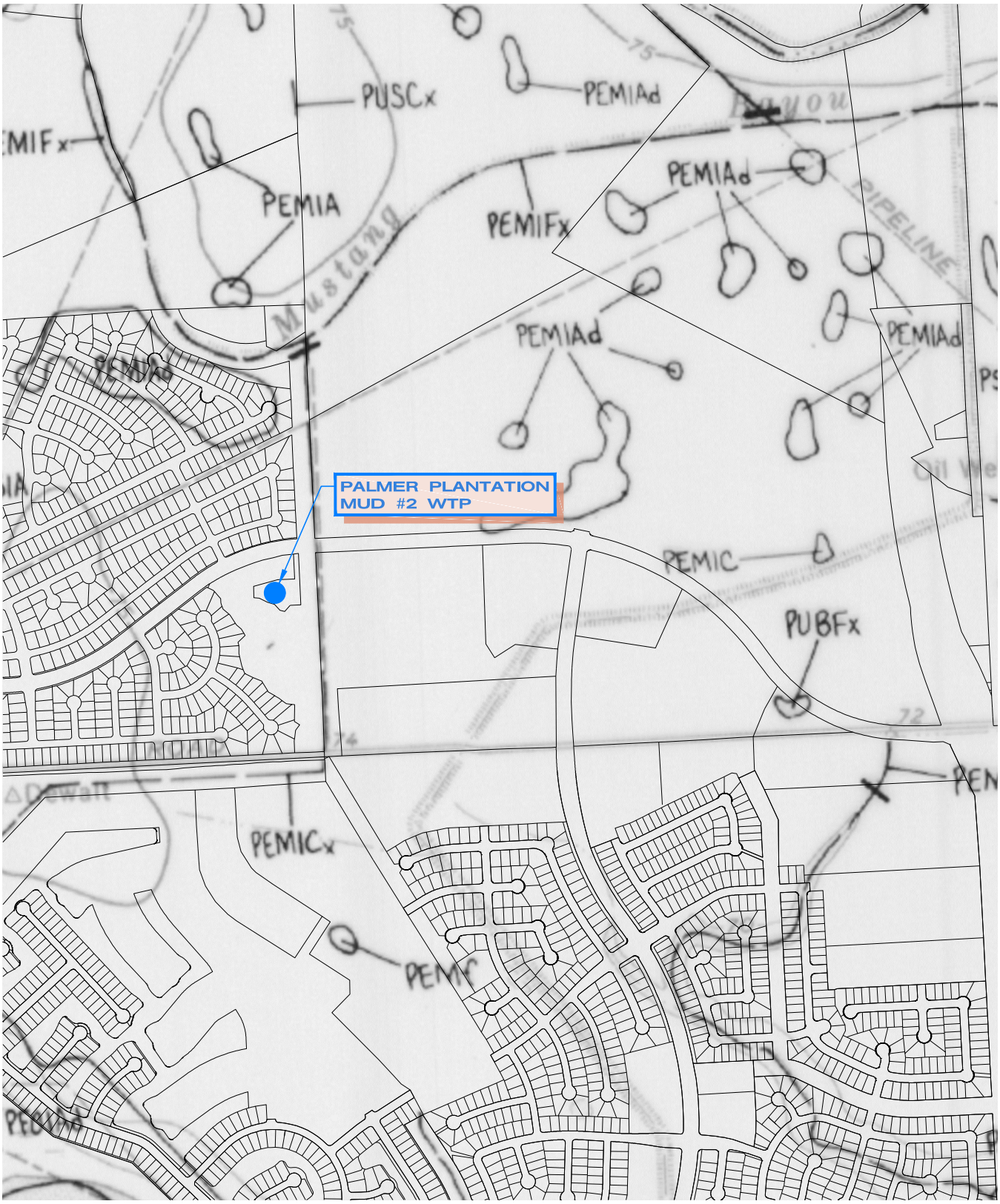
SCALE IN FEET

WETLANDS MAP

THUNDERBIRD UD
(SYSTEM 1) WTP #2
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/14/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

PROPOSED NEW ELEVATED STORAGE TANK LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

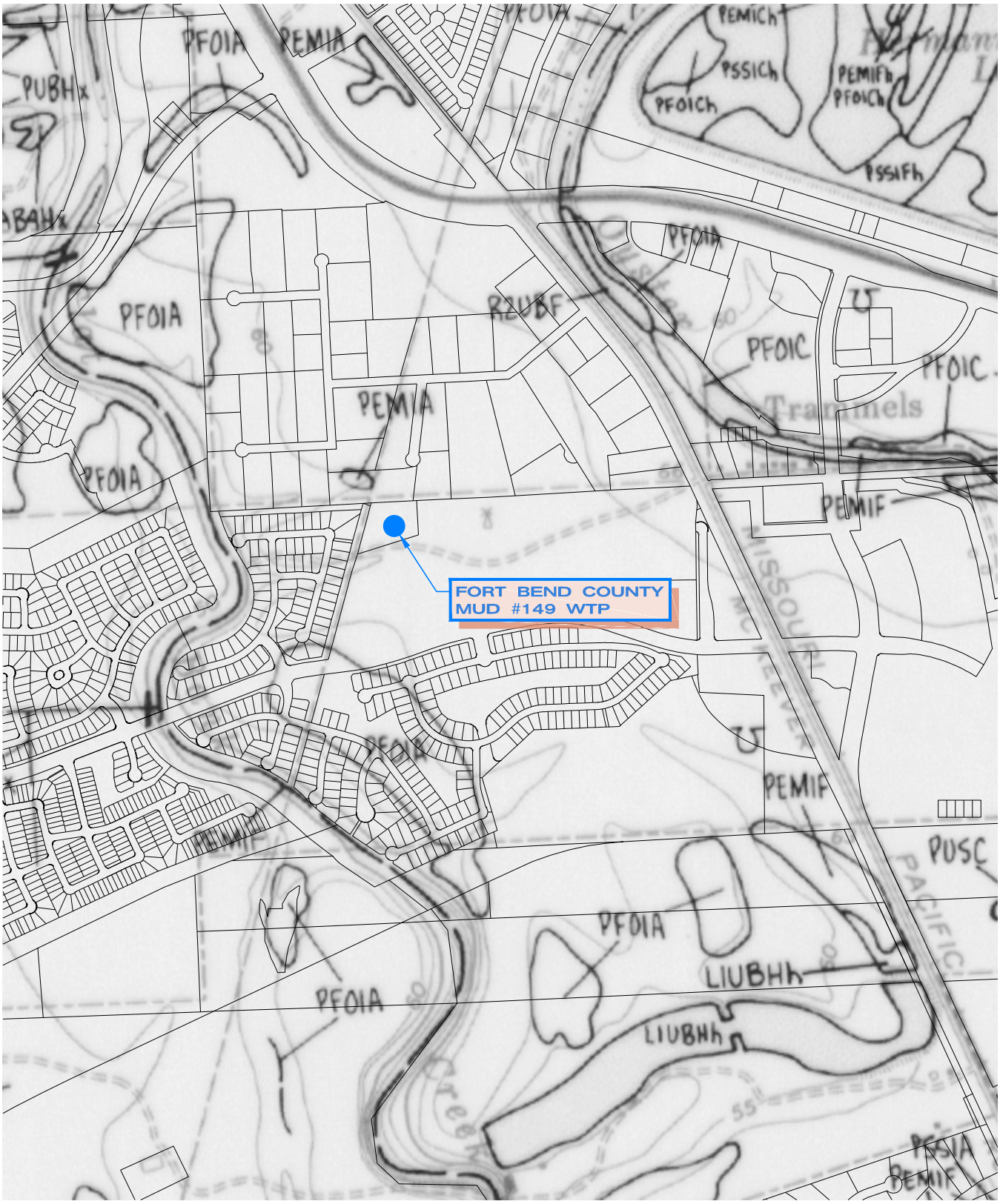
SCALE IN FEET

WETLANDS MAP

PALMER PLANTATION
WTP #2
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/14/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

PROPOSED NEW ELEVATED STORAGE TAN□ LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

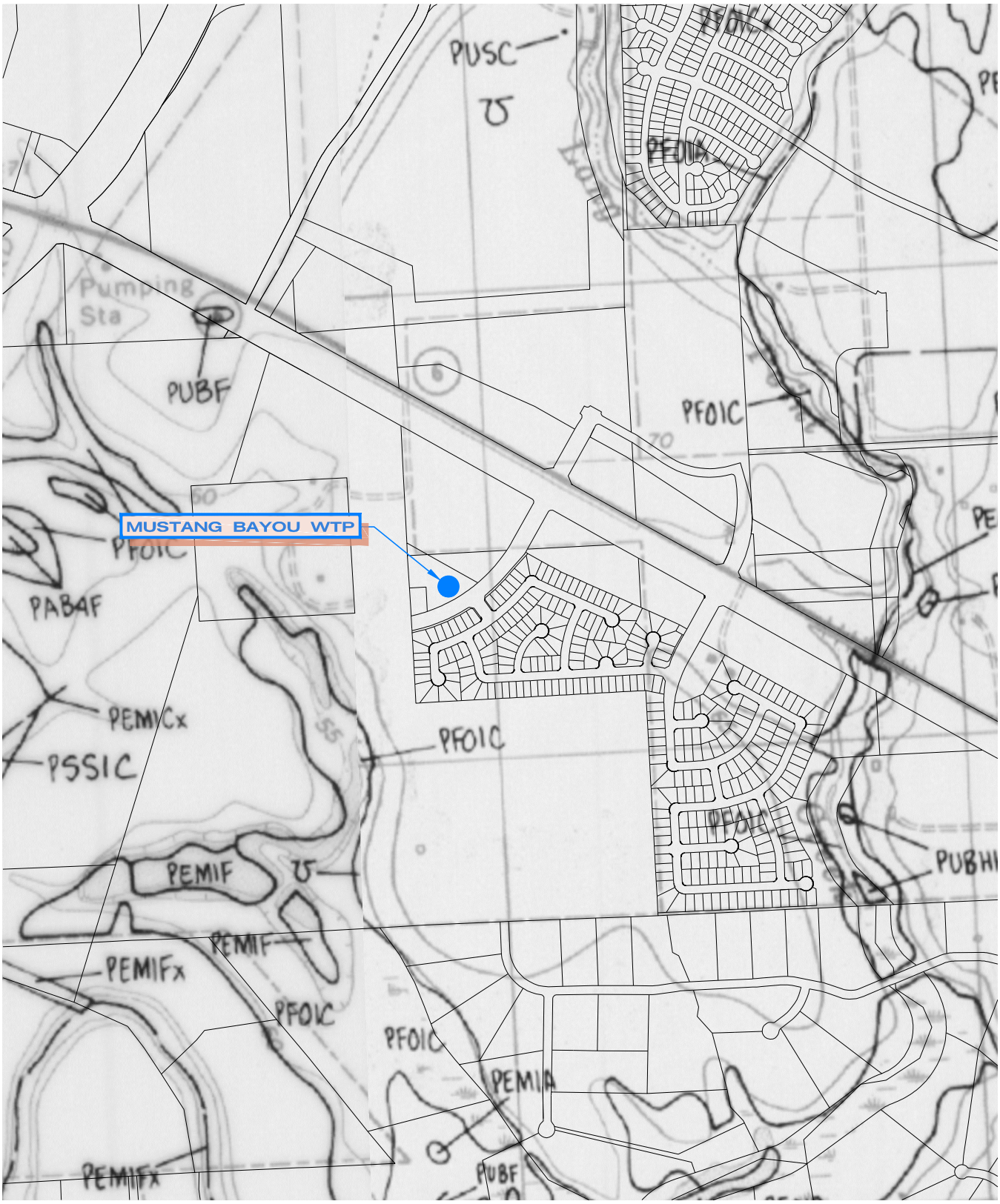
SCALE IN FEET

WETLANDS MAP

FORT BEND COUNTY
MUD #149 WTP
2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/14/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

PROPOSED NEW ELEVATED STORAGE TAN□ LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

SCALE IN FEET

WETLANDS MAP

MUSTANG BAYOU WTP
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/14/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151

LEGEND

PROPOSED NEW ELEVATED STORAGE TANK LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

N

500 0 1000

SCALE IN FEET

WETLANDS MAP

SIENNA PLANTATION #1 WTP 2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/14/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151

500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

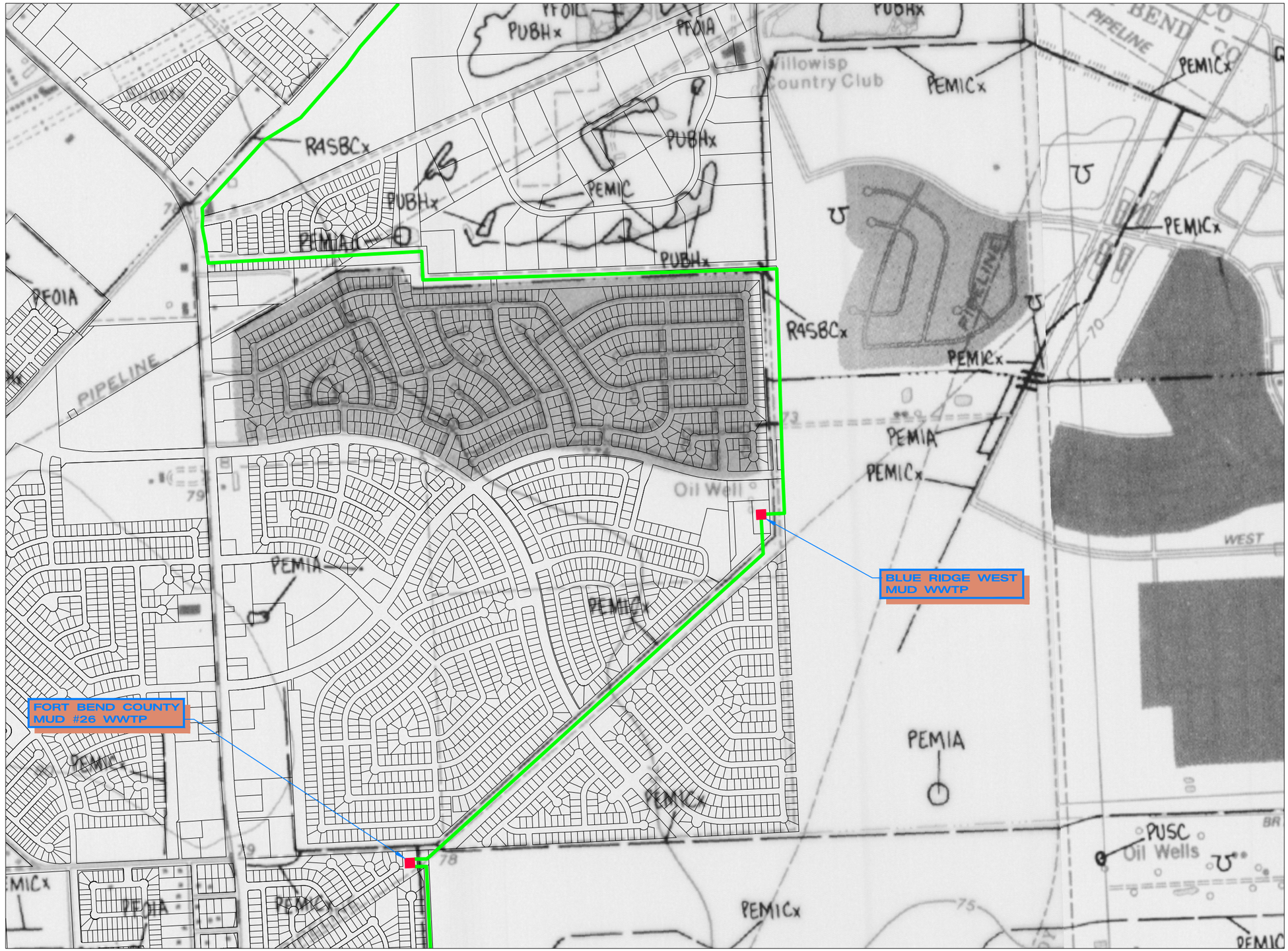
KEY MAP

WETLANDS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

KEY MAP

WETLANDS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151

500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

KEY MAP

WETLANDS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

NORTH

500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

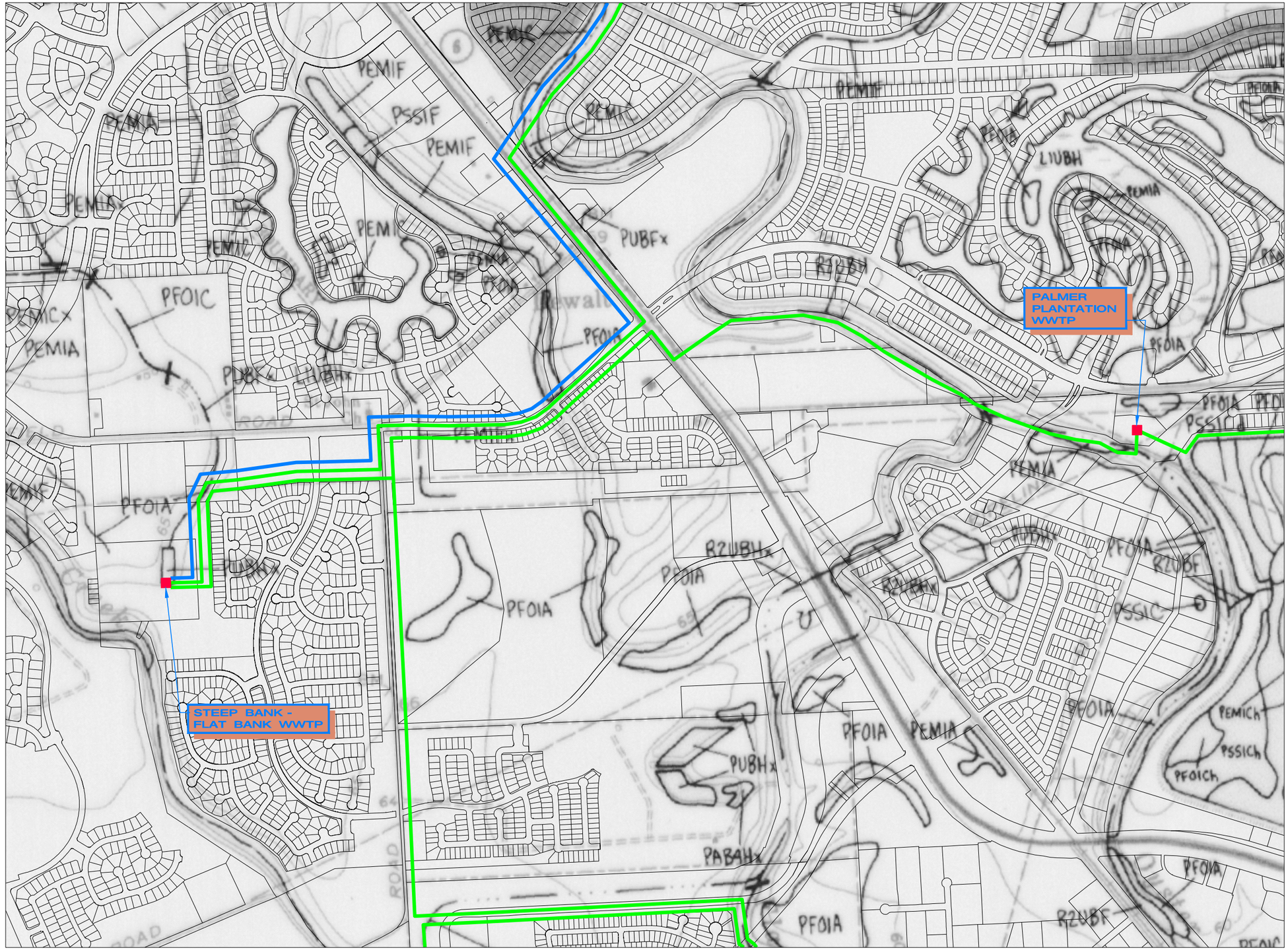
KEY MAP

WETLANDS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151



500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

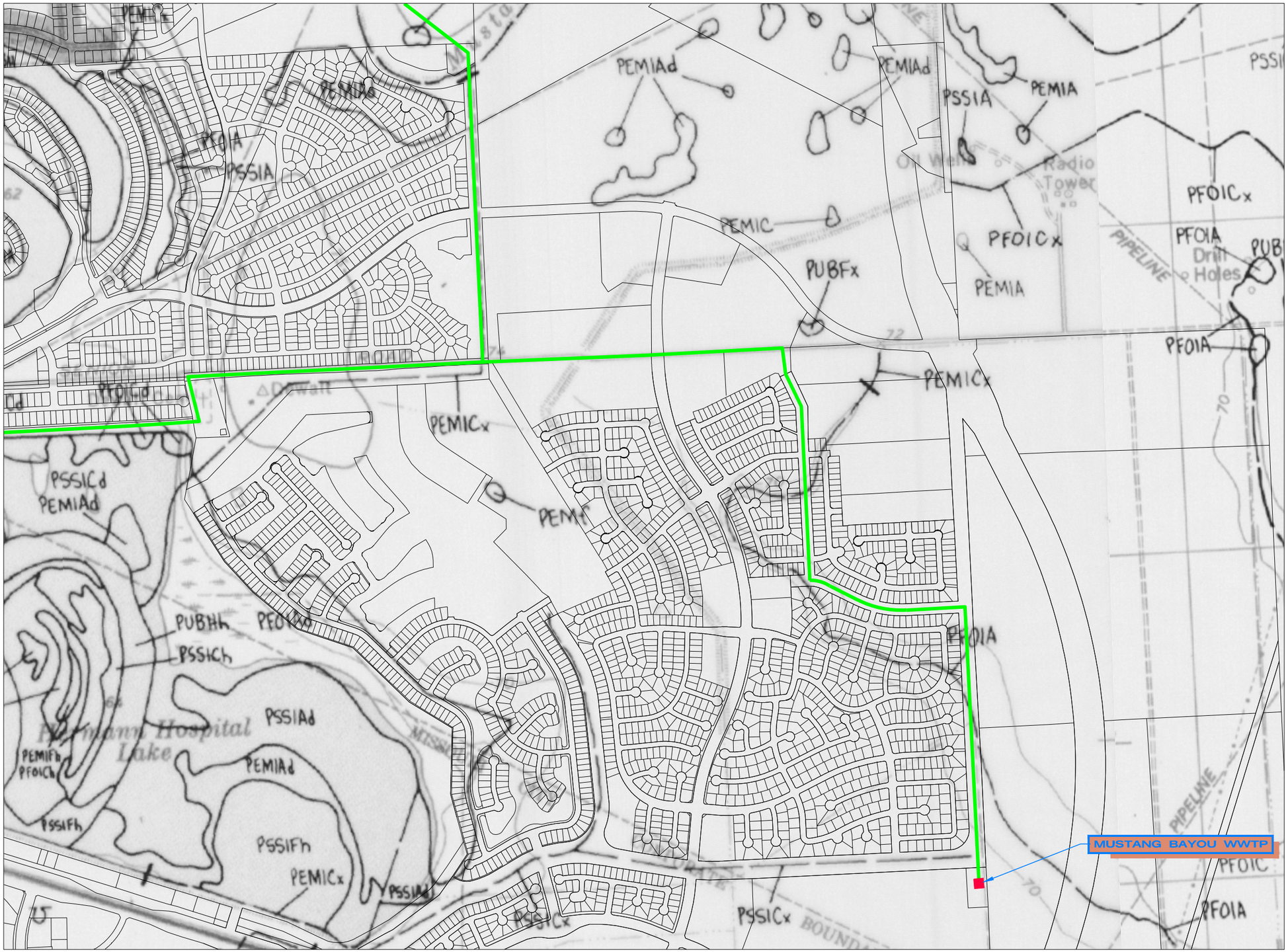
KEY MAP

WETLANDS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

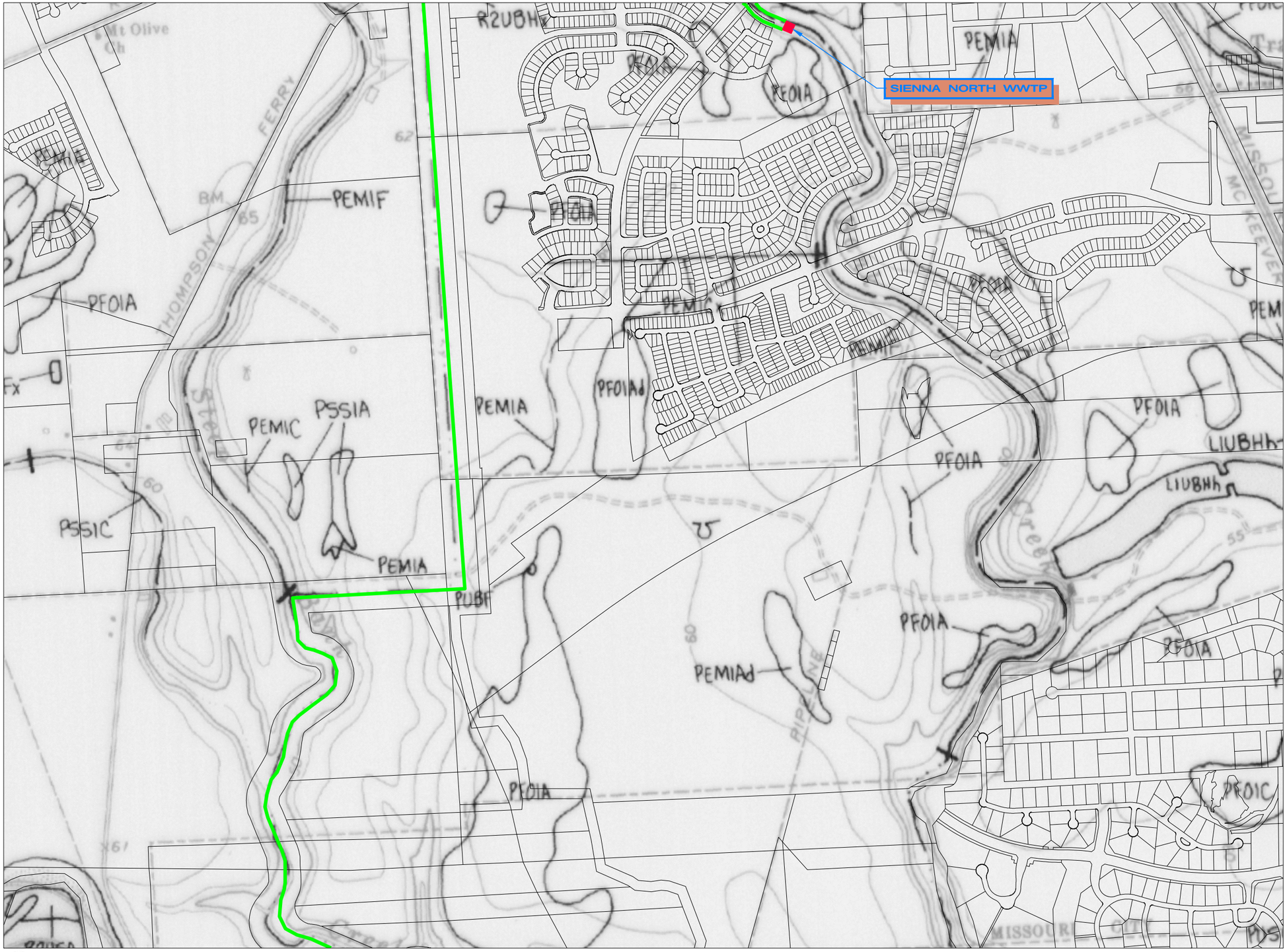
KEY MAP

WETLANDS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

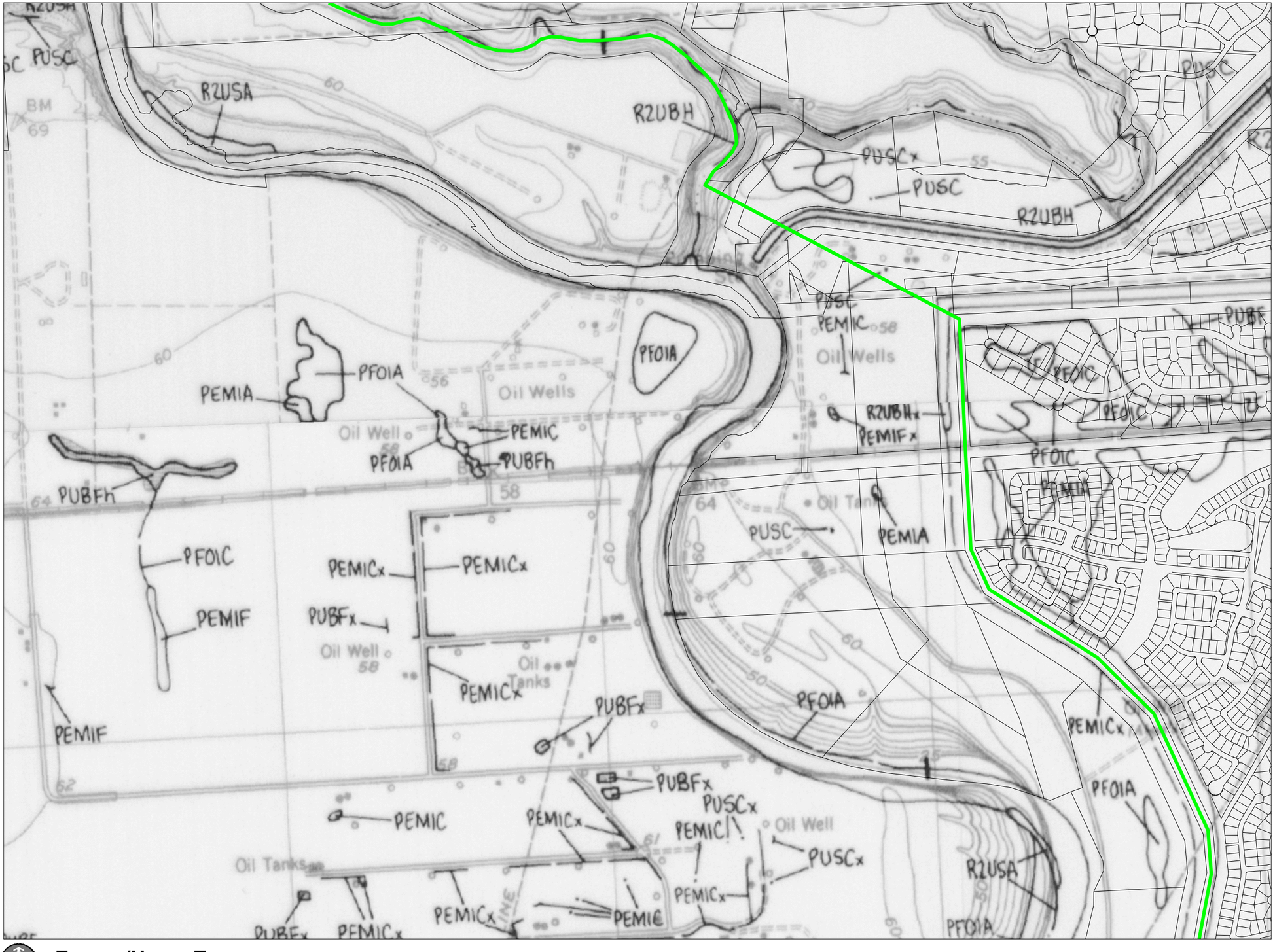
KEY MAP

WETLANDS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151



500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

KEY MAP

WETLANDS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
Firm Registration No. 1151

N

500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

KEY MAP

WETLANDS MAP

2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

500 0 1000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1	
	2	
3	4	
5	6	
7		
8	9	
10	11	

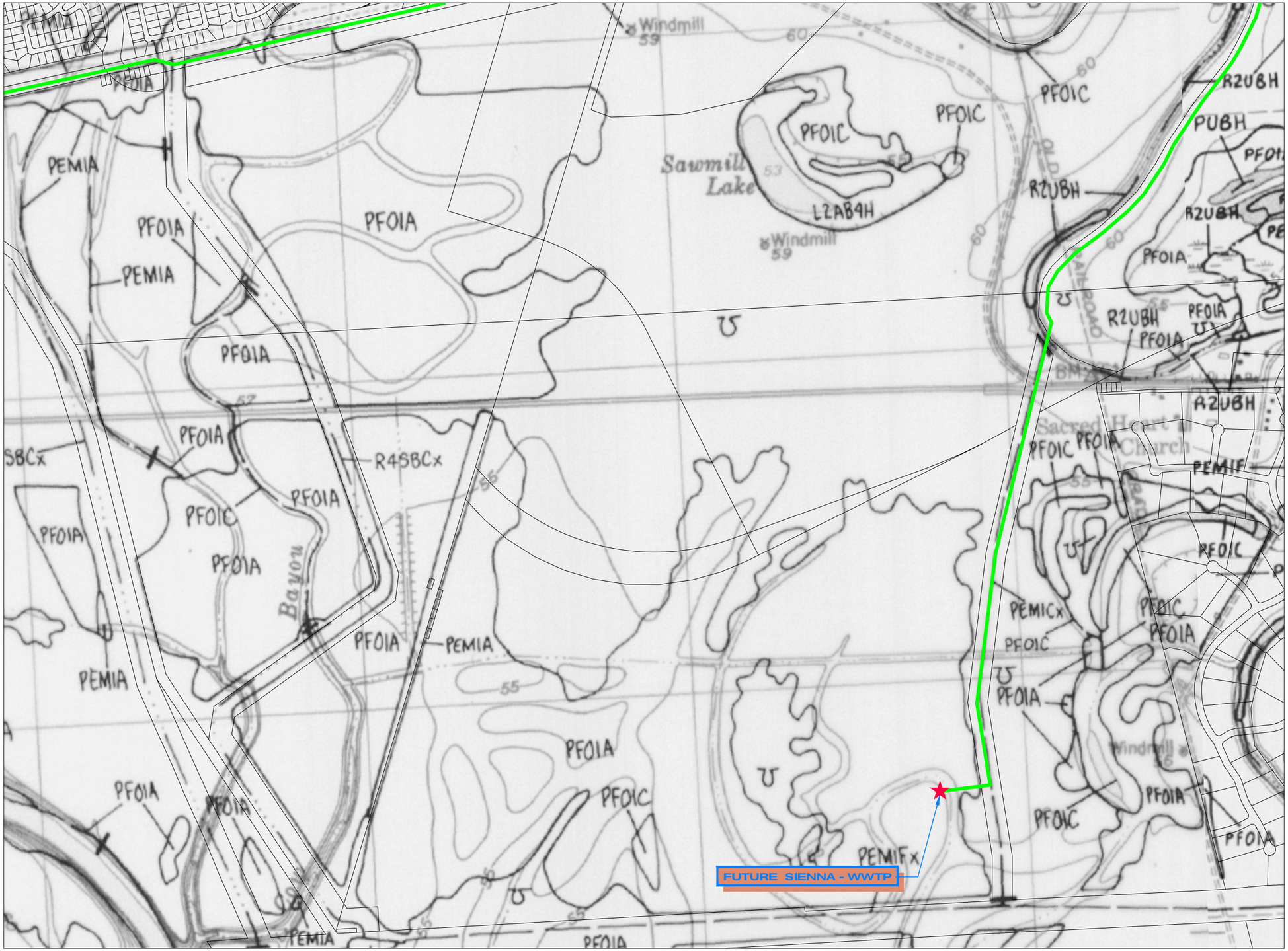
KEY MAP

WETLANDS MAP

2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151



LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION

NOTE

OVERLAID PARCEL LINES AND ROW'S WERE ACQUIRED FROM THE CITY OF MISSOURI CITY GIS DEPARTMENT.

	1
	2
3	4
5	6
7	
8	9
10	11

KEY MAP

WETLANDS MAP

2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 01/27/2012

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
325-698-5560
Abilene, Texas 79601
Firm Registration No. 1151

HOUSTON NW
HOUSTON

ALIEF, TEX.

SCALE 1:24 000

1 MILE
0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER
0 1 2 3 4 5

1 acre | 5 acres | 10 acres | 20 acres | 40 acres

ACREAGE GUIDE

For information on availability of NWI maps, call 1-800-USA-MAPS.

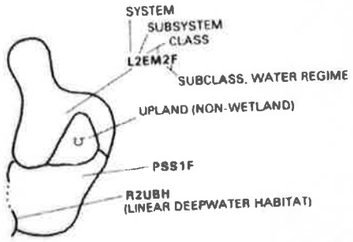
Regional Director (ARDE) Region II
U.S. Fish and Wildlife Service
P.O. Box 1306
Albuquerque, New Mexico 87103

SPECIAL NOTE

This document was prepared primarily by stereoscopic analysis of high altitude aerial photographs. Wetlands were identified on the photographs based on vegetation, visible hydrology, and geography in accordance with **Classification of Wetlands and Deepwater Habitats of the United States** (FWS/OBS - 79/31 December 1979). The aerial photographs typically reflect conditions during the specific year and season when they were taken. In addition, there is a margin of error inherent in the use of the aerial photographs. Thus, a detailed on the ground and historical analysis of a single site may result in a revision of the wetland boundaries established through photographic interpretation. In addition, some small wetlands and those obscured by dense forest cover may not be included on this document.

Federal, State and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, State or local government or to establish the geographical scope of the regulatory programs of government agencies. **Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, State or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.**

SYMBOLOGY EXAMPLE



U Primarily represents upland areas, but may include unclassified wetlands such as man-modified areas, non photo-identifiable areas and/or unintentional omissions.

NOTES TO THE USER

- Subsystems, Classes, Subclasses, and Water Regimes in *Italics* were developed specifically for NATIONAL WETLANDS INVENTORY mapping.
- Some areas designated as R4SB, R4SBW, OR R4SBJ (INTERMITTENT STREAMS) may not meet the definition of wetland.
- This map uses the class Unconsolidated Shore (US). On earlier NWI maps that class was designated Beach/Bar (BB), or Flat (FL). Subclasses remain the same in both versions.

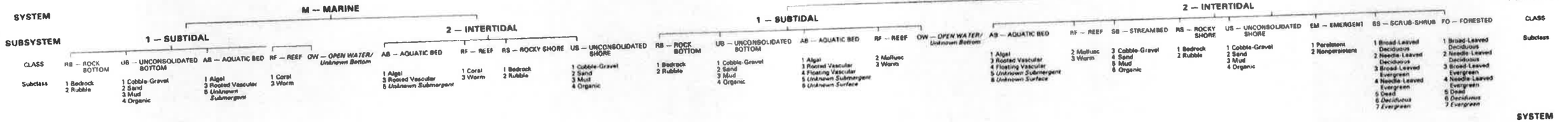
AERIAL PHOTOGRAPHY

DATE:	11 / 92	/ /
SCALE:	1:65 000	
TYPE:	CIR	

U.S. DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

Prepared by National Wetlands Inventory
Base map provided by the United States Geological Survey

1999



MODIFIERS

In order to more adequately describe the wetland and deepwater habitats one or more of the water regime, water chemistry, soil, or special modifiers may be applied at the class or lower level in the hierarchy. The farmed modifier may also be applied at the ecological system level.

WATER REGIME

Non-Tidal
- A Temporarily Flooded
- B Saturated
- C Seasonally Flooded
- D Seasonally Flooded/Well Drained
- E Seasonally Flooded/Saturated
- F Semipermanently Flooded
- G Intermittently Exposed
- H Permanently Flooded
- J Intermittently Flooded
- K Artificially Flooded
- W Intermittently Flooded/Temporary
- Y Saturated/Semipermanent/Seasonal
- Z Intermittently Exposed/Permanent
- U Unknown

Tidal
- K Artificially Flooded
- L Subtidal
- M Irregularly Exposed
- N Regularly Flooded
- P Irregularly Flooded
- *S Temporary-Tidal
- *R Seasonal-Tidal
- *T Semipermanent-Tidal
- *V Permanent-Tidal
- U Unknown

*These water regimes are only used in tidally influenced, freshwater systems.

WATER CHEMISTRY

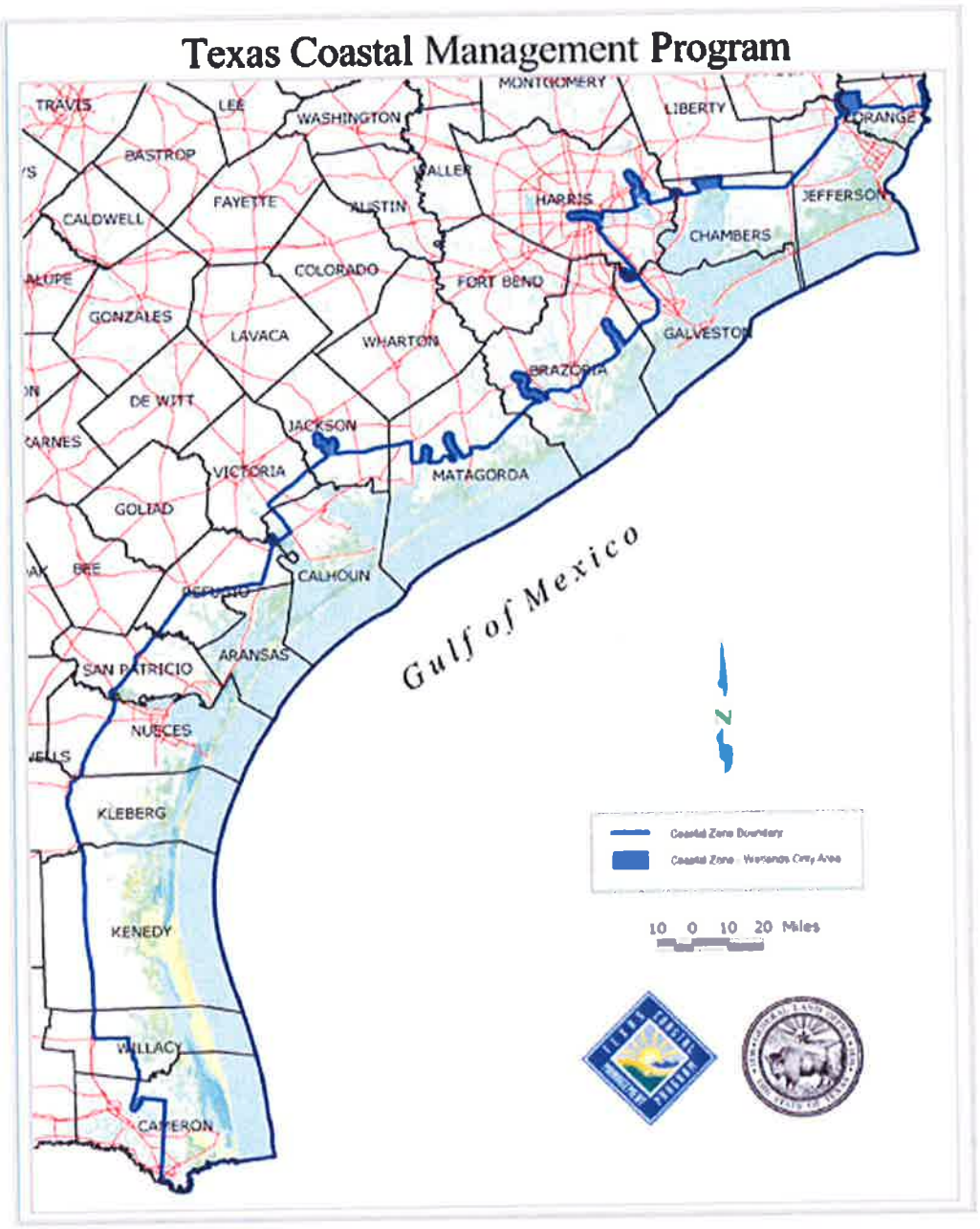
Coastal Salinity
- 1 Hypersaline
- 2 Eusaline
- 3 Mixohaline (Brackish)
- 4 Polyhaline
- 5 Mesohaline
- 6 Oligohaline
- 0 Fresh

Inland Salinity
- 7 Hypersaline
- 8 Eusaline
- 9 Mixosaline
- 0 Fresh

pH Modifiers for all Fresh Water
- a Acid
- t Circumneutral
- i Alkaline

SOIL
- g Organic
- n Mineral

SPECIAL MODIFIERS
- b *Beaver*
- d *Partially Drained/Ditched*
- f Farmed
- h *Diked/Impounded*
- r Artificial Substrate
- s *Spoil*
- x Excavated


Texas Coastal Management Program
TRAVIS
LEE
WASHINGTON
MONTGOMERY
LIBERTY
ORANGE
BASTROP
FAYETTE
AUSTIN
HARRIS
JEFFERSON
CALDWELL
CHAMBERS
COLORADO
FORT BEND
GONZALES
LAVACA
WHARTON
GALVESTON
BRAZORIA
DE WITT
JACKSON
VICTORIA
MATAGORDA
GOLIAD
CALHOUN
Gulf of Mexico
ARANSAS
SAN PATRICIO
NUECES
KLEBERG
KENEDY
WILLACY
CAMERON
Coastal Zone Boundary
10 0 10 20 Miles

FORT BEND COUNTY

AMPHIBIANS

		Federal Status	State Status
Houston toad	*Anaxyrus houstonensis*	LE	E

endemic; sandy substrate, water in pools, ephemeral pools, stock tanks; breeds in spring especially after rains; burrows in soil of adjacent uplands when inactive; breeds February-June; associated with soils of the Sparta, Carrizo, Goliad, Queen City, Recklaw, Weches, and Willis geologic formations

BIRDS

		Federal Status	State Status
American Peregrine Falcon	*Falco peregrinus anatum*	DL	T

year-round resident and local breeder in west Texas, nests in tall cliff eyries; also, migrant across state from more northern breeding areas in US and Canada, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Arctic Peregrine Falcon	*Falco peregrinus tundrius*	DL	

migrant throughout state from subspecies' far northern breeding range, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Attwater's Greater Prairie-Chicken	*Tympanuchus cupido attwateri*	LE	E

this county within historic range; endemic; open prairies of mostly thick grass one to three feet tall; from near sea level to 200 feet along coastal plain on upper two-thirds of Texas coast; males form communal display flocks during late winter-early spring; booming grounds important; breeding February-July

Bald Eagle	*Haliaeetus leucocephalus*	DL	T

found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds

Henslow's Sparrow	*Ammodramus henslowii*		

wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking

Interior Least Tern	*Sterna antillarum athalassos*	LE	E

subspecies is listed only when inland (more than 50 miles from a coastline); nests along sand and gravel bars within braided streams, rivers; also know to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc); eats small fish and crustaceans, when breeding forages within a few hundred feet of colony

Peregrine Falcon	*Falco peregrinus*	DL	T

FORT BEND COUNTY

BIRDS

Federal Status State Status

both subspecies migrate across the state from more northern breeding areas in US and Canada to winter along coast and farther south; subspecies (F. p. anatum) is also a resident breeder in west Texas; the two subspecies' listing statuses differ, F.p. tundrius is no longer listed in Texas; but because the subspecies are not easily distinguishable at a distance, reference is generally made only to the species level; see subspecies for habitat.

Sprague's Pipit *Anthus spragueii* C

only in Texas during migration and winter, mid September to early April; short to medium distance, diurnal migrant; strongly tied to native upland prairie, can be locally common in coastal grasslands, uncommon to rare further west; sensitive to patch size and avoids edges.

Western Burrowing Owl *Athene cunicularia hypugaea*

open grasslands, especially prairie, plains, and savanna, sometimes in open areas such as vacant lots near human habitation or airports; nests and roosts in abandoned burrows

White-faced Ibis *Plegadis chihi* T

prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats

White-tailed Hawk *Buteo albicaudatus* T

near coast on prairies, cordgrass flats, and scrub-live oak; further inland on prairies, mesquite and oak savannas, and mixed savanna-chaparral; breeding March-May

Whooping Crane *Grus americana* LE E

potential migrant via plains throughout most of state to coast; winters in coastal marshes of Aransas, Calhoun, and Refugio counties

Wood Stork *Mycteria americana* T

forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960

FISHES

Federal Status State Status

American eel *Anguilla rostrata*

coastal waterways below reservoirs to gulf; spawns January to February in ocean, larva move to coastal waters, metamorphose, then females move into freshwater; most aquatic habitats with access to ocean, muddy bottoms, still waters, large streams, lakes; can travel overland in wet areas; males in brackish estuaries; diet varies widely, geographically, and seasonally

Sharpnose shiner *Notropis oxyrhynchus* C

endemic to Brazos River drainage; also, apparently introduced into adjacent Colorado River drainage; large turbid river, with bottom a combination of sand, gravel, and clay-mud

FORT BEND COUNTY

MAMMALS

		Federal Status	State Status
Louisiana black bear	*Ursus americanus luteolus*	LT	T

possible as transient; bottomland hardwoods and large tracts of inaccessible forested areas

Plains spotted skunk *Spilogale putorius interrupta*

catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie

Red wolf	*Canis rufus*	LE	E

extirpated; formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies

MOLLUSKS

		Federal Status	State Status
False spike mussel	*Quadrula mitchelli*		T

possibly extirpated in Texas; probably medium to large rivers; substrates varying from mud through mixtures of sand, gravel and cobble; one study indicated water lilies were present at the site; Rio Grande, Brazos, Colorado, and Guadalupe (historic) river basins

Smooth pimpleback	*Quadrula houstonensis*		T

small to moderate streams and rivers as well as moderate size reservoirs; mixed mud, sand, and fine gravel, tolerates very slow to moderate flow rates, appears not to tolerate dramatic water level fluctuations, scoured bedrock substrates, or shifting sand bottoms, lower Trinity (questionable), Brazos, and Colorado River basins

Texas fawnsfoot	*Truncilla macrodon*		T

little known; possibly rivers and larger streams, and intolerant of impoundment; flowing rice irrigation canals, possibly sand, gravel, and perhaps sandy-mud bottoms in moderate flows; Brazos and Colorado River basins

REPTILES

		Federal Status	State Status
Alligator snapping turtle	*Macrochelys temminckii*		T

perennial water bodies; deep water of rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near deep running water; sometimes enters brackish coastal waters; usually in water with mud bottom and abundant aquatic vegetation; may migrate several miles along rivers; active March-October; breeds April-October

Texas horned lizard	*Phrynosoma cornutum*		T

open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September

Timber/Canebrake rattlesnake	*Crotalus horridus*		T

FORT BEND COUNTY

REPTILES

		Federal Status	State Status

swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto

PLANTS

		Federal Status	State Status
Texas prairie dawn	*Hymenoxys texana*	LE	E

Texas endemic; in poorly drained, sparsely vegtated areas (slick spots) at the base of mima mounds in open grassland or almost barren areas on slightly saline soils that are sticky when wet and powdery when dry; flowering late February-early April

Threeflower broomweed *Thurovia triflora*

Texas endemic; near coast in sparse, low vegetation on a veneer of light colored silt or fine sand over saline clay along drier upper margins of ecotone between between salty prairies and tidal flats; further inland associated with vegetated slick spots on prairie mima mounds; flowering September-November

Notes for
County Lists of Texas' Special Species

The Texas Parks and Wildlife (TPWD) county lists **include**:

Vertebrates, Invertebrates, and Vascular Plants identified as being of conservation concern by TPWD within Texas. These special species lists are comprised of species, subspecies, and varieties that are federally listed; proposed to be federally listed; have federal candidate status; are state listed; or carry a global conservation status indicating a species is critically imperiled, very rare, vulnerable to extirpation, or uncommon.

The TPWD county lists **do not include**:

Natural Plant Communities such as Little Bluestem-Indiangrass Series (native prairie remnant), Water Oak-Willow Oak Series (bottomland hardwood community), Saltgrass-Cordgrass Series (salt or brackish marsh), Sphagnum-Beakrush Series (seepage bog).

Other Significant Features such as bird rookeries, migratory songbird fallout areas, comprehensive migratory bird information, bat roosts, bat caves, invertebrate caves, and prairie dog towns.

These lists are not all inclusive for all rare species distributions. The lists were compiled, developed, and are updated based on field guides, staff expertise, scientific publications, and the TPWD Texas Natural Diversity Database (TXNDD) (formerly the Biological and Conservation Data System) occurrence data. Historic ranges for some state extirpated species, full historic distributions for some extant species, accidentals and irregularly appearing species, and portions of migratory routes for particular species are not necessarily included. Species that appear on county lists do not all share the same probability of occurrence within a county. Some species are migrants or wintering residents only. Additionally, a few species may be historic or considered extirpated within a county.

TPWD includes the Federal listing status for your convenience and makes every attempt to keep the information current and correct. However, the US Fish and Wildlife Service (FWS) is the responsible authority for Federal listing status. The TPWD lists do not substitute for contact with the FWS and federally listed species county ranges may vary from the FWS county level species lists because of the inexact nature of range map development and use.

Status Key:

LE, LT -	Federally Listed Endangered/Threatened
PE, PT -	Federally Proposed Endangered/Threatened
SAE, SAT -	Federally Listed Endangered/Threatened by Similarity of Appearance
C -	Federal Candidate for Listing; formerly Category 1 Candidate
DL, PDL -	Federally Delisted/Proposed for Delisting
NL -	Not Federally Listed
E, T -	State Listed Endangered/Threatened
NT -	Not tracked or no longer tracked by the State
"blank" -	Rare, but with no regulatory listing status

This information is specifically for your assistance only; due to continuing data updates, **please do not redistribute the lists**, instead refer all requesters to the web site at: http://www.tpwd.state.tx.us/landwater/land/maps/gis/ris/endangered_species/ or to our office for the most current information available. For questions regarding county lists, please call (512) 389-4571.

Please use the following citation to credit the source for this county level information:

Texas Parks and Wildlife Department, Wildlife Division, Diversity and Habitat Assessment Programs. County Lists of Texas' Special Species. [county name(s) and revised date(s)].

Luci English

From: Bob Gottfried [Bob.Gottfried@tpwd.state.tx.us]
Sent: Thursday, September 15, 2011 3:43 PM
To: Luci English
Subject: RE: Early Project Coordination - Missouri City Planning Project (5052)
Attachments: english_20110908.zip

Ms. English,

Your information request area contains known ecologically significant stream segments. Use the link below to obtain that data.

The Texas Natural Diversity Database (TXNDD) includes federal, and state listed and tracked Threatened, Endangered, and Rare species. The attached .zip file contains documents that will guide you in appropriate use, restrictions, and shapefile interpretation of Texas NDD data as well as a request for adding data to the TXNDD. Also included is a shapefile of the T&E and Rare species element occurrences, information the TXNDD has available presently, within and touching the requested quads along with a companion EO **report**; areas where EO data are absent **do not mean** absence of occurrence for Threatened, Endangered, and Rare species. An EO **list** is included, buffered to approximately 10 miles from the requested quad boundaries to notify you of other potential federal, and state listed and tracked Threatened, Endangered, and Rare species within the area. To round out your review, please use the pertinent TPWD Annotated County lists of Rare Species; webpage address found below. For questions on these county lists please contact Julie Wicker at julie.wicker@tpwd.state.tx.us or (512)389-4579.

- If your project area is in Travis, Williamson, or Bexar county it is highly recommended that you download the GIS shapefiles for the Karst Zones from the USFWS website http://www.fws.gov/southwest/es/austintexas/ and/or contact Jenny Wilson – USFWS at (512)490-0057 x 231 for a review of the project location. All three counties are known to have multiple important karst features.
- If your information request includes one or more records for **Bald Eagle** or **colonial waterbirds**, contact Brent Ortego at brent.ortego@tpwd.state.tx.us or (361) 576-0022 for more up-to-date information on the **Bald Eagle** or **colonial waterbirds**.
- **For communication towers**, in addition to the USFWS guidelines in the attachment and the links at towerkill.com, there is research identifying a simple way to reduce bird strike and high bird mortality at towers. Gehring J., P. Kerlinger, A.M. Manville II. (2009) Communication towers, lights, and birds: successful methods of reducing the frequency of avian collisions. Ecological Applications: Vol. 19, No. 2, pp. 505-514.doi: 10.1890/07-1708.1
- For **wind energy or transmission related projects**, to obtain the Department's guidelines it is also recommended to contact Kathy Boydston, the Department lead, at kathy.boydston@tpwd.state.tx.us or 512/389-4638. In addition, the U.S. Fish and Wildlife Service's Interim Guidance on Avoiding and Minimizing Wildlife Impacts from Wind Turbines, along with other helpful links and information, can be accessed at: http://www.fws.gov/habitatconservation/wind.html.
- If your information request contains records for **Texas trailing phlox** you should contact Jason Singhurst at jason.singhurst@tpwd.state.tx.us or (512) 389-8726.

Absence of information in an area does not mean absence of occurrence. *Given the small proportion of public versus private land in Texas, the TXNDD does not include a representative inventory of rare resources in the state. Data from the TXNDD do not provide a definitive statement as to the presence, absence, or condition of special species, natural communities, or other significant features within your project area. These data cannot substitute for an on-site evaluation by qualified biologists.*

Additional sources of data:
TPWD Annotated County Lists: http://www.tpwd.state.tx.us/landwater/land/maps/gis/ris/endangered_species/
USFWS species lists: http://ecos.fws.gov/tess_public/servlet/gov.doi.tess_pulic.servlets.EntryPage
USFWS CRITICAL HABITAT: http://criticalhabitat.fws.gov/
Ecologically Significant Stream Segments: http://www.tpwd.state.tx.us/landwater/land/maps/gis/data_downloads/
Ecologically Significant Stream Segment Information:
http://www.tpwd.state.tx.us/landwater/water/environconcerns/water_quality/sigsegs/

Bob Gottfried
Texas Natural Diversity Database Admin.

-----Original Message-----
From: Luci English [mailto:luci.english@e-ht.com]
Sent: Thu 2011-09-08 10:18 AM

To: Texas Natural Diversity Database
Subject: Early Project Coordination - Missouri City Planning Project (5052)

Per PWD 1059, Early Project Coordination:
The Missouri City Water and Wastewater Planning project is in the early planning stages. Several construction options are being presented to the City for their consideration. A cursory review of these options is requested through the TXNDD in lieu of submitting a Project Review at this point in the planning phase.

The USGS overview map with potential construction locations is attached along with a detailed ISGS of each project option. The majority of the options involve utility line installation. Some options do not involve construction and are not included with the attachments. There will be one overview map with 13 option maps.

As Form PWD 1059 indicates, please provide a response within the next 5 business days, if possible. If you have any questions, please feel free to contact me via e-mail, cell, or office. Thank you.

Luci English, PE
Project Manager
eHT | Enprotec / Hibbs & Todd, Inc.
Tel (325) 698-5560 | Cell (817) 694-8382 | Email luci.english@e-ht.com

Abilene | Lubbock | Granbury | Plano
www.e-ht.com | PE Firm Registration No. 1151 | PG Firm Registration No. 50103

Printout from Texas Parks & Wildlife Department - Texas Natural Diversity Database

FEATURE_ID	EO_ID	EO_NUM	SCIENTIFIC	COMMON_NAM	GROUP_CLAS	GRANK	SRANK	USESA	SPROT	LASTOBS	PRECISION	TRACK_STAT	SENSITIVE
2933	1650	117	Haliaeetus leucocephalus	Bald Eagle	Vertebrate Animal	G4	S3B,S3N		T	2000	M	Y	Y
8797	7514	54	Haliaeetus leucocephalus	Bald Eagle	Vertebrate Animal	G4	S3B,S3N		T	2001	M	Y	Y
9005	7722	24	Hymenoxys texana	Texas prairie dawn	Vascular Plant	G2	S2	LE	E	2000-SPRG	S	Y	N
3813	2530	586	Rookery		Animal Assemblage	GNR	SNR			1992	S	Y	N
6864	5581	32	Chloris texensis	Texas windmill-grass	Vascular Plant	G2	S2			1993-11-12	S	Y	N
9068	7785	58	Hymenoxys texana	Texas prairie dawn	Vascular Plant	G2	S2	LE	E	1998-SPRG	S	Y	N
2251	968	6	Anaxyrus houstonensis	Houston Toad	Vertebrate Animal	G1	S1	LE	E		M	Y	N
8980	7697	13	Thalictrum texanum	Texas meadow-rue	Vascular Plant	G2Q	S2			2004-01-28	S	Y	N
4890	3607	11	Haliaeetus leucocephalus	Bald Eagle	Vertebrate Animal	G4	S3B,S3N		T	2002	M	Y	N
6578	5295	7	Quercus virginiana-carya illinoensis series	Coastal Live Oak-pecan Series	Terrestrial Community - Other Classification	G3	S3			1986-06	S	Y	N
8738	7455	154	Rookery		Animal Assemblage	GNR	SNR			1988	S	Y	N
3184	1901	18	Chloris texensis	Texas windmill-grass	Vascular Plant	G2	S2			1976-11-11	M	Y	N
4848	3565	55	Hymenoxys texana	Texas prairie dawn	Vascular Plant	G2	S2	LE	E	1999-03	S	Y	N
1309	26	53	Hymenoxys texana	Texas prairie dawn	Vascular Plant	G2	S2	LE	E	1999-03	S	Y	N

Code Key for this printout follows on next 2 pages

Code Key for Printouts from
Texas Parks and Wildlife Department
Texas Natural Diversity Database (TXNDD)

This information is for your assistance only; due to continuing data updates, vulnerability of private land to trespass and of species to disturbance or collection, **please refer all requesters to our office to obtain the most current information available.** Also, please note, identification of a species in a given area does not necessarily mean the species currently exists at the point or area indicated.

LEGAL STATUS AND CONSERVATION RANKS

FEDERAL STATUS (as determined by the US Fish and Wildlife Service)

LE	Listed Endangered
LT	Listed Threatened
PE	Proposed to be listed Endangered
PT	Proposed to be listed Threatened
PDL	Proposed to be Delisted (Note: Listing status retained while proposed)
SAE, SAT	Listed Endangered on basis of Similarity of Appearance, Listed Threatened on basis of Similarity of Appearance
DL	Delisted Endangered/Threatened
C	Candidate. USFWS has substantial information on biological vulnerability and threats to support proposing to list as threatened or endangered. Data are being gathered on habitat needs and/or critical habitat designations.
C*	C, but lacking known occurrences
C**	C, but lacking known occurrences, except in captivity/cultivation
XE	Essential Experimental Population
XN	Non-essential Experimental Population
Blank	Species is not federally listed

TX PROTECTION (as determined by the Texas Parks and Wildlife Department)

E	Listed Endangered
T	Listed Threatened
Blank	Species not state-listed

GLOBAL RANK (as determined by NatureServe)

G1	Critically imperiled globally, extremely rare, typically 5 or fewer viable occurrences
G2	Imperiled globally, very rare, typically 6 to 20 viable occurrences
G3	Very rare and local throughout range or found locally in restricted range, typically 21 to 100 viable occurrences
G4	Apparently secure globally
G5	Demonstrably secure globally
GH	Of historical occurrence through its range
GU	Possibly in peril range-wide, but status uncertain
G#G#	Ranked within a range as status uncertain
GX	Apparently extinct throughout range
Q	Rank qualifier denoting taxonomic assignment is questionable
#?	Rank qualifier denoting uncertain rank
C	In captivity or cultivation only
G#T#	"G" refers to species rank; "T" refers to variety or subspecies rank

STATE (SUBNATIONAL) RANK (as determined by the Texas Parks and Wildlife Department)

S1	Critically imperiled in state, extremely rare, vulnerable to extirpation, typically 5 or fewer viable occurrences
S2	Imperiled in state, very rare, vulnerable to extirpation, typically 6 to 20 viable occurrences
S3	Rare or uncommon in state, typically 21 to 100 viable occurrences
S4	Apparently secure in State
S5	Demonstrably secure in State
S#S#	Ranked within a range as status uncertain
SH	Of historical occurrence in state and may be rediscovered
SU	Unrankable – due to lack of information or substantially conflicting information
SX	Apparently extirpated from State
SNR	Unranked – State status not yet assessed
SNA	Not applicable – species id not a suitable target for conservation activities
?	Rank qualifier denoting uncertain rank in State

Revised 1 Apr 2008

ELEMENT OCCURRENCE RECORD

Element Occurrence Record (EOR) Spatial and tabular record of an area of land and/or water in which a species, natural community, or other significant feature of natural diversity is, or was, present and associated information; may be a single contiguous area or may be comprised of discrete patches or subpopulations

Occurrence # Unique number assigned to each occurrence of each element when added to the NDD

LOCATION INFORMATION

Watershed Code Eight digit numerical code determined by US Geological Survey (USGS)

Watershed Name of watershed as determined by USGS

Quadrangle Name of USGS topographical map

Directions Directions to geographic location where occurrence was observed, as described by observer or in source

SURVEY INFORMATION

First/Last Observation Date a particular occurrence was first/last observed; refers only to species occurrence as noted in source and does not imply the first/last date the species was present

Survey Date If conducted, date of survey

EO Type State rank qualifiers:

- **M** Migrant – species occurring regularly on migration at staging areas, or concentration along particular corridors; status refers to the transient population in the State
- **B** Qualifier indicating basic rank refers to the breeding population in State
- **N** Qualifier indicating basic rank refers to the non-breeding population in State

EO Rank

A	Excellent	**AI**	Excellent, Introduced
B	Good	**BI**	Good, Introduced
C	Marginal	**CI**	Marginal, Introduced
D	Poor	**DI**	Poor, Introduced
E	Extant/Present	**EI**	Extant, Introduced
H	Historical/No Field Information	**HI**	Historical, Introduced
X	Destroyed/Extirpated	**XI**	Destroyed, Introduced
O	Obscure	**OI**	Obscure, Introduced

EO Rank Date Latest date EO rank was determined or revised

Observed Area Acres, unless indicated otherwise

COMMENTS

Description General physical description of area and habitat where occurrence is located, including associated species, soils, geology, and surrounding land use

Comments Comments concerning the quality or condition of the element occurrence at time of survey

Protection Comments Observer comments concerning legal protection of the occurrence

Management Comments Observer comments concerning management recommendations appropriate for occurrence conservation

DATA

EO Data Biological data; may include number of individuals, vigor, flowering/fruiting data, nest success, behaviors observed, or unusual characteristic, etc.

SITE

Site Name Title given to site by surveyor

MANAGED AREA INFORMATION

Managed Area Name Place name or (on EOR printout) name of area when the EO is located within or partially within an area identified for conservation, such as State or Federal lands, nature preserves, parks, etc.

Alias Additional names the property is known by

Acres Total acreage of property, including non-contiguous tracts

Manager Contact name, address, and telephone number for area or nearest area land steward

Please use one of the following citations to credit the source for the printout information:

Texas Natural Diversity Database. [year of printouts]. Wildlife Diversity Program of Texas Parks & Wildlife Department. [day month year of printouts].

Texas Natural Diversity Database. [year of printouts]. Element occurrence printouts for [scientific name] *records # [occurrence number(s)]. Wildlife Diversity Program of Texas Parks & Wildlife Department. [day month year of printouts]. *Use of record #'s is optional.

Revised 1 Apr 2008

TEXAS NATURAL DIVERSITY DATABASE
Data System, Source Types, Utility, Limitations

The Texas Natural Diversity Database (TXNDD), established in 1983, is the Texas Parks and Wildlife Department's (TPWD) most comprehensive source of information on rare, threatened, and endangered plants, animals, invertebrates, exemplary natural communities, and other significant features. The TXNDD is continually updated, providing current or additional information on statewide status and locations of these unique elements of natural diversity. However, the data is not all-inclusive, as there are gaps in coverage and species data, due to the lack of access to land or data, and a lack of staff and resources to collect and process data on all rare and significant resources.

The TXNDD gathers biological information from public information sources, such as: museum and herbarium collection records, peer-reviewed publications, experts in the scientific community, organizations, qualified individuals, and on-site field surveys conducted by TPWD staff on public lands or private lands with written permission. TPWD staff botanists, zoologists, and ecologists perform field surveys to locate and verify specific occurrences of high-priority biological elements and collect accurate information on their condition, quality, and management needs.

The TXNDD can be used to help evaluate environmental impacts of routing and siting options for development projects, environmental review, and permit review, as well as for natural resource management, scientific research, and educational applications. Appropriate use of the TXNDD requires both interpretation and extrapolation because of the many data gaps across the state from current and historic lack of access to private lands, the restriction of data extraction from only public information sources, species and geographic coverage skewed towards listed and the most rare species and ecosystems, and the lack of precise locality data in many secondary sources.

Given the small proportion of public versus private land in Texas, the TXNDD does not include a representative inventory of rare resources in the state. Although it is based on the best data available to TPWD regarding rare species, these data cannot provide a definitive statement as to the presence, absence, or condition of special species, natural communities, or other significant features in any area. Nor can these data substitute for on-site evaluation by qualified biologists. The TXNDD information is intended to assist users in avoiding harm to rare species or significant ecological features. Refer all requests back to the TXNDD to obtain the most current information.

GRANK – Global Conservation Status Rank; for element's entire global range, factors together abundance, total range size, distribution, trends, threats, fragility, and number of adequately protected occurrences within global range

SRANK – State Conservation Status Rank; for element's state range, factors together abundance, state range size, distribution, trends, threats, fragility, and number of adequately protected occurrences within state range

LASTOBS – Last Observed; date a particular occurrence was last observed as noted in the source(s); **refers only to species occurrence as noted in source and does not imply the last date the species was present**

DATA SENSITIVE flag – a "Y" indicates the species or location is sensitive due to threat from collection, disturbance, or illegal trespass onto private lands

LAT – Latitude of occurrence record point, or polygon link point located in upper right corner of polygon

LONG – Longitude of occurrence record point, or polygon link point located in upper right corner of polygon

PRECISION – Mapping Precision of occurrence record; lat/long coordinates of point or polygon link point; mapping precision of record determined by preciseness of locality information provided in source(s)

S - Second: For point records, accuracy within 3-second radius, or approximately 1000 foot radius margin-of-error from lat/long of point on map; for boundary/polygon records, accuracy within 3-second radius of drawn polygon as represented in the source(s), not the lat/long of the polygon link point

M - Minute: For point records, accuracy within 1-minute radius, or approximately 2 kilometers or 1.5 miles radius margin-of-error from lat/long of point on map; for records with a boundary/polygon, the polygon should be considered marginally uncertain based on inferred extent of record as stated in the source(s), not the lat/long of the polygon link point

G - General: For point records, accuracy general to locale, quad(s), or place name precision, or default of approximately 8 kilometers or 5 miles radius margin-of-error from lat/long of point on map; for records with a boundary/polygon, the polygon should be considered somewhat imprecise or generalized based on implied extent of record as stated in the source(s), not the lat/long of the polygon link point

U - Unmappable: Records with little to no locality information provided in the source(s), such as noting only county name or generalized region of state

Notes for
County Lists of Texas' Special Species

The Texas Parks and Wildlife (TPWD) county lists **include**:

Vertebrates, Invertebrates, and Vascular Plants identified as being of conservation concern by TPWD within Texas. These special species lists are comprised of species, subspecies, and varieties that are federally listed; proposed to be federally listed; have federal candidate status; are state listed; or carry a global conservation status indicating a species is critically imperiled, very rare, vulnerable to extirpation, or uncommon.

The TPWD county lists **do not include**:

Natural Plant Communities such as Little Bluestem-Indiangrass Series (native prairie remnant), Water Oak-Willow Oak Series (bottomland hardwood community), Saltgrass-Cordgrass Series (salt or brackish marsh), Sphagnum-Beakrush Series (seepage bog).

Other Significant Features such as bird rookeries, migratory songbird fallout areas, comprehensive migratory bird information, bat roosts, bat caves, invertebrate caves, and prairie dog towns.

These lists are not all inclusive for all rare species distributions. The lists were compiled, developed, and are updated based on field guides, staff expertise, scientific publications, and the TPWD Texas Natural Diversity Database (TXNDD) (formerly the Biological and Conservation Data System) occurrence data. Historic ranges for some state extirpated species, full historic distributions for some extant species, accidentals and irregularly appearing species, and portions of migratory routes for particular species are not necessarily included. Species that appear on county lists do not all share the same probability of occurrence within a county. Some species are migrants or wintering residents only. Additionally, a few species may be historic or considered extirpated within a county.

TPWD includes the Federal listing status for your convenience and makes every attempt to keep the information current and correct. However, the US Fish and Wildlife Service (FWS) is the responsible authority for Federal listing status. The TPWD lists do not substitute for contact with the FWS and federally listed species county ranges may vary from the FWS county level species lists because of the inexact nature of range map development and use.

Status Key:

LE, LT -	Federally Listed Endangered/Threatened
PE, PT -	Federally Proposed Endangered/Threatened
SAE, SAT -	Federally Listed Endangered/Threatened by Similarity of Appearance
C -	Federal Candidate for Listing; formerly Category 1 Candidate
DL, PDL -	Federally Delisted/Proposed for Delisting
NL -	Not Federally Listed
E, T -	State Listed Endangered/Threatened
NT -	Not tracked or no longer tracked by the State
"blank" -	Rare, but with no regulatory listing status

This information is specifically for your assistance only; due to continuing data updates, **please do not redistribute the lists**, instead refer all requesters to the web site at: http://www.tpwd.state.tx.us/landwater/land/maps/gis/ris/endangered_species/ or to our office for the most current information available. For questions regarding county lists, please call (512) 389-4571.

Please use the following citation to credit the source for this county level information:

Texas Parks and Wildlife Department, Wildlife Division, Diversity and Habitat Assessment Programs. County Lists of Texas' Special Species. [county name(s) and revised date(s)].

Element Occurrence Record

Scientific Name: Anaxyrus houstonensis

Occurrence #: 6 **Eo Id:** 968

Track Status: Track all extant and selected historical EOs

Common Name: Houston Toad

TX Protection Status: E

Global Rank: G1 **State Rank:** S1

Federal Status: LE

Location Information:

Watershed:

12070104 - Lower Brazos

County Name:

Fort Bend

State:

TX

Mapsheet:

29095-E4, Almeda

Directions:

2 MILES WEST OF FRESNO, FORT BEND COUNTY

Survey Information:

First Observation: 1953

Survey Date:

Last Observation:

Eo Type:

Eo Rank: D

Eo Rank Date:

Observed Area:

Comments:

General Description: SANDY SUBSTRATE. EPHEMERAL POOLS AND STOCK TANKS.

Comments: COLLECTED BY JOHN C. WATTRING. OLD, VAGUE LOCALITY RECORD.

Protection Comments:

Management Comments:

Data:

EO Data: NEEDS SAND SUBSTRATE, WATER IN POOLS. BREEDS IN FEBRUARY AFTER RAINS. RELICTUAL FROM MORE EQUABLE CLIMATE. OCCASIONALLY HYBRIDIZES WITH OTHER BUFO SP.

Managed Area:

Managed Area Name

Reference:

Citation:

BROWN, LAUREN E., 1971. NATURAL HYBRIDIZATION AND TREND TOWARD EXTINCTION IN SOME RELICT TEXAS TOAD POPULATIONS. SOUTHWESTERN NATURALIST 16(2):185-199.

BROWN, L.E., ET. AL., 1983. AGENCY REVIEW DRAFT OF THE RECOVERY PLAN FOR THE HOUSTON TOAD (BUFO HOUSTONENSIS). USF& WS, ALBUQUERQUE, NM. 48PP.

SANDERS, O. 1953. A NEW SPECIES OF TOAD WITH A DISCUSSION OF MORPHOLOGY OF THE BUFONID SKULL. HERPETOLOGICA 9:25-47.

Specimen:

Element Occurrence Record

Scientific Name: Chloris texensis

Occurrence #: 18 **Eo Id:** 1901

Track Status: Track all extant and selected historical EOs

Common Name: Texas windmill-grass

TX Protection Status:

Global Rank: G2 **State Rank:** S2

Federal Status:

Location Information:

Watershed:

12040104 - Buffalo-San Jacinto

County Name:

Harris

State:

TX

Mapsheet:

29095-F4, Bellaire

Directions:

AROUND AMERICAN LEGION LITTLE LEAGUE FIELD NEAR WESTBURY HIGH SCHOOL IN HOUSTON

Survey Information:

First Observation:

Survey Date:

Last Observation: 1976-11-11

Eo Type:

Eo Rank:

Eo Rank Date:

Observed Area:

Comments:

General Description: TIGHT BLACK CLAY SOIL IN MOWED AREA

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: COMMON; FLOWERING IN NOVEMBER 1976

Managed Area:

Managed Area Name

Reference:

Citation:

Specimen:

Southern Methodist University Herbarium. 1976. L.E. Brown #2121, Specimen # none SMU. 11 November 1976.

Element Occurrence Record

Scientific Name: Chloris texensis

Occurrence #: 32 **Eo Id:** 5581

Track Status: Track all extant and selected historical EOs

Common Name: Texas windmill-grass

TX Protection Status:

Global Rank: G2 **State Rank:** S2

Federal Status:

Location Information:

Watershed:

12040104 - Buffalo-San Jacinto

County Name:

Harris

State:

TX

Mapsheet:

29095-F6, Clodine

Directions:

A SMALL CROWDED POPULATION IN A VACANT FIELD ADJACENT TO A WAL-MART STORE ALONG BEECHNUT STREET JUST EAST OF HIGHWAY 6 IN SOUTHWEST HOUSTON

Survey Information:

First Observation: 1993

Survey Date:

Last Observation: 1993-11-12

Eo Type:

Eo Rank:

Eo Rank Date:

Observed Area:

Comments:

General Description: VACANT FIELD

Comments:

Protection Comments:

Management Comments:

Data:

EO Data: SMALL CROWDED POPULATION; ACCORDING TO LABEL, "THIS POPULATION WILL BE DESTROYED BY ENLARGEMENT OF THE PARKING LOT"

Managed Area:

Managed Area Name

Reference:

Citation:

Specimen:

TEXAS A & M UNIVERSITY, TRACY HERBARIUM. 1993. L.E. BROWN #17638, SPECIMEN # ? TAES. 12 NOVEMBER 1993.

Element Occurrence Record

Scientific Name: Haliaeetus leucocephalus

Occurrence #: 11 **Eo Id:** 3607

Track Status: Track all extant and selected historical EOs

Common Name: Bald Eagle

TX Protection Status: T

Global Rank: G4 **State Rank:** S3B,S3N **Federal Status:**

Location Information:

Watershed:

12070104 - Lower Brazos

County Name:

Fort Bend

State:

TX

Mapsheet:

29095-D6, Smithers Lake

29095-D5, Thompsons

Directions:

TERRITORY INCLUDES AREA +/- THREE MILE RADIUS CENTERED ON WORTHINGTON LAKE

Survey Information:

First Observation: 1982 **Survey Date:** 2003 **Last Observation:** 2002

Eo Type: **Eo Rank:** **Eo Rank Date:**

Observed Area:

Comments:

General Description: FOREST NEAR WATER

Comments: TPWD NEST NUMBERS 079-1A/B/C/D/E/F/G/H/I

Protection Comments:

Management Comments:

Data:

EO Data: NEST # 079-1A: 1982-1983 - NEST WAS INACTIVE; 1984 - THE NEST FELL. NEST # 097-1B: 1982 - NEST PRODUCED 2 YOUNG; 1983 - NEST PRODUCED 3 YOUNG; 1984-1987 - NEST WAS INACTIVE; 1988 - NEST WAS ACTIVE BUT PRODUCED 0 YOUNG; 1989 - THE NEST FELL. NEST # 079-1C: 1984 - NEST PRODUCED 2 YOUNG; 1985 - NEST WAS ACTIVE BUT PRODUCED 0 YOUNG; 1986 - NEST PRODUCED 1 YOUNG; 1987 - THE NEST FELL. NEST # 079-1D: 1989 - NEST WAS ACTIVE BUT PRODUCED 0 YOUNG; 1990-1992 - NEST WAS INACTIVE; 1993 - THE NEST FELL. NEST # 079-1E: 1990 - NEST WAS ACTIVE BUT PRODUCED 0 YOUNG; 1991-1992 - NEST WAS INACTIVE; 1993 - THE NEST FELL. NEST # 079-1F: 1990-1992 - NEST WAS INACTIVE; 1994 - THE NEST FELL. NEST # 079-1G: 1993 - NEST PRODUCED 1 YOUNG; 1997 - THE NEST FELL. NEST # 079-1H: 1995-1996 - NEST PRODUCED 1 YOUNG; 1997 - THE NEST FELL; 2001-2002 - NEST WAS INACTIVE. NEST # 079-1I: 1997-1998 - NEST WAS ACTIVE BUT PRODUCED 0 YOUNG; 1999 - NEST WAS INACTIVE; 2000-2001 - NEST PRODUCED 1 YOUNG; 2002 - NEST PRODUCED 2 YOUNG; 2003 - NEST WAS INACTIVE.

Element Occurrence Record

Managed Area:

Managed Area Name

Reference:

Citation:

MITCHELL, MARK. 1999. PROJECT NO. 30: BALD EAGLE NEST SURVEY AND MANAGEMENT. PERFORMANCE REPORT. AUGUST 31, 1999.

MITCHELL, MARK. 1997. MEMO TO SHANNON BRESLIN OF 30 JULY 1997 PROVIDING BALD EAGLE NESTING DATA, INCLUDING COUNTY MAPS WITH ESTIMATED TERRITORIES.

Polasek, Len. 1999. Chronological outcome of bald eagle nest surveys in Texas 1982-1999.

Polasek, Len G. 2000. Performance report Project No. 10: Bald eagle nest survey and management. Federal Aid Grant No. W-125-R-11. 31 August 2000.

Ortego, Brent. 2001. Performance Report Project No. 10: Bald eagle nest survey and management. Federal Aid Grant No. W-125-R-12. 30 September 2001.

Ortego, Brent. 2003. Chronological outcome of bald eagle nest surveys in Texas, 1982-2003.

Specimen:

Element Occurrence Record

Scientific Name: Haliaeetus leucocephalus

Occurrence #: 54 **Eo Id:** 7514

Track Status: Track all extant and selected historical EOs

Common Name: Bald Eagle

TX Protection Status: T

Global Rank: G4 **State Rank:** S3B,S3N **Federal Status:**

Location Information:

Watershed:

12070104 - Lower Brazos

County Name:

Fort Bend

State:

TX

Mapsheet:

29095-D6, Smithers Lake
29095-E6, Sugar Land
29095-E5, Missouri City
29095-D5, Thompsons

Directions:

TERRITORY INCLUDES AREA +/- THREE MILE RADIUS CENTERED ON SMITHERS LAKE

Survey Information:

First Observation: 1991 **Survey Date:** 2002 **Last Observation:** 2001

Eo Type: **Eo Rank:** **Eo Rank Date:**

Observed Area:

Comments:

General Description:

Comments: TPWD NEST #079-2A/B/C

Protection Comments:

Management Comments:

Data:

EO Data: NEST # 079-2A: 1991 - THE NEST FELL. NEST # 079-2B: 1991 - NEST PRODUCED 2 YOUNG; 1992 - NEST WAS INACTIVE; 1993 - THE NEST WAS DETERIORATING; 1994 - NEST WAS INACTIVE; 1995 - THE NEST FELL. NEST # 079-2C: 1992 - NEST PRODUCED 1 YOUNG; 1993 - NEST PRODUCED 2 YOUNG; 1994 - NEST PRODUCED 1 YOUNG; 1995 - NEST PRODUCED 2 YOUNG; 1996 - NEST PRODUCED 1 YOUNG; 1997-1998 - NEST WAS ACTIVE BUT PRODUCED 0 YOUNG; 1999 - NEST PRODUCED 2 YOUNG; 2000-2001 - NEST PRODUCED 1 YOUNG; 2002 - NEST WAS INACTIVE.

Managed Area:

Managed Area Name

Reference:

Citation:

MITCHELL, MARK. 1999. PROJECT NO. 30: BALD EAGLE NEST SURVEY AND MANAGEMENT. PERFORMANCE REPORT. AUGUST 31, 1999.

MITCHELL, MARK. 1997. MEMO TO SHANNON BRESLIN OF 30 JULY 1997 PROVIDING BALD EAGLE NESTING DATA, INCLUDING COUNTY MAPS WITH ESTIMATED TERRITORIES.

Polasek, Len. 1999. Chronological outcome of bald eagle nest surveys in Texas 1982-1999.

Polasek, Len G. 2000. Performance report Project No. 10: Bald eagle nest survey and management. Federal Aid Grant No. W-125-R-11. 31 August 2000.

Ortego, Brent. 2001. Performance Report Project No. 10: Bald eagle nest survey and management. Federal Aid Grant No. W-125-R-12. 30 September 2001.

Specimen:

Element Occurrence Record

Scientific Name: Haliaeetus leucocephalus

Occurrence #: 117 **Eo Id:** 1650

Track Status: Track all extant and selected historical EOs

Common Name: Bald Eagle

TX Protection Status: T

Global Rank: G4 **State Rank:** S3B,S3N **Federal Status:**

Location Information:

Watershed:

12070104 - Lower Brazos

12040205 - Austin-Oyster

County Name:

Fort Bend

State:

TX

Mapsheet:

29095-F6, Clodine

29095-E6, Sugar Land

Directions:

TERRITORY WEST OF SUGAR LAND, CENTERED ON OYSTER CREEK

Survey Information:

First Observation: 2000 **Survey Date:** 2002 **Last Observation:** 2000

Eo Type: **Eo Rank:** **Eo Rank Date:**

Observed Area:

Comments:

General Description:

Comments: TPWD NEST #079-4A

Protection Comments:

Management Comments:

Data:

EO Data: NEST # 079-4A: 2000 - NEST PRODUCED 1 YOUNG; 2001 - THE NEST DETERIORATED; 2002 - UNABLE TO LOCATE NEST.

Managed Area:

Managed Area Name

Reference:

Element Occurrence Record

Citation:

Ortego, Brent. 2001. Performance Report Project No. 10: Bald eagle nest survey and management. Federal Aid Grant No. W-125-R-12. 30 September 2001.

Ortego, Brent. 2002. Maps clarifying questions about bald eagle territory locations from the 2001 survey. 13 June 2002.

Polasek, Len G. 2000. Performance report Project No. 10: Bald eagle nest survey and management. Federal Aid Grant No. W-125-R-11. 31 August 2000.

Specimen:

Element Occurrence Record

Scientific Name: Hymenoxys texana

Occurrence #: 24 **Eo Id:** 7722

Track Status: Track all extant and selected historical EOs

Common Name: Texas prairie dawn

TX Protection Status: E

Global Rank: G2 **State Rank:** S2

Federal Status: LE

Location Information:

Watershed:

12040104 - Buffalo-San Jacinto

County Name:

Fort Bend

State:

TX

Mapsheet:

29095-F6, Clodine

Directions:

CA 0.45 MILES SOUTHWEST OF CLUBHOUSE LAKE ALONG BUFFALO BAYOU, CA 0.6 MILES NORTH OF BARKER DAM, NEAR PIPELINE, IN BARKER RESERVOIR.

Survey Information:

First Observation: 1988

Survey Date:

Last Observation: 2000-SPRG

Eo Type:

Eo Rank:

Eo Rank Date:

Observed Area: 1.00

Comments:

General Description: 1997-AREA BECOMING OVERGROWN

Comments: VOUCHER SPECIMEN NEEDS TO BE COLLECTED SINCE FORT BEND COUNTY REPRESENTS A NEW COUNTY RECORD IN 1988; BARROWS 1996 SOURCE CONTAINS MAPS AND DIRECTIONS; BARROWS 2001 SOURCE CONTAINS OCCURRENCE DATA (BHT 002, 003); 1996 DROUGHT YEAR - IN GENERAL, MAJORITY OF PLANTS UNDERSIZED AND DRIED UP

Protection Comments:

Management Comments:

Data:

EO Data: Site needs survey. Mr. Van Shipley of the Galveston Corps of Engineers sent topo-map plotted locations (no other data), based on his 1988 survey of Addicks - Barker reservoirs; 1993 - ca. 2000 healthy plants; 1994-95 - no data; 1996 - ca. 1500 dime-half dollar size rosettes (most plants dime-nickel size), one 8 stalked plant; 1997 - ca. 250 dime-quarter size rosettes; 1998 - ca. 260 dime sized rosettes; 1999 - 95 scattered plants (too late in season for accurate count), dime-nickel size rosettes; 2000 - ca. 300 scattered plants, dime-quarter size rosettes

Managed Area:

Managed Area Name

Reference:

Citation:

BARROWS, JAMES. 2001. E-MAIL TO SANDY BIRNBAUM CONTAINING HYMENOXYS TEXANA DATA. PERS.COMM. FEBRUARY 23, 2001.

BARROWS, JAMES. 1996. PERS.COMM. MAPS AND DIRECTIONS FOR HYMENOXYS TEXANA LOCATIONS IN ADDICKS AND BARKER RESERVOIRS SENT TO BILL CARR. JULY 31, 1996.

UNPUBLISHED MAP. U.S. CORPS OF ENGINEERS, GALVESTON DISTRICT. 1988. HYMENOXYS TEXANA LOCATIONS FROM 1988 SURVEY OF ADDICKS-BARKER RESERVOIRS BY VAN SHIPLEY.

Specimen:

University of Texas at Austin Herbarium. 1989. S.L. Orzell #9025 and E.L. Bridges, Specimen # ? TEX. 3 April 1989.

Element Occurrence Record

Scientific Name: Hymenoxys texana

Occurrence #: 53 **Eo Id:** 26

Common Name: Texas prairie dawn

Track Status: Track all extant and selected historical EOs

TX Protection Status: E

Global Rank: G2 **State Rank:** S2

Federal Status: LE

Location Information:

Watershed:

12040104 - Buffalo-San Jacinto

County Name:

Harris

State:

TX

Mapsheet:

29095-F4, Bellaire

Directions:

(Site 1) NORTH OF GASMER AND EAST OF SOUTH POST OAK, SOUTH OF SUBDIVISION; FOLLOW PIPELINE RIGHT-OF-WAY SOUTHEAST ACROSS PROPERTY TO 293911N, 0952725W, THEN HEAD NORTH TO 293913N, 0952724W and (Site 2) NORTH OF RAILROAD TRACKS, SOUTH OF SUBDIVISION; FOLLOW TRAIL MADE BY LOCAL RESIDENTS THROUGH FENCE SOUTH OF INTERSECTION OF WARM SPRINGS AND WILLOWILDE AND TURN LEFT AT FIRST SMALL SIDE TRAIL

Survey Information:

First Observation: 1999-03

Survey Date:

Last Observation: 1999-03

Eo Type:

Eo Rank: E

Eo Rank Date: 1999-03-18

Observed Area:

Comments:

General Description:

Comments:

Protection Comments:

Management Comments:

Data:

EO Data:

Managed Area:

Managed Area Name

Reference:

Element Occurrence Record

Citation:

BROWN, LARRY E. 1999. LETTER TO EDITH ERFLING OF USFWS-CLEAR LAKE OFFICE DATED 18 MARCH 1999 CONTAINING NEW HYMENOXYS TEXANA OCCURRENCES.

Specimen:

Element Occurrence Record

Scientific Name: Hymenoxys texana
Occurrence #: 55 **Eo Id:** 3565
Track Status: Track all extant and selected historical EOs
Common Name: Texas prairie dawn
TX Protection Status: E
Global Rank: G2 **State Rank:** S2 **Federal Status:** LE

Location Information:

Watershed:

12040104 - Buffalo-San Jacinto

County Name:	State:	Mapsheet:
Harris	TX	29095-F4, Bellaire

Directions:

(Site 1) BEHIND FOXFIRE FARMS ON WEST SIDE OF SOUTH POST OAK ROAD SOUTH OF INTERSECTION WITH ALLUM AND NORTH OF INTERSECTION WITH LOTUS and (Site 2) FOLLOW PIPELINE RIGHT-OF-WAY SOUTHWEST FROM LOTUS STREET WEST OF SOUTH POST OAK; AT INTERSECTION WITH POWERLINE RIGHT-OF-WAY TURN DUE WEST.

Survey Information:

First Observation: 1999-03 **Survey Date:** **Last Observation:** 1999-03
Eo Type: **Eo Rank:** E **Eo Rank Date:** 1999-03-18
Observed Area:

Comments:

General Description:

Comments:

Protection Comments:

Management Comments:

Data:

EO Data:

Managed Area:

Managed Area Name

Reference:

Citation:

BROWN, LARRY E. 1999. LETTER TO EDITH ERFLING OF USFWS-CLEAR LAKE OFFICE DATED 18 MARCH 1999 CONTAINING NEW HYMENOXYS TEXANA OCCURRENCES.

Specimen:

Element Occurrence Record

Scientific Name: Hymenoxys texana

Occurrence #: 58 **Eo Id:** 7785

Track Status: Track all extant and selected historical EOs

Common Name: Texas prairie dawn

TX Protection Status: E

Global Rank: G2 **State Rank:** S2

Federal Status: LE

Location Information:

Watershed:

12040104 - Buffalo-San Jacinto

County Name:

Fort Bend

State:

TX

Mapsheet:

29095-F6, Clodine

Directions:

SOUTH OF BUFFALO BAYOU, WEST OF LONG POINT SLOUGH; CA. 500' WEST OF CINCO ROAD BENEATH HL& P POWERLINES IN BARKER FLOOD CONTROL RESERVOIR

Survey Information:

First Observation: 1993

Survey Date:

Last Observation: 1998-SPRG

Eo Type:

Eo Rank:

Eo Rank Date:

Observed Area:

Comments:

General Description: POWERLINE RIGHT-OF-WAY

Comments: BARROWS 1996 SOURCE CONTAINS MAPS AND DIRECTIONS; BARROWS 2001 SOURCE CONTAINS OCCURRENCE DATA BHT 001; 1996 DROUGHT YEAR - IN GENERAL, MAJORITY OF PLANTS UNDERSIZED AND DRIED UP

Protection Comments:

Management Comments:

Data:

EO Data: 1993 - <200 plants, some with half dollar size rosettes; 1994-95 - no data; 1996 - 450 plants, nickel to quarter size rosettes, most plants northwest of stake; 1997 - no plants; 1998 - 15 plants, dime size rosettes; 1999 - 0 plants (too late in season for accurate count); 2000 - no data

Managed Area:

Managed Area Name

Reference:

Citation:

BARROWS, JAMES. 2001. E-MAIL TO SANDY BIRNBAUM CONTAINING HYMENOXYS TEXANA DATA. PERS.COMM. FEBRUARY 23, 2001.

BARROWS, JAMES. 1996. PERS.COMM. MAPS AND DIRECTIONS FOR HYMENOXYS TEXANA LOCATIONS IN ADDICKS AND BARKER RESERVOIRS SENT TO BILL CARR. JULY 31, 1996.

Specimen:

Element Occurrence Record

Scientific Name: Quercus virginiana-carya illinoensis series
Occurrence #: 7 **Eo Id:** 5295
Track Status: Track all extant and selected historical EOs
Common Name: Coastal Live Oak-pecan Series
TX Protection Status:
Global Rank: G3 **State Rank:** S3
Federal Status:

Location Information:

Watershed:

12070104 - Lower Brazos

County Name:	State:	Mapsheet:
Fort Bend	TX	29095-D5, Thompsons
Brazoria	TX	

Directions:

1.5 MILES NORTH OF INTERSECTION OF FM 1492 AND FM 762, WEST OF FM 762

Survey Information:

First Observation: 1986 **Survey Date:** 1986-06 **Last Observation:** 1986-06
Eo Type: **Eo Rank:** B **Eo Rank Date:**
Observed Area: 200.00

Comments:

General Description: PATCHY; BEST WOODLANDS ALONG BRAZOS RIVER CONTAIN OLD GROWTH LIVE OAK, PECAN, CEDAR ELM, RED OAK, SHUMARD OAK, HACKBERRY, AND HAWTHORN; GOOD SPECIES DIVERSITY FOR THIS COMMUNITY TYPE

Comments: ADJACENT UPLAND GRASSLANDS MOSTLY FAIR; UPLAND LIVE OAK-PECAN WOODLANDS GOOD

Protection Comments:

Management Comments:

Data:

EO Data:

Managed Area:

Managed Area Name

BRAZOS BEND STATE PARK

Reference:

Element Occurrence Record

Citation:

DIAMOND, D.D., I. BUTLER, N.J. CRAIG, AND T. FOTI. 1986. A SURVEY OF THE POTENTIAL NATIONAL NATURAL LANDMARKS OF THE WEST GULF COASTAL PLAIN: BIOTIC THEMES. USDOI, NPS, WASHINGTON, D.C.

Specimen:

Element Occurrence Record

Scientific Name: Rookery **Occurrence #:** 154 **Eo Id:** 7455

Track Status: Track all extant and selected historical EOs

Common Name:

TX Protection Status:

Global Rank: GNR **State Rank:** SNR **Federal Status:**

Location Information:

Watershed:

12070104 - Lower Brazos

County Name:	State:	Mapsheet:
Fort Bend	TX	29095-D6, Smithers Lake

Directions:

WORTHINGTON LAKE; SOUTH OF SMITHERS LAKE

Survey Information:

First Observation: 1978 **Survey Date:** **Last Observation:** 1988

Eo Type: **Eo Rank:** **Eo Rank Date:**

Observed Area:

Comments:

General Description: SWAMP; SHRUBS AND TREES TO 5 METERS; MAXIMUM ELEVATION UNKNOWN

Comments: COLONY NUMBER 600-320

Protection Comments:

Management Comments:

Data:

EO Data: NESTING COLONY OF THE CATTLE EGRET, ANHINGA

Managed Area:

Managed Area Name

Reference:

Element Occurrence Record

Citation:

TEXAS COLONIAL WATERBIRD SOCIETY AND TEXAS PARKS & WILDLIFE DEPARTMENT. 1986-1989. TEXAS COLONIAL WATERBIRD CENSUS SUMMARY. SPECIAL ADMINISTRATIVE REPORTS.

MULLINS, L.M. ET.AL. 1982. ET.SEQ. ATLAS & CENSUS OF TEXAS WATERBIRD COLONIES, 1973-1980. TX COLONIAL WATERBIRD SOCIETY.

Specimen:

Element Occurrence Record

Scientific Name: Rookery

Occurrence #: 586 **Eo Id:** 2530

Track Status: Track all extant and selected historical EOs

Common Name:

TX Protection Status:

Global Rank: GNR **State Rank:** SNR **Federal Status:**

Location Information:

Watershed:

12070104 - Lower Brazos

County Name:

Fort Bend

State:

TX

Mapsheet:

29095-D5, Thompsons
29095-D6, Smithers Lake
29095-C6, Damon
29095-C5, Otey

Directions:

PILANT LAKE, CA. 6 AIR MILES SOUTH OF SMITHERS LAKE

Survey Information:

First Observation:

Survey Date:

Last Observation: 1992

Eo Type:

Eo Rank:

Eo Rank Date:

Observed Area:

Comments:

General Description:

Comments: COLONY NUMBER 600-321

Protection Comments:

Management Comments:

Data:

EO Data: NESTING COLONY OF THE OLIVACEOUS CORMORANT, LITTLE BLUE HERON

Managed Area:

Managed Area Name

BRAZOS BEND STATE PARK

Reference:

Citation:

Wagner, Matt. 1992. Texas Colonial Waterbird Census Summary 1991 - 1992. Compiled for Texas Parks & Wildlife Dept. and Texas Colonial Waterbird Society. 1992.

Specimen:

Element Occurrence Record

Scientific Name: Thalictrum texanum

Occurrence #: 13 **Eo Id:** 7697

Track Status: Track all extant and selected historical EOs

Common Name: Texas meadow-rue

TX Protection Status:

Global Rank: G2Q **State Rank:** S2

Federal Status:

Location Information:

Watershed:

12040104 - Buffalo-San Jacinto

County Name:

Harris

State:

TX

Mapsheet:

29095-F4, Bellaire

Directions:

JUNCTION OF CLIFFWOOD AND MCDERMED ROADS, EAST AT 10 METERS AND 90 METERS UNDER POWERLINE IN WILLOW PARK

Survey Information:

First Observation: 2004-01-28 **Survey Date:** 2004-01-28 **Last Observation:** 2004-01-28

Eo Type: **Eo Rank:** **Eo Rank Date:**

Observed Area:

Comments:

General Description: MICRO-RELIEF, RELATIVELY FLAT TERRAIN WITH PLANTS GROWING ON HIGHER, SLIGHTLY MOUNDED FEATURES IN WILLOW PARK; SPOROBOLUS INDICUS AND STENOTAPHRUM SECUNDATUM DOMINANTS

Comments: HIGHLY DISTURBED AND MANICURED PARK

Protection Comments:

Management Comments:

Data:

EO Data: THREE SUBPOPULATIONS OF PLANTS UNDER POWERLINE GOING WEST TO EAST; SUBPOPULATION 1 IS CA. 150 INDIVIDUALS, SUBPOPULATION 2 IS 34 PLANTS, AND SUBPOPULATION 3 IS 7 PLANTS; PLANTS VEGETATIVE ONLY

Managed Area:

Managed Area Name

Reference:

Element Occurrence Record

Citation:

SINGHURST, JASON. 2004. FIELD NOTES ON THALICTRUM TEXANUM IN HARRIS AND WALLER COUNTIES, 28 JANUARY 2004.

Specimen:

BAYLOR UNIVERSITY HERBARIUM. 2004. JASON SINGHURST #12540 AND BILL CARR, SPECIMEN # ? BAYLU. 28 JANUARY 2004.

Managed Area Information

Managed Area Name: Brazos Bend State Park **Acres:** 4,897.00

Alias:

County Name:	Mapsheet Name:	Mapsheet Code:
Fort Bend	Thompsons	29095-D5
	Otey	29095-C5
	Smithers Lake	29095-D6
	Damon	29095-C6

Description:

BRAZOS RIVER FLOOD PLAIN; INCLUDES COASTAL PRAIRIE, LIVE OAK WOODLANDS, AND BOTTOMLAND MIXED HARDWOOD PLUS NUMEROUS MICRO-HABITATS, INCLUDING WETLANDS

Comments:

PARK HAS SUFFERED HUMAN, WILDLIFE, AND LIVESTOCK DAMAGE; MANAGEMENT OF FIRE ANTS, FERAL HOGS, AND WATER HYACINTHS IS UNDERWAY

Manager:

JERRY BARTEL
SUPERINTENDENT
21901 FM 762

NEEDVILLE,TX 77461
409 553-3243

Wildlife Diversity Section
Texas Parks and Wildlife

Note that the referenced Shapefiles are not included in this Study.

Texas Wildlife Diversity Database: Shapefile Data Interpretation and Use

In our database every element occurrence representation (EORep) is represented geographically as a polygon. The polygon is a combination of the geographic location of the reported observation and the locational uncertainty of the observation.

Data Conversion

Most of the data that was part of our previous database was maintained geographically as a point location consisting of a latitude and longitude. The point was one of three symbols, a circle, a triangle, and a square, that represented the "precision" of the occurrence. The three categories were seconds (circle) which was the highest precision, minutes (triangle) which was the mid precision and meant that the location could not be more accurately mapped based on available information than +/- 1 minute, and general (square) which was the least precise and used only when the location description was especially vague.

When the data from the previous database was converted to the new system the point data was converted to polygon data by taking the latitude and longitude and applying a buffer to that point location. The buffer that was applied to a point was based on the precision of that record. Records with a second precision received a buffer of 100 m radius, records with a minute precision received a buffer of 2000 m radius, and records with a general precision received a buffer of 8000 m radius. Now instead of point data, each record is a polygon in which the imprecision and uncertainty of the data is graphically represented.

Some of the data that was in the previous database was mapped on paper topographic maps as polygons with meaningful boundaries. Before the conversion to the new database each of the records with a boundary on a topographic map had that boundary digitized using ArcGis. When the conversion occurred those digital boundaries were used to represent those records in place of the point stored in the database. Because the care and precision with which the boundaries were initially mapped is unknown, each of the records with a boundary had a 100 m radius buffer applied to the boundary to achieve the final shape.

Data Interpretation

When viewing the shapefile data that has been provided, interpretation is not necessarily intuitive. Each record consists of at least one polygon, be that polygon a simple circle or a more complex boundary. However, a record may consist of numerous shapes that all combine to represent a single occurrence. An occurrence may consist of many observations over many years. What an occurrence of a species has in common is geographic proximity to other observations of that same species. By combining observations over time we develop a better representation of that species in a specific area. Distances used to decide if an observation should be part of an occurrence or not

can be found as part of the species information on the NatureServe Explorer web site (http://www.natureserve.org/explorer/) under the heading of EO Separation Distances.

When interpreting an occurrence as it is displayed on screen in a GIS application or on a map, the representation of that occurrence is the smallest feature that could be drawn that we are confident contains that occurrence inside its boundaries. Therefore, when analyzing an EORep, we are confident that the element in question (plant, animal, ...) could be found within the boundary of the EORep on the day it was observed. We cannot be certain where within that EORep the element occurred or what the distribution of the element was within the EORep. We only know that for the day(s) in question, the element could be found within the boundaries of the EORep. Further, the boundary of any EORep is not necessarily meant to indicate the total real extent of the element. The EORep is only meant to geographically represent the observation(s) in the best, most accurate way possible based on the available data. The absence of information on the map should not be interpreted as an absence of rare, threatened, or endangered species in that location. These data cannot provide a definitive statement as to the presence, absence, or condition of special species, natural communities, or other significant features in any area. Nor can these data substitute for on-site evaluation by qualified biologists. The Texas Wildlife Diversity Database information is intended to assist users in avoiding harm to rare species or significant ecological features.

Refer all requests for data or maps back to the Texas Wildlife Diversity Database to obtain the most current information. The Texas Wildlife Diversity Database is a dynamic database that changes almost daily. You are encouraged to request updates to data at least quarterly for ongoing long term projects.

If you have any questions about use or interpretation of the data please call Bob Gottfried (512)389-8744 or email to bob.gottfried@tpwd.state.tx.us.

06/29/2011 Version Date

Office Use Only
Date Received: _____(yyyy-mm-dd)
Sourcecode: U_____TXUS
EOR transcribed/updated by:_____(initials)_____(date)
Scientist Reviewer:_____(initials) EO id:_____

Texas Natural Diversity Database Reporting Form
Wildlife Diversity Program
Texas Parks and Wildlife Department
4200 Smith School Road
Austin, TX 78744 (512) 389-8111

We Need Your Help. If you have information on the location of a rare plant or animal and would like to help us build the Texas Natural Diversity Database, please complete the form below. Thank you!

It is assumed that data submitted to the TXNDD were obtained while in compliance with all Texas laws, including obtaining landowner permission before entering private property.

Instructions:

1. Complete this form for first hand field observations only.
2. DO NOT COMPLETE THIS FORM if the source of your information is a report, letter, conversation or other document. Send us the documentation.
3. Rare Birds: Complete this form only for observations during the breeding season or at large concentration areas during migration or in winter.
4. Attach a copy of a map (USGS 1:24,000 topographic map preferred) and mark the location of the rare species or its boundary (if known). Note, you may print copies of topo maps from the internet at http://www.topozone.com . Please use 1:24,000 or 1:25,000 scale only.

Source of Your Information: (check one of the following)

☐ Firsthand field observation Does the identification need to be confirmed? ☐yes ☐ no

☐ Other: Please do not complete this form; send us a copy of the documentation instead. If source is a conversation with someone, send us a note.

Form Completed By:

Name	Date	Phone

Identification:

Complete **only one form per rare plant or animal per site.** If you need a list of rare species we are currently tracking, contact our office.

Name of the rare plant or animal:	
Method of ID: (Source of key, photo, name of expert, other):	

Date First Observed:		Date Last Observed:	

Observer:

Name:	Address:	Phone:

Location:

GPS data:	Latitude:		Longitude:	
	Accuracy:		GPS Brand:	

Survey Site Name (locale or place name):	

Directions (describe in detail the precise location of the species or community; begin with an easily identifiable starting point, include nearby landmarks, street names, and mileages):

County:		Town:	
Name of USGS 7.5' topo (if known)			

06/29/2011 Version Date

Observation Data:

For Animals: Indicate the number of adults, juveniles, nests, etc.

For Plants: Indicate 1) the number of flowering plants and/or sterile stems, 2) the number of separate plant groupings, 3) the health of the plants, etc.

Size:

Please indicate the estimated area occupied by the plant or animal:

	Acres or		sq. meters

If the area occupied is long and narrow (less than 12.5 meters wide), please indicate:

Length (meters):		Width (meters):	

Habitat Description: Write a description of the habitat for the species at this location. Include ecological communities, dominants, associated species, substrates, soils, aspect, slope, hydrology, etc.

Managed Area (Name of the state or federally owned area):

Landscape (Describe the current landscape surrounding the plant or animal (i.e. farmland, residential, forest,etc.))

Current and Potential Threats:

Management Comments:

Specimen: Was a specimen taken? ☐ yes ☐ no

If yes, indicate the herbarium, collector(s) name(s) and number(s), accession #, and date collected:

Photograph: Was a photo taken? ☐ yes ☐ no If yes, ☐ slide ☐ print ☐ digital If possible, please submit a copy of the photo.

Is a copy included with the form? ☐ yes ☐ no

General Comments:

Guidelines Recommended by the U.S. Fish and Wildlife Service (FWS) For Communications Tower Siting, Construction, Operation, and Decommissioning

1. Collocation of the communications equipment on an existing communication tower or other structure (*e.g.*, billboard, water tower, or building mount) is strongly recommended. Depending on tower load factors, from 6 to 10 providers may collocate on an existing tower.

2. If collocation is not feasible and a new tower or towers are to be constructed, it is strongly recommended that the new towers are not more than 199 feet above ground level (AGL) and that construction techniques do not require guy wires (*e.g.*, use a lattice structure, monopole, etc.). Such towers should be unlighted if Federal Aviation Administration (FAA) regulations permit.

3. If constructing multiple towers, the cumulative impacts of all the towers to migratory birds and threatened and endangered species, as well as the impacts of each individual tower, should be considered.

4. If at all possible, new towers should be sited within existing "antenna farms" (clusters of towers). Towers should not be sited in or near wetlands, other known bird concentration areas (*e.g.*, state or Federal refuges, staging areas, rookeries), in known migratory or daily movement flyways, or in habitat of threatened or endangered species. Towers should not be sited in areas with a high incidence of fog, mist, and low ceilings.

5. If taller (>199 feet AGL) towers requiring lights for aviation safety must be constructed, the minimum amount of pilot warning and obstruction avoidance lighting required by the FAA should be used. Unless otherwise required by the FAA, only white (preferable) or red strobe lights should be used at night, and these should be the minimum number, minimum intensity, and minimum number of flashes per minute (longest duration between flashes) allowable by the FAA. The use of solid red or pulsating red warning lights at night should be avoided. Current research indicates that solid or pulsating (beacon) red lights attract night-migrating birds at a much higher rate than white strobe lights. Red strobe lights have not yet been studied.

6. Tower designs using guy wires for support, which are proposed to be located in known raptor or waterbird concentration areas, daily movement routes, major diurnal migratory bird movement routes or stopover sites, should have daytime visual markers on the wires to prevent collisions by these diurnally moving species. (For guidance on markers, see *Avian Power Line Interaction Committee (APLIC). 1994. Mitigating Bird Collisions with Power Lines: The State of the Art in 1994. Edison Electric Institute, Washington, D.C., 78 pp*, and *Avian Power Line Interaction Committee (APLIC). 1996. Suggested Practices for Raptor Protection on Power Lines. Edison Electric Institute/Raptor Research Foundation, Washington, D.C., 128 pp.* Copies can be obtained via the Internet at http://www.eei.org/resources/pubcat/enviro/ or by calling 1-800/334-5453).

7. Towers and appendant facilities should be sited, designed and constructed so as to avoid or minimize habitat loss within and adjacent to the tower "footprint". However, a larger tower footprint is preferable to the use of guy wires in construction. Road access and fencing should be

minimized to reduce or prevent habitat fragmentation and disturbance, and to reduce above ground obstacles to birds in flight.

8. If significant numbers of breeding, feeding, or roosting birds are known to habitually use the proposed tower construction area, relocation to an alternate site is recommended. If this is not an option, seasonal restrictions on construction is advised in order to avoid disturbance during periods of high bird activity.

9. In order to reduce the number of towers needed in the future, new towers should be structurally and electrically designed to accommodate the proposed antennas and comparable antennas for at least two additional users (minimum of three users for each tower structure). This does not apply if this would require that the design include additional lights or guy wires to an otherwise unlighted and/or unguyed tower.

10. Security lighting for on-ground facilities and equipment should be down-shielded to keep light within the boundaries of the site.

11. It is strongly recommended that FWS personnel or researchers from the Communication Tower Working Group be allowed access to the site to evaluate bird use, conduct dead-bird searches, place above ground net catchments below the towers, radar, Global Positioning System, infrared, thermal imagery, and acoustical monitoring equipment as necessary. This will allow for assessment and verification of bird movements and to gain information on the impacts of various tower sizes, configurations, and lighting systems.

12. Towers no longer in use or determined to be obsolete should be removed within 12 months of cessation of use.

13. In order to obtain information on the usefulness of these guidelines in preventing bird strikes, please advise FWS personnel of the final location and specifications of the proposed tower, and which of the measures recommended were implemented. If any of the recommended measures can not be implemented, please explain why they were not feasible. This will assist FWS in identifying any recurring problems with the implementation of the guidelines, which may necessitate modifications.

U.S. Fish & Wildlife Service

Endangered Species List

Back to Start

List of species by county for Texas:

Counties Selected: Fort Bend

Select one or more counties from the following list to view a county list:

Anderson
Andrews
Angelina
Aransas
Archer

View County List

Fort Bend County

Common Name	Scientific Name	Species Group	Listing Status	Species Image	Species Distribution Map	Critical Habitat	More Info
Texas prairie dawn-flower	*Hymenoxys texana*	Flowering Plants	E				P
whooping crane	*Grus americana*	Birds	E, EXPN				P

U.S. Fish & Wildlife Service

Endangered Species List

Back to Start

List of species by county for Texas:

Counties Selected: Harris

Select one or more counties from the following list to view a county list:

Anderson
Andrews
Angelina
Aransas
Archer

View County List

Harris County

Common Name	Scientific Name	Species Group	Listing Status	Species Image	Species Distribution Map	Critical Habitat	More Info
Texas prairie dawn-flower	*Hymenoxys texana*	Flowering Plants	E				P

Appendix F: Additional WWTP Consolidation Scenario

Conceptual capital and O&M costs were also developed for an additional (sixth) WWTP alternative based on comments from the utility districts during the final draft report review. The additional WWTP alternative is based on the concept of transferring wastewater flows from the three northernmost WWTPs (HCMUD #122, WCID-Fondren Road and SWHCMUD #1) to the WC&ID #2 wastewater system, to be treated at its proposed new WWTP, which is currently under planning and design.

Costs have been developed to determine improvements needed for the Study area, which under this scenario reflect a reduced total required treatment capacity of 14.9 MGD. The total capital costs include the Opinion of Probable Construction Cost (OPCC) plus additional engineering and construction overhead estimates.

Multiple advantages and disadvantages relate to this scenario, including, but not limited to:

- **Advantages**
    - Lowest life cycle cost of the various scenarios;
    - Eliminates the need to cross the WC&ID #2 area to send northernmost wastewater flows to the SB-FB WWTP;
    - Potentially lower wastewater rates due to economies of scale for treatment cost and lower O&M via a single treatment facility; and,
    - The existing administration for each utility district could still be maintained even though treatment would occur at only one location.
- **Disadvantages**
    - There may be existing debt service that would need to be incorporated into the costing scenarios, discussed earlier in Section 4, that could impact the direction taken in the consolidation scenarios;
    - Consolidation to a super-regional WWTP would require extensive coordination with the utility districts to operate and maintain multiple rate structures;
    - There could be a perceived loss of ownership and control of the local WWTPs by the utility districts; and,
    - Reduces the potential for total capture of all the City's current and future effluent produced to increase total bed and banks water rights.

Table F-1 Capital and O&M Costs for WWTP Scenario 6					
Item	**Description**	**OPCC**	**Total Capital Cost**	**Annual O&M Cost**	**30-Yr Life Cycle Cost**
1	Construct new transfer pump station to transfer SWHCMUD #1 plant flow to the new Fondren Road PS, includes PS and pipeline	$175,000	$248,000	$2,100	$290,000
2	Construction of a new pump station at the Fondren Road plant site to transfer flows to the HCMUD #122 PS, includes PS and pipeline	$681,250	$965,000	$3,300	$1,030,000
3	Construct a transfer PS at HCMUD #122 WWTP to transfer north plant flows to WC&ID #2, includes PS and pipeline	$379,500	$538,000	$9,900	$733,000
4	Construct a new transfer PS at the Blue Ridge West WWTP to transfer plant flow to the new Fort Bend County MUD #26 WWTP PS, includes PS and pipeline	$493,000	$699,000	$10,700	$909,000
5	Construct new transfer PS at Fort Bend County MUD #26 WWTP to transfer northeast plant flows to the new Palmer Plantation WWTP PS, includes PS and pipeline	$1,987,500	$2,815,000	$18,500	$3,178,000
6	Construct new transfer PS at Quail Valley UD WWTP to transfer plant flow to the SB-FB WWTP, includes PS and pipeline for raw wastewater and reuse PS and 6" pipeline to return 0.5 MGD effluent back to Quail Valley UD lake	$1,100,000	$1,558,000	$23,100	$2,011,000
7	Construct new transfer PS at Mustang Bayou WWTP to transfer plant flow to the new Palmer Plantation WWTP PS, includes PS and 10" pipeline	$868,750	$1,231,000	$19,000	$1,604,000
8	Construct a transfer PS at Palmer Plantation WWTP to transfer plant flow to SB-FB WWTP, includes PS and 18" pipeline	$1,040,000	$1,473,000	$32,000	$2,101,000
9	Construct new transfer PS in south Sienna area to transfer Sienna flow to new Sienna South WWTP PS, includes PS and 12" pipeline	$1,687,500	$2,390,000	$19,000	$2,763,000
10	Construct new transfer PS at Sienna South WWTP to transfer Sienna South flows to the new Sienna North WWTP PS, includes PS and 16" pipeline	$3,962,500	$5,611,000	$43,000	$6,454,000
11	Construct new transfer PS at Sienna North WWTP to transfer all south flows to the SB-FB WWTP, includes PS and 18" pipeline	$2,825,000	$4,001,000	$50,000	$4,982,000
12	Expand and upgrade SB-FB WWTP for growth and to handle remaining plant flows, including structure rehab and equipment replacement	$33,300,000	$47,153,000	$943,000	$65,637,000
TOTAL		**$48,500,000**	**$68,682,000**	**$1,173,600**	**$91,692,000**

Notes:

1 - This estimate assumes no offsite collection improvements are required.

2 - This estimate assumes that no other major capital improvements would be necessary during the project life.

3 - This estimate assumes a 30-yr improvement life, at an interest rate of 3%.

4.2.3 Wastewater Improvements Summary

The summary of the five main scenarios reviewed are provided in Table 4-38 Based on the review of the various project scenarios for the existing and proposed WWTPs, it appears that the most cost effective scenario is to convert the SB-FB WWTP into a super-regional treatment facility, and attempt to incorporate the northernmost WWTPs into the WC&ID #2 system. However, since this scenario would reduce the total available effluent for bed and banks credits, the City would need to coordinate closely with WC&ID #2 to determine if transferring the northernmost WWTP flows to the WC&ID #2 is really the best solution for the City in the future.

Table F-2
Summary of Capital and O&M Costs for WWTP Scenarios

Scenario Description	WWTPs Online in This Scenario	Projected Total Capital Cost	Projected Annual O&M Cost	Projected 30-Year Life Cycle Cost
Rehab/Expand all existing WWTPs as needed and construct new South Regional WWTP to continue use for 30 years (11 existing WWTPs plus 1 new WWTP)	Southwest Harris County MUD #1, Harris County MUD #122, Harris County MUD-Fondren Road, Blue Ridge West MUD, Fort Bend County MUD #26, Palmer Plantation, Quail Valley UD, SB-FB, Mustang Bayou, Sienna North, Sienna South, New Sienna Regional	$113,603,000	$3,475,000	$181,722,000
Consolidate WWTPs based on MUD engineering firm recommendations (7 existing WWTPs plus 1 new WWTP)	Southwest Harris County MUD #1, Harris County MUD-Fondren Road, Blue Ridge West MUD, Quail Valley UD, SB-FB, Mustang Bayou, Sienna North, New Sienna Regional	$105,191,000	$2,662,100	$157,378,000
Consolidate WWTPs to reduce total number of WWTPs using Quail Valley UD as a regional facility (4 existing WWTPs plus 1 new WWTP)	Harris County MUD-Fondren Road, Quail Valley UD, SB-FB, Mustang Bayou, New Sienna Regional	$99,036,000	$1,896,900	$136,224,000
Consolidate WWTPs to reduce total number of WWTPs using Blue Ridge West MUD as a regional facility (4 existing WWTPs plus 1 new WWTP)	Blue Ridge West MUD, Quail Valley UD, SB-FB, Mustang Bayou, New Sienna Regional	$99,874,000	$2,280,700	$144,586,000
Consolidate WWTPs to reduce total number of WWTPs using SB-FB as the only regional WWTP facility (1 existing WWTP)	SB-FB	$82,689,000	$1,331,400	$108,792,000
Consolidate WWTPs to reduce total number of WWTPs using WC&ID #2 and SB-FB as regional facilities (1 existing WWTP plus 1 offsite WWTP)	SB-FB, WC&ID #2 WWTP	$68,682,000	$1,173,600	$91,692,000

This Technical Memorandum summarizes the findings of Task II of the City of Missouri City Regional Water and Wastewater Planning Study (the Study). The focus of Task II of the Study is the determination of Water System Demands for the Study area.

Activities in Task II included the following:

- ✓ Delineate Service Areas;
- ✓ Develop water demand factors;
- ✓ Compile population projections;
- ✓ Compare and discuss differences between population projections (City data vs. TWDB);
- ✓ Develop maps of existing and future development in 5-year increments over the 30-year planning horizon;
- ✓ Develop water demand by service areas over the 30-year planning horizon;
- ✓ Develop a map showing existing water distribution and treatment facilities; and,
- ✓ Prepare a technical memorandum summarizing the findings.

Service Areas

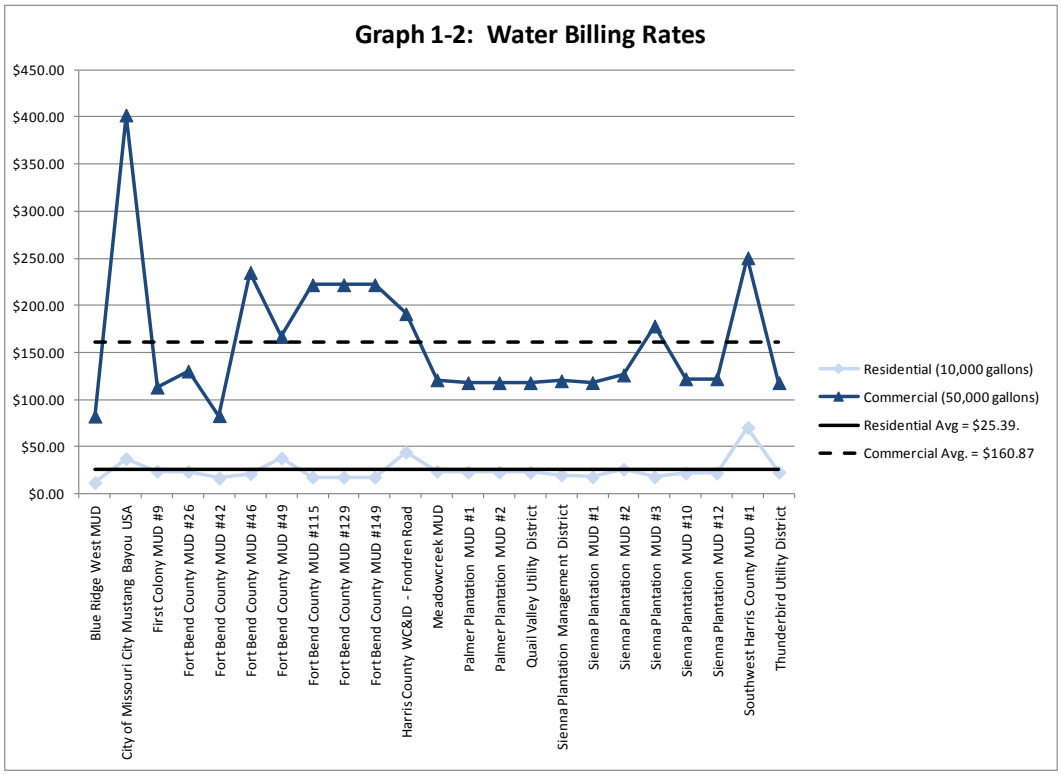
The Study, in geographic terms, includes the current City limits of Missouri City, as well as its ETJ. As stipulated by Chapter 42 of the Texas Local Government Code, based on city population size, Missouri City's ETJ extends 3.5 miles beyond the City limits. Within the Study area there are 30 participating utility districts. Exhibit 1-2 shows the Study area and participants and delineates the service area of each participating utility district. It should be noted that Fort Bend County MUD #23 and #24 are not included since they are outside of the City's ETJ. Fort Bend County WC&ID #2 is also not included due to the fact that it is in three separate jurisdictions (Missouri City, Stafford and Sugar Land).

Current Billing Rates

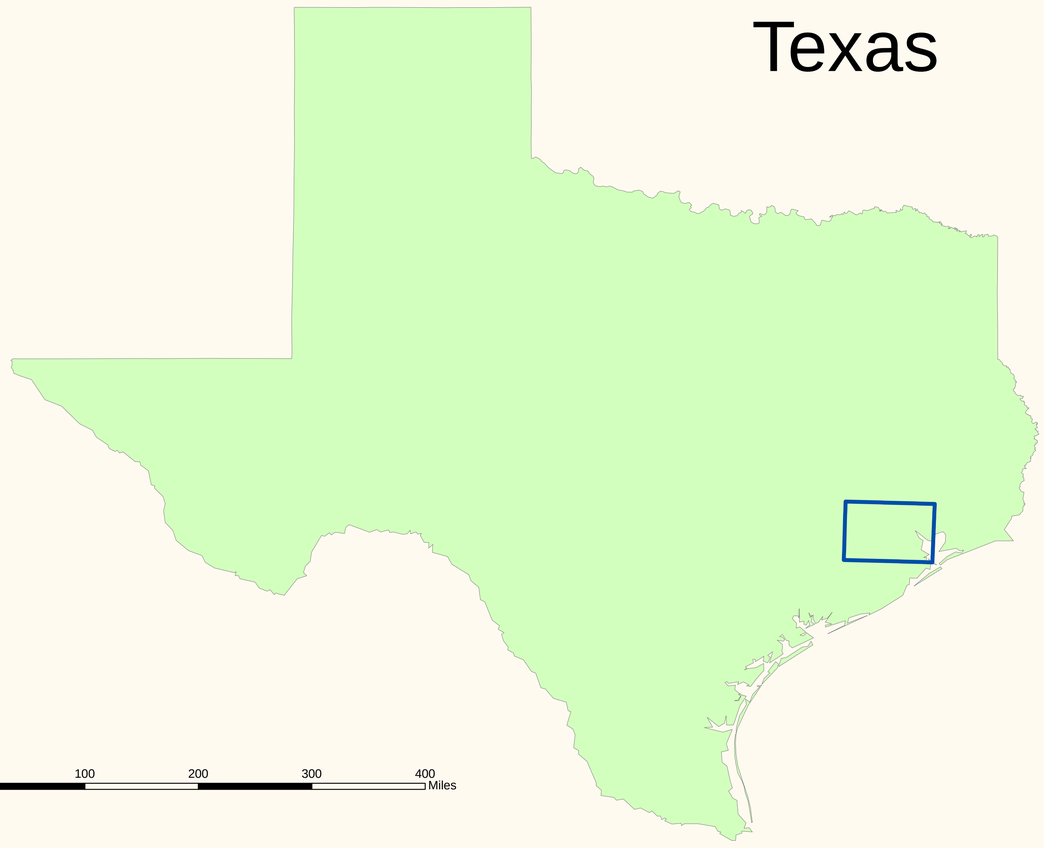
Each utility district individually sets its rates for water service. Because each district is currently at a different stage of build out, the rates paid by customers vary within the Study area. Newer utility districts that are still constructing additional facilities as they grow and are also continuing to pay back debt on recently constructed facilities have higher rates than the older utility districts which have been completely built out and have repaid all or a large portion of their debt. Each utility district provided its billing rates for water service, as well as their average monthly usage and amount billed.

The average monthly water usage throughout the Study area was calculated as 10,000 gallons per month for a residential connection and 50,000 gallons per month for a commercial connection. Using the current billing rates for each utility district, the monthly cost for the average usage was

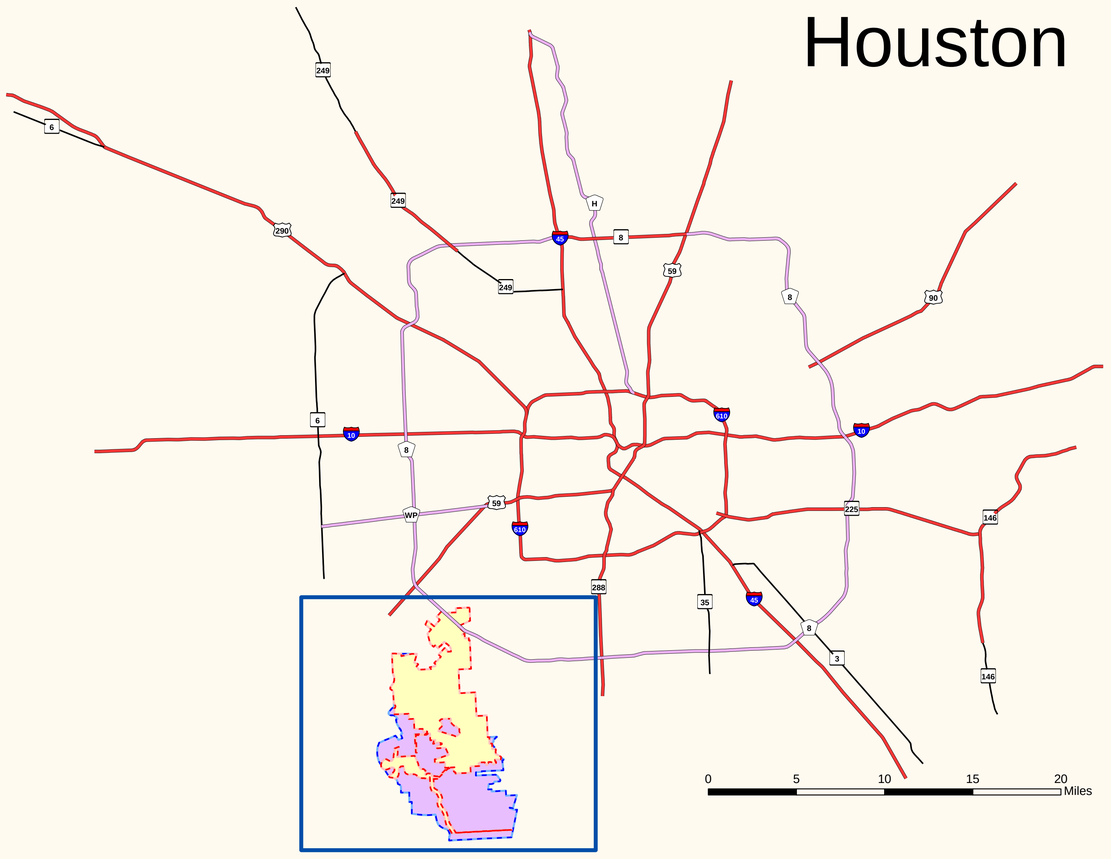
calculated to use as a comparison between individual districts. Graph 1-2 shows the varying costs in each district for water billing rates.

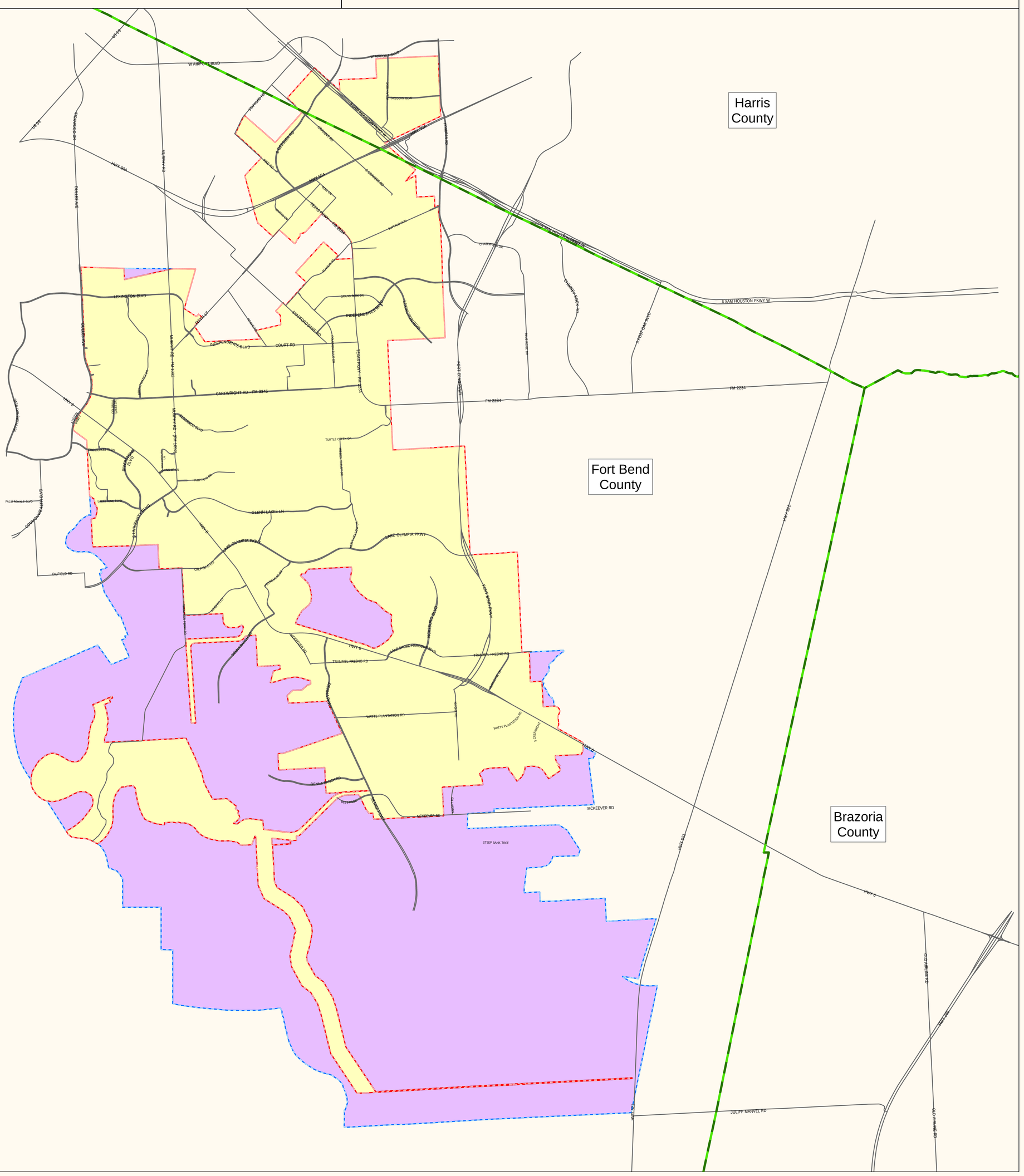


Texas



Houston





Map By:
GIS Division
September 2011

Exhibit 1-1 Missouri City Location Map

Legend

- County Lines
- City Limits
- ETJ

0 4,000 8,000 16,000 24,000 Feet

Geographic Coordinate System North American Datum 1983 (NAD83)

The information on this map is provided and maintained by various agencies, including county departments, municipal governments, state and federal agencies. The map is designed to serve as a secondary representation of real property found within this jurisdiction, and is compiled from the recorded deeds, plats, and other public records, which are primary sources for this public information. The data layers do not take the place of a legal survey or other primary source documentation.The City and its vendors assume no legal responsibility for the information on this map.

Water Demand Factors

The expected water demand was obtained by multiplying the number of connections by the average usage per connection per month. The average usage per connection per month was calculated in the Joint GRP by dividing the annual pumpage by the connection count times 12 months. Those districts that are not included in the Joint GRP directly provided their average usage per connection per month.

Population Projections

The methodology for determining the Study area population projections was taken from the City's Joint GRP. The starting point was the actual connection counts in each utility district which were taken from the Joint GRP and then updated using 2010 data from the utility districts. The assumptions of expected growth patterns were taken from the Joint GRP and the connection counts were projected in 5-year increments to the year 2040 and ultimate build-out. The connection counts were multiplied by the average persons per housing unit to determine the population of each utility district service area. The average persons per housing unit was developed using data from the 2010 Census. The 2010 Census data was recently released and the new totals for the City are 81,079 persons and 26,433 occupied housing units, resulting in an updated population density of 3.07 persons per connection.

Connections

The current 2010 connections for Study participants vary from 18 to 4,423 for a total of 29,019 connections for the Study area. The 2010 total connections for the Study area are 29,019 and increase to 60,539 by 2040. Table 1-3 shows the current and projected connection counts for each utility district and the total for the Study area. Currently the Study area is at 47% build-out and increasing to 98% build-out by 2040.

Table 1-3
Current and Projected Connection Counts

District	Current Connections (2010)	2015	2020	2025	2030	2035	2040	Build Out Connection Count
Sienna Plantation Management District	69	84	150	225	300	375	450	453
Sienna Plantation MUD #1	18	18	19	20	21	23	25	25
Sienna Plantation MUD #2	1,784	1,784	1,784	1,784	1,784	1,784	1,784	1,784
Sienna Plantation MUD #3	2,455	2,455	2,455	2,455	2,455	2,455	2,455	2,455
Sienna Plantation MUD #4, 5, 6, 7	0	600	2,600	5,600	8,600	10,000	10,000	10,000
Sienna Plantation MUD #10	1,376	1,796	1,996	2,196	2,396	2,433	2,433	2,433
Sienna Plantation MUD #12	151	235	547	1,087	1,423	1,439	1,439	1,439
Sienna Plantation MUD #13	0	0	165	440	715	990	1,194	1,194
Fort Bend MUD #129	1,015	1,463	1,550	1,550	1,550	1,550	1,550	1,550
Fort Bend MUD #149	125	970	1,700	1,700	1,700	1,700	1,700	1,700

Table 1-3
Current and Projected Connection Counts

District	Current Connections (2010)	2015	2020	2025	2030	2035	2040	Build Out Connection Count
Blue Ridge West MUD	2,494	2,503	2,507	2,507	2,507	2,507	2,507	2,509
First Colony MUD #9	2,677	2,727	2,777	2,827	2,877	2,927	2,977	3,300
Fort Bend County MUD #115	548	567	580	580	580	580	580	580
Fort Bend County MUD #26	1,484	1,484	1,490	1,500	1,510	1,520	1,530	2,145
Fort Bend County MUD #42	1,303	1,408	1,507	1,507	1,507	1,507	1,507	1,507
Fort Bend County MUD #46	771	960	1,035	1,035	1,035	1,035	1,035	1,073
Fort Bend County MUD #47	533	825	942	942	942	942	942	1,000
Fort Bend County MUD #48	634	641	716	837	957	1,077	1,197	1,370
Fort Bend County MUD #49	340	356	364	370	375	380	385	396
Meadow Creek MUD	888	933	943	953	963	973	983	985
Palmer Plantation MUD #1	599	680	702	707	712	717	722	798
Palmer Plantation MUD #2	813	872	894	904	914	924	934	1,000
Quail Valley Utility District	4,423	4,423	4,431	4,514	4,514	4,514	4,514	4,514
Thunderbird Utility District	1,916	1,916	1,922	1,932	1,942	1,952	1,962	1,986
City of Missouri City Mustang Bayou USA	649	1,340	2,050	2,760	3,044	3,044	3,044	3,178
City of Missouri City Mustang Bayou USA Phase 2	0	0	1,365	3,640	5,915	8,190	9,095	9,095
Harris County MUD #122	410	480	550	622	693	714	714	714
Southwest Harris County MUD #1	527	684	842	1,000	1,157	1,315	1,315	1,315
Harris County WC&ID - Fondren Road	1,017	1,128	1,252	1,409	1,534	1,566	1,566	1,566
Total Estimated Connections	**29,019**	**33,332**	**39,835**	**47,603**	**54,622**	**59,133**	**60,539**	**62,064**

Population

From year 2010 to 2040 the Study area is projected to increase from 89,088 to 185,855 persons – an additional 96,767 persons over the next 30 years or approximately 3,225 persons per year. Table 1-4 shows the current and projected population for each utility district and the total for the Study area.

Table 1-4
Current and Projected Population Counts

District	Current Population (2010)	2015	2020	2025	2030	2035	2040	Build Out Population Estimate
Sienna Plantation Management District	212	258	461	691	921	1,151	1,382	1,391
Sienna Plantation MUD #1	55	55	58	61	64	71	77	77
Sienna Plantation MUD #2	5,477	5,477	5,477	5,477	5,477	5,477	5,477	5,477
Sienna Plantation MUD #3	7,537	7,537	7,537	7,537	7,537	7,537	7,537	7,537
Sienna Plantation MUD #4, 5, 6, 7	0	1,842	7,982	17,192	26,402	30,700	30,700	30,700
Sienna Plantation MUD #10	4,224	5,514	6,128	6,742	7,356	7,469	7,469	7,469
Sienna Plantation MUD #12	464	721	1,679	3,337	4,369	4,418	4,418	4,418
Sienna Plantation MUD #13	0	0	507	1,351	2,195	3,039	3,666	3,666
Fort Bend MUD #129	3,116	4,491	4,759	4,759	4,759	4,759	4,759	4,759

Table 1-4
Current and Projected Population Counts

District	Current Population (2010)	2015	2020	2025	2030	2035	2040	Build Out Population Estimate
Fort Bend MUD #149	384	2,978	5,219	5,219	5,219	5,219	5,219	5,219
Blue Ridge West MUD	7,657	7,684	7,696	7,696	7,696	7,696	7,696	7,703
First Colony MUD #9	8,218	8,372	8,525	8,679	8,832	8,986	9,139	10,131
Fort Bend County MUD #115	1,682	1,741	1,781	1,781	1,781	1,781	1,781	1,781
Fort Bend County MUD #26	4,556	4,556	4,574	4,605	4,636	4,666	4,697	6,585
Fort Bend County MUD #42	4,000	4,323	4,626	4,626	4,626	4,626	4,626	4,626
Fort Bend County MUD #46	2,367	2,947	3,177	3,177	3,177	3,177	3,177	3,294
Fort Bend County MUD #47	1,636	2,533	2,892	2,892	2,892	2,892	2,892	3,070
Fort Bend County MUD #48	1,946	1,968	2,198	2,570	2,938	3,306	3,675	4,206
Fort Bend County MUD #49	1,044	1,093	1,117	1,136	1,151	1,167	1,182	1,216
Meadow Creek MUD	2,726	2,864	2,895	2,926	2,956	2,987	3,018	3,024
Palmer Plantation MUD #1	1,839	2,088	2,155	2,170	2,186	2,201	2,217	2,450
Palmer Plantation MUD #2	2,496	2,677	2,745	2,775	2,806	2,837	2,867	3,070
Quail Valley Utility District	13,579	13,579	13,603	13,858	13,858	13,858	13,858	13,858
Thunderbird Utility District	5,882	5,882	5,901	5,931	5,962	5,993	6,023	6,097
City of Missouri City Mustang Bayou USA	1,992	4,114	6,294	8,473	9,345	9,345	9,345	9,756
City of Missouri City Mustang Bayou USA Phase 2	0	0	4,191	11,175	18,159	25,143	27,922	27,922
Harris County MUD #122	1,259	1,474	1,689	1,910	2,128	2,192	2,192	2,192
Southwest Harris County MUD #1	1,618	2,100	2,585	3,070	3,552	4,037	4,037	4,037
Harris County WC&ID - Fondren Road	3,122	3,463	3,844	4,326	4,709	4,808	4,808	4,808
Total Estimated Population	**89,088**	**102,329**	**122,293**	**146,141**	**167,690**	**181,538**	**185,855**	**190,536**

The comparisons between population numbers from the various sources of population data are presented in Table 1-5.

Table 1-5
Comparison of Population Estimates

Population Source	2010	2015	2020	2025	2030	2035	2040
Joint GRP Population Estimate	94,100	110,796	127,887	147,732	166,282	N/A	N/A
TWDB Population Estimate[1]	97,432	N/A	119,825	N/A	140,479	N/A	161,405
Study Population Estimates	89,088	102,329	122,293	146,141	167,690	181,538	185,855
2010 Census Count	81,079						

Notes:
1 - TWDB Population Estimates were taken from the 2011 Regional Water Plan for Region H. Available online at http://www.twdb.state.tx.us/wrpi/rwp/rwp.asp

As shown in this table the population estimates only vary slightly from each other and the Census total; therefore, the population numbers were assumed to be accurate. However; there were some notable differences between these estimates and the Census total which are discussed below.

- The totals included in the Joint GRP included Fort Bend County MUD #23 & #24. These MUDs were not included in this Study and therefore were removed from this estimate.

- Harris County MUD #122, Harris County WC&ID-Fondren Road, and Southwest Harris County MUD #1 were not included in the Joint GRP.

- There is a large section of Fort Bend County WC&ID #2 within the incorporated limits of the City. This district is not part of the Study and, therefore was not accounted for in this estimate. It is assumed that the population within this area is accounted for in the TWDB estimates and in the Census count.

- The TWBD Region H estimates identify separate totals for First Colony MUD #9, Missouri City (Fort Bend County), Missouri City (Harris County), and Sienna Plantation MUD #2. These individual totals were summed to reach the numbers listed in Table 1-5. There were no other areas except for Sienna Plantation MUD #2 identified within the ETJ. Therefore it is not clear whether these numbers cover the entire ETJ included in this Study.

- The 2010 Census data used was for the City was listed as "Missouri City (City)" and the Sienna Plantation was listed with the qualifier "Census Designated Place (CDP)". Because the Census tract boundaries do not match directly with the Study area limits, there is likely to be additional population accounted for in these totals which is not included in this Study.

Existing and Future Development Areas

While many of the older neighborhoods in the northern portions of the City are already built out, many of the southern neighborhoods are still rapidly growing. The City Planning Department has established Development Ordinances along with the City's Zoning and Subdivision Ordinances which set the guidelines for future growth and redevelopment within the City. The Planning Department has developed a Comprehensive Plan which designates the pattern and intended character of future development. Table 1-16 presents the projected land area of each character district.

Table 1-16
Missouri City Future Land Use & Character

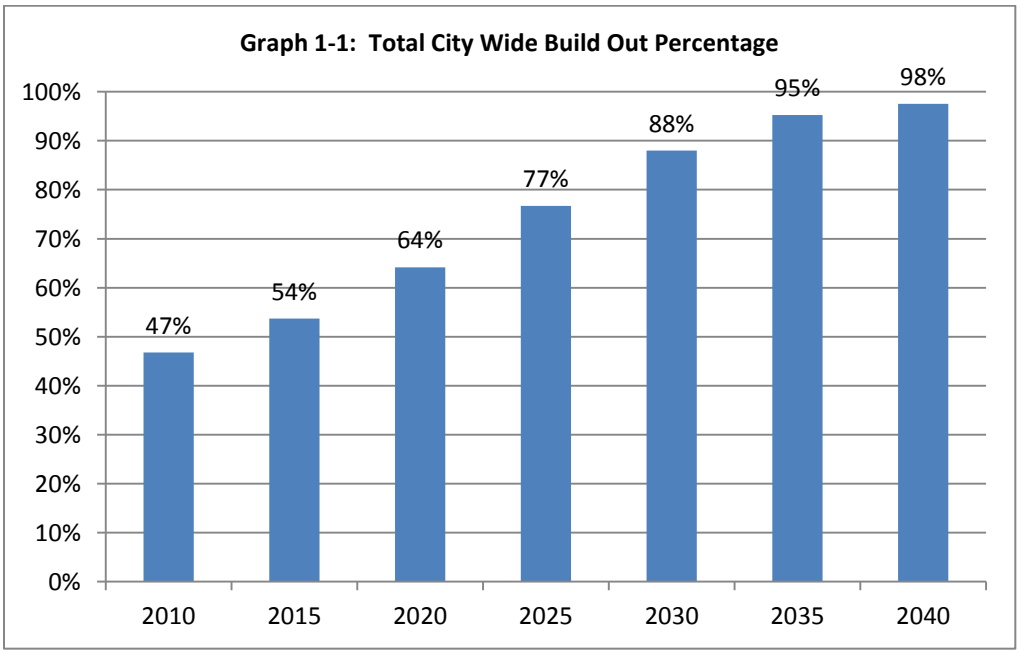
Designation	Acreage	Percent of Total
Rural	1,120.6	6.8%
Estate	2,048.7	12.4%
Suburban Residential	2,989.8	18.1%
Single-Family Residential	2,703.4	16.4%

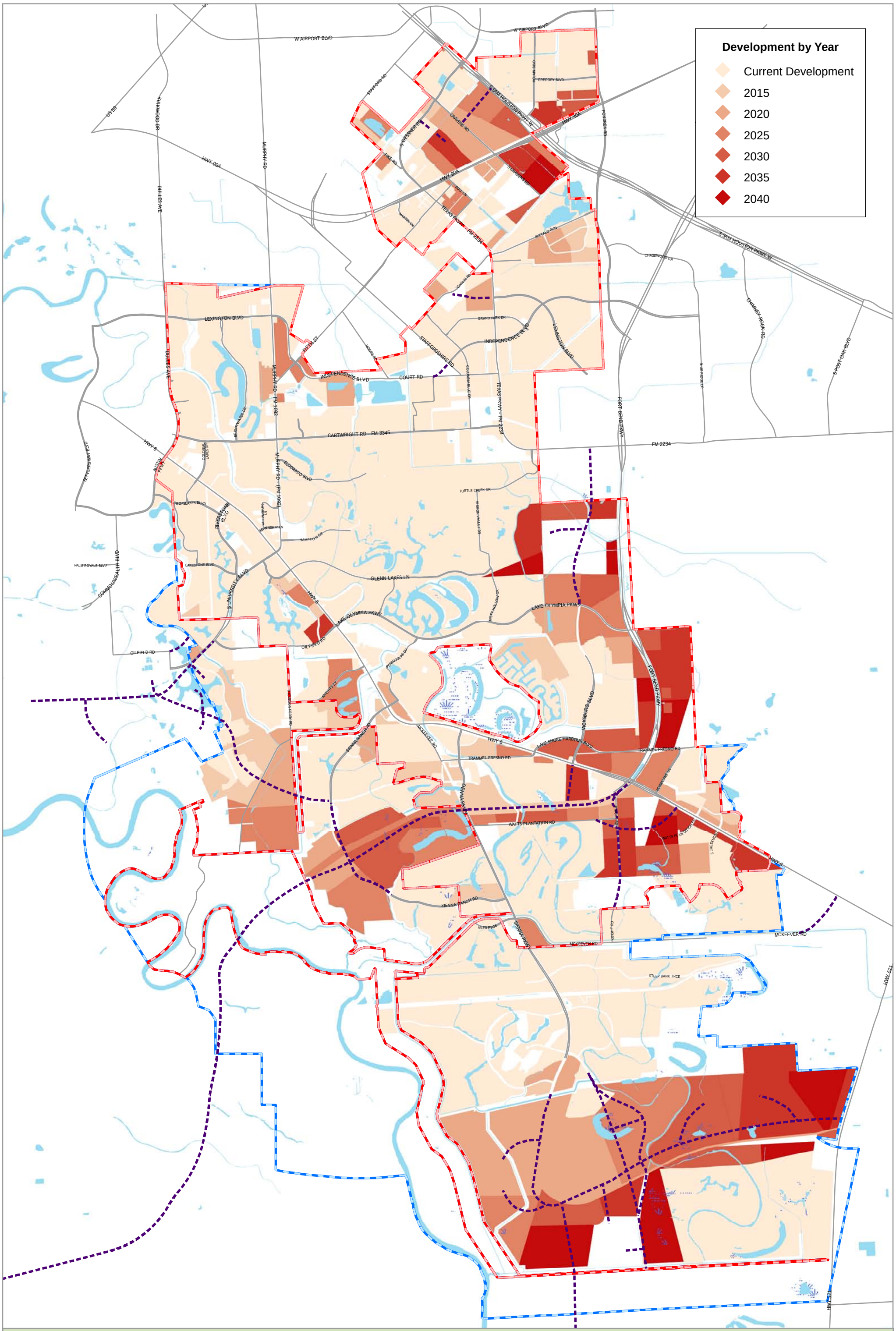
Table 1-16
Missouri City Future Land Use & Character

Designation	Acreage	Percent of Total
Multi-Family Residential	324.2	2.0%
Suburban Commercial	1,005.4	6.1%
Commercial	1,067.3	6.5%
Urban	98.8	0.6%
Business Park	2,213.9	13.4%
Community Facility	486.5	2.9%
Park & Recreation	1,326.1	8.0%
Water	1,144.3	6.9%
Total	**16,529**	**100.0%**

The majority of the future development within the City will occur in the southern portion of the City within three major subdivisions. These subdivisions are Riverstone, Sienna Plantation and the Sienna South development. These developments have adopted individual master plans in accordance with the City's Comprehensive Plan. In order to estimate areas of future development for each of the Study's five year increments, copies of these master plans were obtained along with traffic impact analyses and discussions with the City's Planning Department Staff. Using this information Exhibit 1-8 was prepared which shows the project growth areas throughout the City.

A graphic representation of the City-wide build out percentage was also put together based on the projected connection counts presented in Table 1-3. The build out percentage was determined by dividing the build out connection count by each of the five year planning study increments. The current build out percentage of the City is 47% and is estimated to reach 98% by the year 2040. Complete results are presented in Graph 1-1.




Development by Year
Current Development
2015
2020
2025
2030
2035
2040
W AIRPORT BLVD
US-59
KIRKWOOD DR
DULLES AVE
MURPHY RD
HWY 90A
STAFFORD RD
S GESSNER RD
GRAVES RD
S SAM HOUSTON PKWY W
MCCRARY RD
GREGORY BLVD
FONDREN RD
PIKE RD
S GRAVES RD
BILL LN
MARTIN LN
TEXAS PKWY - FM 2234
BUFFALO RUN
CHASEWOOD DR
SCANLON RD
GRAND PARK DR
LEXINGTON BLVD
FIFTH ST
MOORE RD
STAFFORDSHIRE RD
INDEPENDENCE BLVD
COURT RD
COLUMBIA BLUFF DR
BLUE RIDGE DR
CHIMNEY ROCK RD
S POST OAK BLVD
FORT BEND PKWY
FM 2234
LEXINGTON BLVD
MURPHY RD - FM 1092
BRIGHTWATER DR
CARTWRIGHT RD - FM 3345
HWY 6
AUSTIN PKWY
COLONIAL LAKES DR
ELDORADO BLVD
TURTLE CREEK DR
MISSION VALLEY DR
SETTLERS WAY BLVD
CROSSLAKES BLVD
RIVERSTONE BLVD
TOWNSHIP LN
HAMPTON DR
PALM ROYALE BLVD
LAKESTONE BLVD
COMMONWEALTH BLVD
S UNIVERSITY BLVD
GLENN LAKES LN
LAKE OLYMPIA PKWY
MISTY HOLLOW DR
OILFIELD RD
PENNSYLVANIA DR
KNIGHTS CT
HUNTINGTON FERRY RD
SIENNA RANCH RD
MCKEEVER RD
VICKSBURG BLVD
HURRICANE LN
SIENNA PKWY
WATTS PLANTATION RD
S CREEKMONT
KNIGHT RD
BEES PSGE
STEEP BANK TRCE
HWY 521
Map By:
GIS Division
October 2011
Exhibit 1-8
Projected Growth Areas
Legend
Hydro
Marsh
Proposed Major Thoroughfares
City Limits Line
ETJ Line
Geographic Coordinate System North American Datum 1983 (NAD83)
0 2,000 4,000 6,000 8,000 Feet
The information on this map is provided and maintained by various agencies, including county departments, municipal governments, state and federal agencies. No guarantee is given as to the accuracy or currency of any of the data. The map is designed to serve as a secondary representation of real property found within this jurisdiction, and is compiled from the recorded deeds, plats, and other public records, which are primary sources for this public information. Users of this map are hereby notified that these primary sources should be consulted for verification of the information presented here. The data layers do not take the place of a legal survey or other primary source documentation. The county and its vendors assume no legal responsibility for the information on this map.

Water Demand for the 30-Year Planning Period

A key step in this Study is the development of population/water demands projections for each entity in the Study area. Data on existing water usage was collected from several sources to form the basis of the projections for future demand. Data from the Joint GRP was used, along with additional data acquired from the utility districts not participating in the Joint GRP, to prepare the existing and projected water demands within the Study area.

In using the same process as the Joint GRP, the average water usage per connection per month was multiplied by the total number of connections. The monthly water usage for all districts was summed and multiplied by 12 months to obtain the annual water usage. The data for the average water usage per connection was obtained from the Joint GRP, or directly from the utility districts, if provided.

The current water demand is 12.4 MGD for the Study area with a projected water demand in year 2040 of 26.7 MGD and a build-out demand of 27.3 MGD. Table 1-6 shows the current and projected water demand for each utility district and the total for the Study area.

Table 1-6
Current and Projected Monthly Water Demand

District	Average Usage Per Connection Per Month (Gallons)	Current Water Demand (2010)	2015	2020	2025	2030	2035	2040	Build Out Water Demand
Sienna Plantation Management District	64,350	4,440,150	5,405,400	9,652,500	14,478,750	19,305,000	24,131,250	28,957,500	29,150,550
Sienna Plantation MUD #1	81,425	1,465,650	1,465,650	1,547,075	1,628,500	1,709,925	1,872,775	2,035,625	2,035,625
Sienna Plantation MUD #2	14,618	26,078,512	26,078,512	26,078,512	26,078,512	26,078,512	26,078,512	26,078,512	26,078,512
Sienna Plantation MUD #3	14,618	35,887,190	35,887,190	35,887,190	35,887,190	35,887,190	35,887,190	35,887,190	35,887,190
Sienna Plantation MUD #4, 5, 6, 7	14,618	0	8,770,800	38,006,800	81,860,800	125,714,800	146,180,000	146,180,000	146,180,000
Sienna Plantation MUD #10	14,618	20,114,368	26,253,928	29,177,528	32,101,128	35,024,728	35,565,594	35,565,594	35,565,594
Sienna Plantation MUD #12	14,618	2,207,318	3,435,230	7,996,046	15,889,766	20,801,414	21,035,302	21,035,302	21,035,302
Sienna Plantation MUD #13	14,618	0	0	2,411,970	6,431,920	10,451,870	14,471,820	17,453,892	17,453,892
Fort County	22,008	22,338,120	32,197,704	34,112,400	34,112,400	34,112,400	34,112,400	34,112,400	34,112,400

Table 1-6
Current and Projected Monthly Water Demand

District	Average Usage Per Connection Per Month (Gallons)	Current Water Demand (2010)	2015	2020	2025	2030	2035	2040	Build Out Water Demand
Bend MUD #129									
Fort Bend County MUD #149	11,873	1,484,125	11,516,810	20,184,100	20,184,100	20,184,100	20,184,100	20,184,100	20,184,100
Blue Ridge West MUD	11,538	28,775,772	28,879,614	28,925,766	28,925,766	28,925,766	28,925,766	28,925,766	28,948,842
First Colony MUD #9	12,372	33,119,844	33,738,444	34,357,044	34,975,644	35,594,244	36,212,844	36,831,444	40,827,600
Fort Bend County MUD #115	22,008	12,060,384	12,478,536	12,764,640	12,764,640	12,764,640	12,764,640	12,764,640	12,764,640
Fort Bend County MUD #26	8,393	12,455,212	12,455,212	12,505,570	12,589,500	12,673,430	12,757,360	12,841,290	18,002,985
Fort Bend County MUD #42	12,825	16,710,975	18,057,600	19,327,275	19,327,275	19,327,275	19,327,275	19,327,275	19,327,275
Fort Bend County MUD #46	16,620	12,814,020	15,955,200	17,201,700	17,201,700	17,201,700	17,201,700	17,201,700	17,833,260
Fort Bend County MUD #47	12,783	6,813,339	10,545,975	12,041,586	12,041,586	12,041,586	12,041,586	12,041,586	12,783,000
Fort Bend County MUD #48	12,783	8,104,422	8,193,903	9,152,628	10,699,371	12,233,331	13,767,291	15,301,251	17,512,710
Fort Bend County MUD #49	26,448	8,992,320	9,415,488	9,627,072	9,785,760	9,918,000	10,050,240	10,182,480	10,473,408
Meadowcreek MUD	8,762	7,780,656	8,174,946	8,262,566	8,350,186	8,437,806	8,525,426	8,613,046	8,630,570
Palmer Plantation MUD #1	26,448	15,842,352	17,984,640	18,566,496	18,698,736	18,830,976	18,963,216	19,095,456	21,105,504
Palmer Plantation MUD #2	14,003	11,384,439	12,210,616	12,518,682	12,658,712	12,798,742	12,938,772	13,078,802	14,003,000
Quail Valley Utility District	10,940	48,387,620	48,387,620	48,475,140	49,383,160	49,383,160	49,383,160	49,383,160	49,383,160
Thunderbird Utility District	10,344	19,819,104	19,819,104	19,881,168	19,984,608	20,088,048	20,191,488	20,294,928	20,543,184
Mustang Bayou USA	11,873	7,705,577	15,909,820	24,339,650	32,769,480	36,141,412	36,141,412	36,141,412	37,732,394
Mustang Bayou USA Phase 2	11,873	0	0	16,206,645	43,217,720	70,228,795	97,239,870	107,984,935	107,984,935
Harris County MUD #122	8,190	3,357,900	3,931,200	4,504,500	5,094,180	5,675,670	5,847,660	5,847,660	5,847,660
Southwest Harris County MUD #1	5,310	2,798,370	3,632,040	4,471,020	5,310,000	6,143,670	6,982,650	6,982,650	6,982,650

Table 1-6
Current and Projected Monthly Water Demand

District	Average Usage Per Connection Per Month (Gallons)	Current Water Demand (2010)	2015	2020	2025	2030	2035	2040	Build Out Water Demand
Harris County WC&ID - Fondren Road	6,750	6,864,750	7,614,000	8,451,000	9,510,750	10,354,500	10,570,500	10,570,500	10,570,500
Total Monthly Water Demand (Gallons)		377,802,489	438,395,182	526,634,269	631,941,840	728,032,690	789,351,799	810,900,096	828,940,442
Total Water Demand (MGD)		**12.4**	**14.4**	**17.3**	**20.8**	**23.9**	**26.0**	**26.7**	**27.3**

Existing Water Distribution and Treatment Facilities

The existing water production and distribution facilities vary throughout the Study area. This is largely because each entity was created and developed at different times, with different growth rates, and with different design criteria. The various ages, technologies, and design methods can also be attributed to these reasons. The data for the existing infrastructure described herein were developed from information provided by each utility district, the City's GIS database, and from the Texas Commission on Environmental Quality (TCEQ).

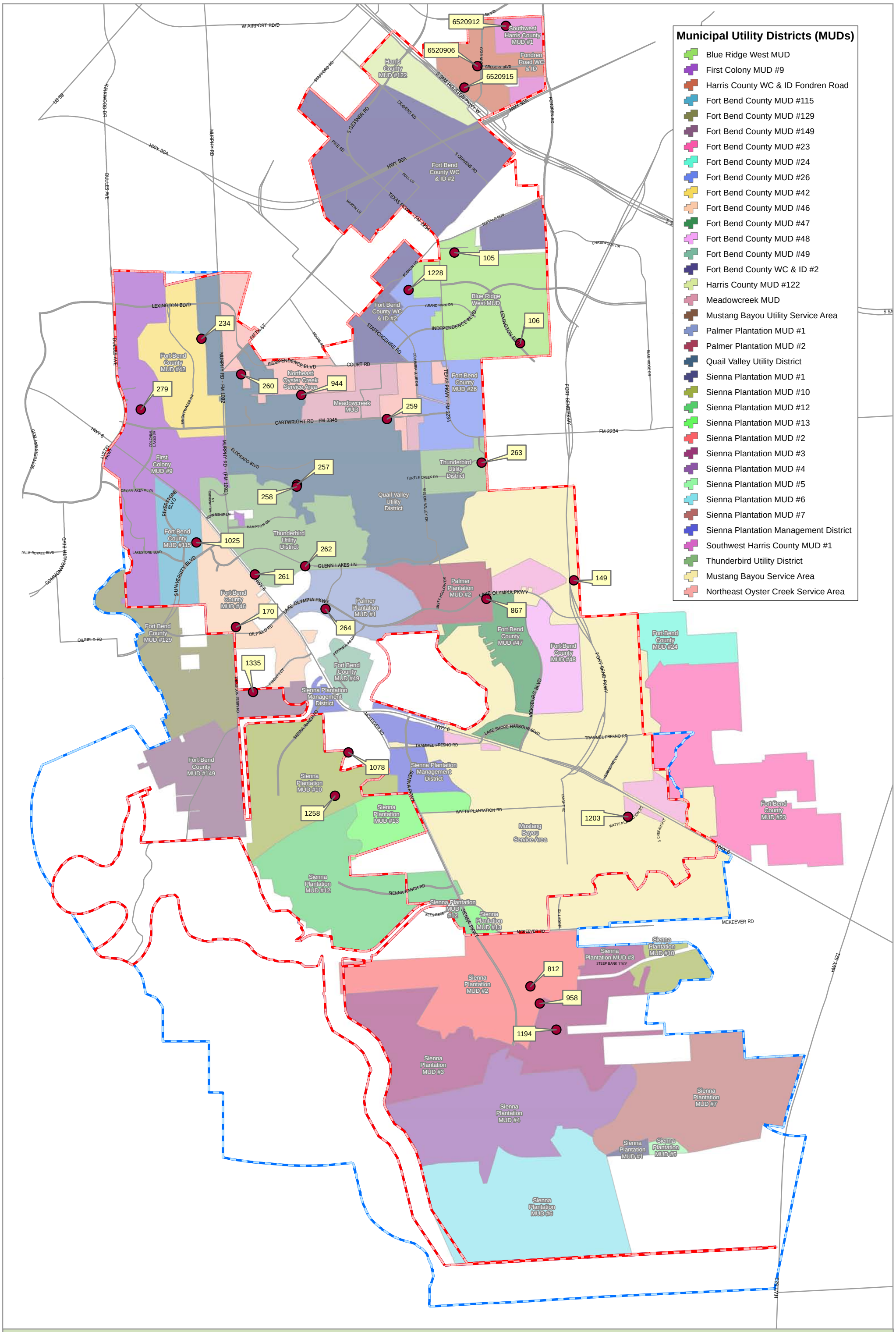
However, more detailed information on the age, condition, and remaining useful life of the individual water plants and various distribution system components was not readily available during the development of this Study. The City is in the process of updating their GIS database with specific data on the age and capacity of all the existing components and it will be available in the future for more detailed master planning and design efforts. Data that was collected and considered on the existing water wells, WTPs, and the various utility district distribution systems is presented in this section.

Groundwater Wells

The majority of the water supplied to the utility districts within the Study area comes from groundwater. Currently only a few of the northern most utility districts are receiving surface water from the City of Houston, which include Harris County WC&ID - Fondren Road, Southwest Harris County MUD #1 and Harris County MUD #122. Almost all of the districts operate their own well as a means to supply this groundwater. There are a total of 28 existing public wells within the planning area. Data on the wells was obtained from the Joint GRP and the utility districts and is presented in Table 1-9. A map of these wells is contained in Exhibit 1-3. The wells located in Fort Bend County are identified by the FBSD well number and the wells located in Harris County are identified by the TWDB state well number.

Table 1-9
Existing Water Wells

	District	Well #	Location	Drill Date	Depth	Tested GPM	Rated GPM
1	Sienna Plantation MUD #1	812	Murray Ct.	N/A	N/A	N/A	N/A
2	"	958	McMahon Way	N/A	N/A	N/A	N/A
3	"	1194	Scanlan Trace	7/20/2005	1930	1200	1200
4	"	1078	Mckever Rd.	1/15/2004	1311	1566	1500
5	"	1258	7738 ½ Fallen Leaf	7/23/2008	1930	1520	1500
6	Blue Ridge West MUD	105	1415 FM 2234	1/10/1975	1262	1461	1400
7	"	106	903 Manor Glen	1980	772	542	500
8	First Colony MUD #9	279	Ringrose Dr.	5/15/1984	1205	2170	2100
9	Fort Bend MUD #115	1025	20425 University Blvd.	9/12/2001	923	1510	1905
10	Fort Bend MUD #149	1335	5603 1/2 Rising Walk Lane	11/18/2009	1140	0	1711
11	Fort Bend MUD #26	1228	1812 Fresh Meadows	1/9/2006	1150	1694	1600
12	Fort Bend MUD #42	234	1819 1/2 Lake Winds	10/23/1984	1092	1595	1700
13	Fort Bend MUD #46	170	4835 Thompson Ferry Rd.	5/17/1985	1065	1000	1000
14	Fort Bend MUD #47 & #48	149	Senior Rd.	10/24/1983	600	1000	1000
15	Meadowcreek MUD	944	3100 N. Park	9/11/2000	1106	815	800
16	Palmer Plantation MUD #1	264	4335 Crown Valley	5/13/1983	1225	1168	1000
17	Palmer Plantation MUD #2	867	1603 Lake Olympia Pkwy	1983	1225	1200	1200
18	Quail Valley Utility District	257	2935 Blue Lakes Ln.	1977	1320	1300	2100
19	"	258	2935 Blue Lakes Ln.	1969	1200	0	500
20	"	259	2143 Cartwright	1972	1077	1353	1400
21	"	260	1930 Rothwell	1978	1325	2252	2300
22	Thunderbird Utility District	261	6605 Highway 6	1972	1074	1170	1200
23	"	262	3003 Glenn Lakes Dr.	1976	1157	849	850
24	"	263	1455 Turtle Creek	1975	1314	674	800
25	Southwest Harris County MUD #1	6520912	7843 LaRochelle	5/13/1980	772	520	500
26	Harris County WC&ID - Fondren Road	6520909	11802 McClain	11/12/1970	1167	1234	1260
27	"	6520915	13455 Beltway 8	3/13/1987	980	855	850
28	Missouri City	1203	Watts Plantation Dr.	9/1/2005	1384	2163	2200

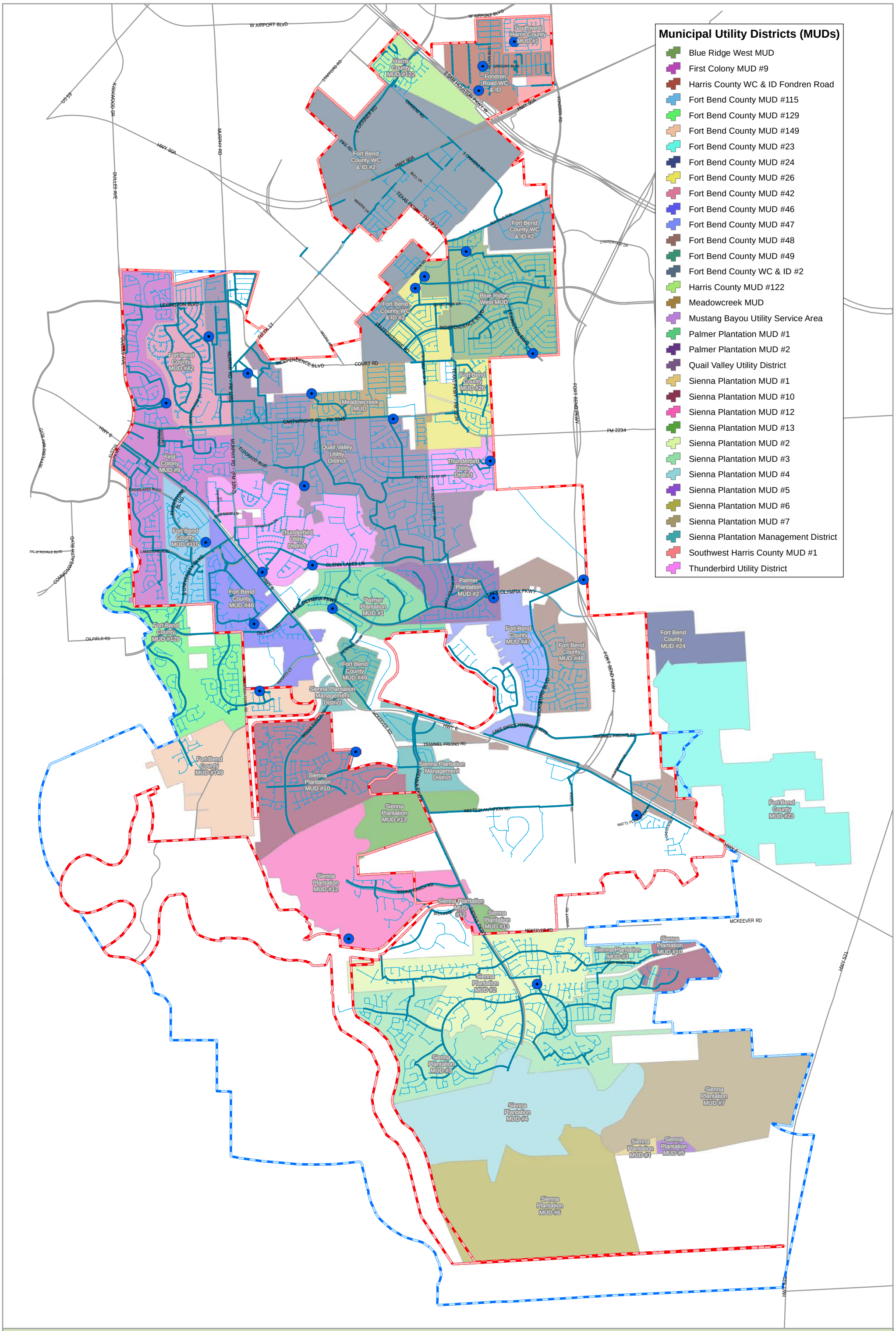

Municipal Utility Districts (MUDs)
Blue Ridge West MUD
First Colony MUD #9
Harris County WC & ID Fondren Road
Fort Bend County MUD #115
Fort Bend County MUD #129
Fort Bend County MUD #149
Fort Bend County MUD #23
Fort Bend County MUD #24
Fort Bend County MUD #26
Fort Bend County MUD #42
Fort Bend County MUD #46
Fort Bend County MUD #47
Fort Bend County MUD #48
Fort Bend County MUD #49
Fort Bend County WC & ID #2
Harris County MUD #122
Meadowcreek MUD
Mustang Bayou Utility Service Area
Palmer Plantation MUD #1
Palmer Plantation MUD #2
Quail Valley Utility District
Sienna Plantation MUD #1
Sienna Plantation MUD #10
Sienna Plantation MUD #12
Sienna Plantation MUD #13
Sienna Plantation MUD #2
Sienna Plantation MUD #3
Sienna Plantation MUD #4
Sienna Plantation MUD #5
Sienna Plantation MUD #6
Sienna Plantation MUD #7
Sienna Plantation Management District
Southwest Harris County MUD #1
Thunderbird Utility District
Mustang Bayou Service Area
Northeast Oyster Creek Service Area
6520912
6520906
6520915
105
1228
106
234
260
944
279
259
263
257
258
1025
262
261
170
264
149
867
1335
1078
1258
1203
812
958
1194
Southwest Harris County MUD #1
Fondren Road WC & ID
Harris County MUD #122
Fort Bend County WC & ID #2
Blue Ridge West MUD
Fort Bend County MUD #42
Northeast Oyster Creek Service Area
Meadowcreek MUD
Fort Bend County MUD #26
First Colony MUD #9
Thunderbird Utility District
Quail Valley Utility District
Fort Bend County MUD #115
Fort Bend County MUD #46
Fort Bend County MUD #129
Palmer Plantation MUD #1
Palmer Plantation MUD #2
Fort Bend County MUD #47
Fort Bend County MUD #48
Fort Bend County MUD #24
Fort Bend County MUD #49
Sienna Plantation Management District
Fort Bend County MUD #149
Sienna Plantation MUD #10
Sienna Plantation MUD #13
Mustang Bayou Service Area
Fort Bend County MUD #23
Sienna Plantation MUD #12
Sienna Plantation MUD #3
Sienna Plantation MUD #2
Sienna Plantation MUD #7
Sienna Plantation MUD #4
Sienna Plantation MUD #1
Sienna Plantation MUD #5
Sienna Plantation MUD #6
W AIRPORT BLVD
US 59
KIRKWOOD DR
HWY 90A
MURPHY RD
DULLES AVE
STAFFORD RD
S GESSNER RD
CRAVENS RD
PIKE RD
S CRAVENS RD
BULL LN
MARTIN LN
TEXAS PKWY - FM 2234
S SAM HOUSTON PKWY W
GREGORY BLVD
FONDREN RD
BUFFALO RUN
CHASEWOOD DR
SCANLIN RD
STAFFORDSHIRE RD
GRAND PARK DR
INDEPENDENCE BLVD
LEXINGTON BLVD
LEXINGTON BLVD
FIFTH ST
MOORE RD
COURT RD
COLUMBIA BLUE DR
TEXAS PKWY - FM 2234
BLUE RIDGE DR
FORT BEND PKWY
FM 2234
LEXINGTON BLVD
BRIGHTWATER DR
MURPHY RD - FM 1092
CARTWRIGHT RD - FM 3345
HWY 6
AUSTIN PKWY
COLONIAL LAKES DR
ELDORADO BLVD
TURTLE CREEK DR
MISSION VALLEY DR
SETTLERS WAY BLVD
CROSSLAKES BLVD
RIVERSTONE BLVD
WILLAMSBURG LN
TOWNSHIP LN
HAMPTON DR
PALM ROYALE BLVD
LAKESTONE BLVD
COMMONWEALTH BLVD
S UNIVERSITY BLVD
HWY 6
GLENN LAKES LN
MISTY HOLLOW DR
LAKE OLYMPIA PKWY
LAKE OLYMPIA PKWY
OILFIELD RD
OILFIELD RD
PENINSULA DR
KNIGHT CT
THOMPSON FERRY RD
SIENNA RANCH RD
MCKEEVER RD
HWY 6
LAKE SHORE HARBOUR BLVD
TRAMMEL FRESNO RD
TRAMMEL FRESNO RD
VICKSBURG BLVD
FORT BEND PKWY
AUBURNMEWE LN
SIENNA PKWY
KNIGHT RD
WATTS PLANTATION RD
WATTS PLANTATION RD
S CREEKMONT
HWY 6
MCKEEVER RD
SIENNA RANCH RD
SIENNA PKWY
KNIGHT RD
SEES PASE
STEEP BANK TRCE
HWY 521
HWY 521
Map By:
GIS Division
October 2011
Exhibit 1-3
Public Water Wells
Legend
Water Wells
City Limits Line
ETJ Line
Geographic Coordinate System North American Datum 1983 (NAD83)
0 2,000 4,000 6,000 8,000
Feet
The information on this map is provided and maintained by various agencies, including county departments, municipal governments, state and federal agencies. No guarantee is given as to the accuracy or currency of any of the data. The map is designed to serve as a secondary representation of real property found within this jurisdiction, and is compiled from the recorded deeds, plats, and other public records, which are primary sources for this public information. Users of this map are hereby notified that these primary sources should be consulted for verification of the information presented here. The data layers do not take the place of a legal survey or other primary source documentation. The county and its vendors assume no legal responsibility for the information on this map.

Water Treatment

There are currently 24 WTPs operating within the Study area. In addition to these the City is currently constructing a RWTP located in Sienna Plantation. This plant will begin operations in 2012. Exhibit 1-4 shows the location of the existing WTPs within the Study area. Total water treatment capacity currently available is 49.54 MGD. All of the WTPs use groundwater as a source. The smallest water treatment plant is Fort Bend County MUD #149 at 0.648 MGD while the largest belongs to the QVUD with a total capacity of 8.524 MGD. Table 1-10 shows the existing water treatment plants for the Study area.

Table 1-10
Existing Water Treatment Plants

Number	Name	Location	Current Permitted Capacity
1	Blue Ridge West MUD WTP #1	1415 FM 2234	3.168 MGD
2	Blue Ridge West MUD WTP #2	903 Manor Glen	
3	First Colony MUD #9 WTP	Ringrose Dr.	3.024 MGD
4	Fort Bend County MUD #26 WTP	1812 Fresh Meadows	2.728 MGD
5	Fort Bend County MUD #42 WTP	1819 1/2 Lake Winds	2.304 MGD
6	Fort Bend County MUD #46 WTP	4835 Thompson Ferry Rd.	1.440 MGD
7	Fort Bend County MUD #115 WTP	20425 University Blvd.	2.174 MGD
8	Fort Bend County MUD #149 WTP	Maverick Bend Ln.	0.648 MGD
9	Harris County WC&ID - Fondren Road WTP #1	11802 1/2 McClain Blvd.	3.760 MGD
10	Harris County WC&ID - Fondren Road WTP #2	9380 S. Sam Houston Pkwy. W.	
11	Meadowcreek MUD WTP	3100 N. Park	1.158 MGD
12	Mustang Bayou WTP	Watts Plantation	3.159 MGD
13	Palmer Plantation MUD #1 WTP	4335 Crown Valley	2.138 MGD
14	Palmer Plantation MUD #2 WTP	1603 Lake Olympia Pkwy.	1.728 MGD
15	Quail Valley Utility District WTP #1	2935 Blue Lakes Ln.	8.524 MGD
16	Quail Valley Utility District WTP #2	2143 Cartwright	
17	Quail Valley Utility District WTP #3	1930 Rothwell	
18	Sienna WTP #1	Murray Ct.	7.380 MGD
19	Sienna WTP #2	Mckeever	
20	Southwest Harris County MUD #1 WTP	7843 Larochelle Cr.	0.748 MGD
21	Thunderbird Utility District (System 1) WTP #1	6605 Highway 6	3.060 MGD
22	Thunderbird Utility District (System 1) WTP #2	3003 Glenn Lakes Dr.	
23	Thunderbird Utility District (System 2) WTP #1	1455 Turtle Creek	0.959 MGD
24	Vicksburg Joint Powers WTP	2775 Senior Rd.	1.440 MGD
Total Permitted Capacity = 49.540 MGD			


Municipal Utility Districts (MUDs)
Blue Ridge West MUD
First Colony MUD #9
Harris County WC & ID Fondren Road
Fort Bend County MUD #115
Fort Bend County MUD #129
Fort Bend County MUD #149
Fort Bend County MUD #23
Fort Bend County MUD #24
Fort Bend County MUD #26
Fort Bend County MUD #42
Fort Bend County MUD #46
Fort Bend County MUD #47
Fort Bend County MUD #48
Fort Bend County MUD #49
Fort Bend County WC & ID #2
Harris County MUD #122
Meadowcreek MUD
Mustang Bayou Utility Service Area
Palmer Plantation MUD #1
Palmer Plantation MUD #2
Quail Valley Utility District
Sienna Plantation MUD #1
Sienna Plantation MUD #10
Sienna Plantation MUD #12
Sienna Plantation MUD #13
Sienna Plantation MUD #2
Sienna Plantation MUD #3
Sienna Plantation MUD #4
Sienna Plantation MUD #5
Sienna Plantation MUD #6
Sienna Plantation MUD #7
Sienna Plantation Management District
Southwest Harris County MUD #1
Thunderbird Utility District
W AIRPORT BLVD
US 59
KIRKWOOD DR
HWY 90A
MURPHY RD
DULLES AVE
STAFFORD RD
S GESSNER RD
CRAVENS RD
PIKE RD
BULL LN
MARTIN LN
TEXAS PKWY - FM 2234
S SAM HOUSTON PKWY W
GREGORY BLVD
FONDREN RD
BUFFALO RUN
CHASEWOOD DR
SCANLIN RD
GRAND PARK DR
INDEPENDENCE BLVD
LEXINGTON BLVD
STAFFORDSHIRE RD
FIFTH ST
MOORE RD
COURT RD
MURPHY RD - FM 1092
CARTWRIGHT RD - FM 3345
FM 2234
FORT BEND PKWY
HWY 6
AUSTIN PKWY
SETTLERS WAY BLVD
ELDORADO BLVD
TURTLE CREEK DR
MISSION VALLEY DR
ROSSLAKES BLVD
RIVERSTONE BLVD
TOWNSHIP LN
HAMPTON DR
GLENN LAKES LN
PALM ROYALE BLVD
COMMONWEALTH BLVD
LAKESTONE BLVD
S UNIVERSITY BLVD
RIVER PL
LAKE OLYMPIA PKWY
OILFIELD RD
PENNA TRAIL
KIMBRIS CT
MCKEEVER RD
PENNA RANCH DR
TRAMMEL FRESNO RD
LAKE SHORE HARBOUR BLVD
VICKSBURG BLVD
SIENNA PKWY
WATTS PLANTATION RD
KNIGHT RD
GREENSIDE DR
SIENNA RANCH RD
BEES FORK
STEEP BANK TRCE
HWY 521
Map By:
GIS Division
October 2011
Exhibit 1-4
Water Distribution System
Legend
Waterlines
Under 12 Inches
12 Inches or Larger
Water Treatment Plants
City Limits Line
ETJ Line
Geographic Coordinate System North American Datum 1983 (NAD83)
0 2,000 4,000 6,000 8,000 Feet
The information on this map is provided and maintained by various agencies, including county departments, municipal governments, state and federal agencies. No guarantee is given as to the accuracy or currency of any of the data. The map is designed to serve as a secondary representation of real property found within this jurisdiction, and is compiled from the recorded deeds, plats, and other public records, which are primary sources for this public information. Users of this map are hereby notified that these primary sources should be consulted for verification of the information presented here. The data layers do not take the place of a legal survey or other primary source documentation. The county and its vendors assume no legal responsibility for the information on this map.

Water Distribution

The existing water distribution system for the Study area consists of approximately 410 miles of water transmission and distribution piping of various sizes, types and ages. Each utility district is responsible for construction and maintenance of its individual distribution system. Age, condition, type and sizing of water lines were evaluated in this study only to the extent of determining necessary improvements when considering potential consolidation alternatives. Further evaluation of the individual systems would require the development of a City-wide system model, which was not included in the scope of this Study.

In addition to the normal distribution piping for each utility district water system, interconnects have been constructed between many of the existing distribution systems. These interconnects provide the capability to transfer treated water from one utility district to another. See Exhibit 1-4 for a map of the existing distribution lines and Exhibit 1-5 for the locations of existing system interconnects and major transmission lines throughout the Study area. Each interconnect on Exhibit 1-5 has been numbered and information about each interconnect can be found in Table 1-11.

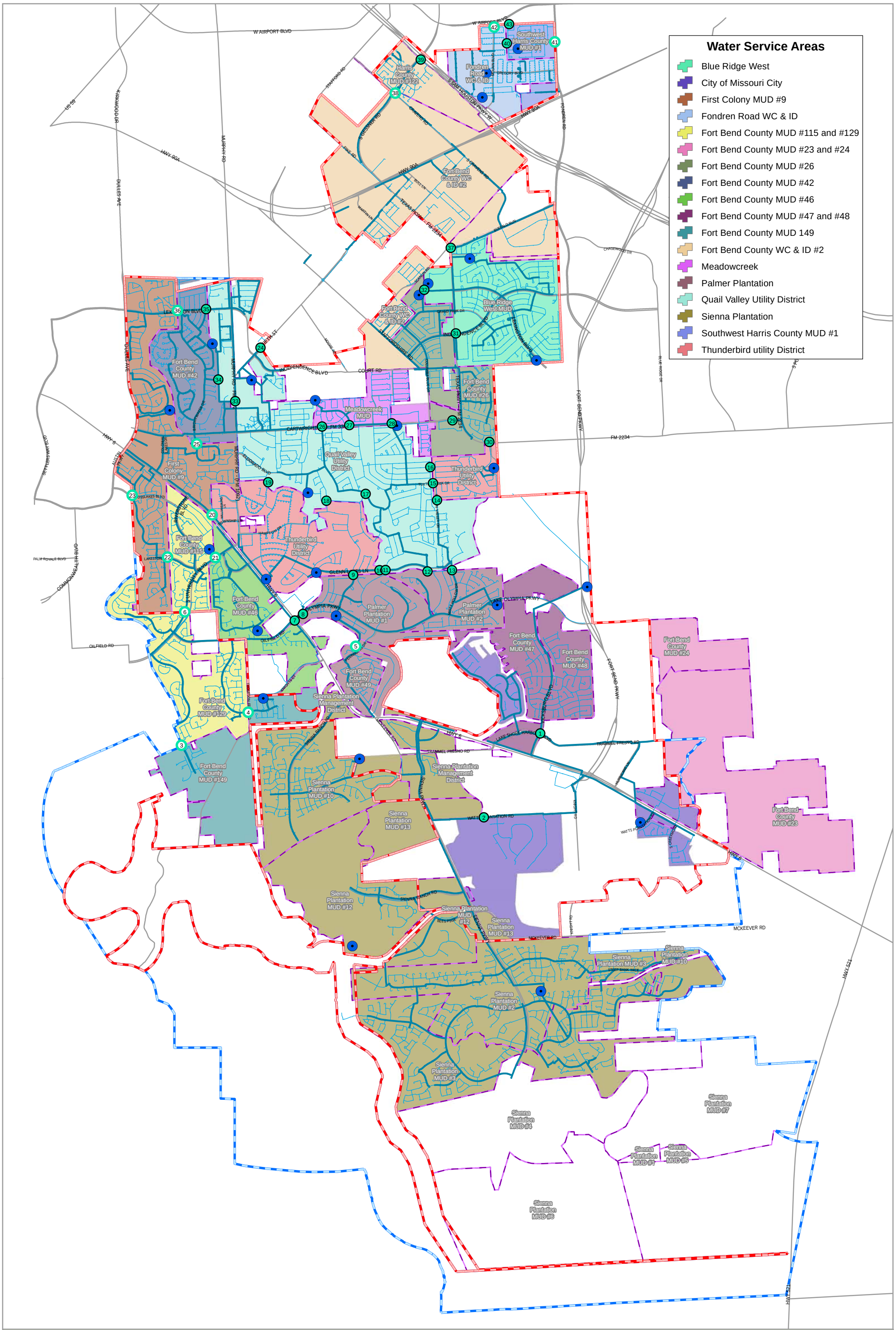

Water Service Areas
Blue Ridge West
City of Missouri City
First Colony MUD #9
Fondren Road WC & ID
Fort Bend County MUD #115 and #129
Fort Bend County MUD #23 and #24
Fort Bend County MUD #26
Fort Bend County MUD #42
Fort Bend County MUD #46
Fort Bend County MUD #47 and #48
Fort Bend County MUD 149
Fort Bend County WC & ID #2
Meadowcreek
Palmer Plantation
Quail Valley Utility District
Sienna Plantation
Southwest Harris County MUD #1
Thunderbird utility District
W AIRPORT BLVD
HWY 90A
US 59
KIRKWOOD DR
MURPHY RD
DULLES AVE
S GESSNER RD
STAFFORD RD
PIKE RD
S SAM HOUSTON PKWY W
FONDREN RD
Harris County MUD #122
Fondren Road WC & ID
Southwest Harris County MUD #1
Fort Bend County WC & ID #2
Blue Ridge West MUD
Fort Bend County MUD #42
Fort Bend County MUD #26
Meadowcreek MUD
Quail Valley Utility District
First Colony MUD #9
Thunderbird Utility District
Fort Bend County MUD #115
Fort Bend County MUD #46
Palmer Plantation MUD #1
Palmer Plantation MUD #2
Fort Bend County MUD #47
Fort Bend County MUD #48
Fort Bend County MUD #24
Fort Bend County MUD #49
Fort Bend County MUD #129
Sienna Plantation Management District
Fort Bend County MUD #149
Sienna Plantation MUD #10
Sienna Plantation MUD #13
Sienna Plantation MUD #12
Sienna Plantation MUD #2
Sienna Plantation MUD #3
Sienna Plantation MUD #4
Sienna Plantation MUD #7
Sienna Plantation MUD #1
Sienna Plantation MUD #5
Sienna Plantation MUD #6
Fort Bend County MUD #23
FM 2234
TRAMMEL FRESNO RD
MCKEEVER RD
HWY 6
HWY 521
FORT BEND PKWY
Map By:
GIS Division
October 2011
Exhibit 1-5
Water
Interconnects
*Interconnect numbers refer to data in corresponding spreadsheet
Legend
MUD Boundaries
City Limits Line
ETJ Line
Waterlines
Under 12 Inches
12 Inches or Larger
Interconnects
Closed
Open
Water Treatment Plants
Geographic Coordinate System North American Datum 1983 (NAD83)
0 2,000 4,000 6,000 8,000 Feet
The information on this map is provided and maintained by various agencies, including county departments, municipal governments, state and federal agencies. No guarantee is given as to the accuracy or currency of any of the data. The map is designed to serve as a secondary representation of real property found within this jurisdiction, and is compiled from the recorded deeds, plats, and other public records, which are primary sources for this public information. Users of this map are hereby notified that these primary sources should be consulted for verification of the information presented here. The data layers do not take the place of a legal survey or other primary source documentation. The county and its vendors assume no legal responsibility for the information on this map.

Table 1-11
Existing Water System Interconnects

	District		District	Metered Connection (Y or N)	Valved Connection (Y or N)	Valve Position (Open or Closed)	Size	Water Type
1	Mustang Bayou USA	to	Fort Bend County MUD #47 & #48	Y	Y	Closed	12"	GW
2	Mustang Bayou USA	to	Sienna Plantation MUD #1	Y	Y	Closed	24"	GW
3	Fort Bend County MUD #129	to	Fort Bend County MUD #149	N	Y	Open	12"	GW
4	Fort Bend County MUD #129	to	Fort Bend County MUD #149	N	Y	Open	12"	GW
5	Fort Bend County MUD #49	to	Palmer Plantation MUD #1 & #2	N	N	Open	12"	GW
6	Fort Bend County MUD #129	to	Fort Bend County MUD #115	N	Y	Open	12"	GW
7	Fort Bend County MUD #46	to	Palmer Plantation MUD #1 & #2	N	Y	Closed	8"	GW
8	Palmer Plantation MUD #1 & #2	to	Thunderbird Utility District	N	Y	Closed	10"	GW
9	Palmer Plantation MUD #1 & #2	to	Thunderbird Utility District	N	Y	Closed	12"	GW
10	Quail Valley Utility District	to	Thunderbird Utility District #1	N	Y	Closed	12"	GW
11	Quail Valley Utility District	to	Palmer Plantation MUD #1 & #2	N	Y	Closed	12"	GW
12	Palmer Plantation MUD #1 & #2	to	Quail Valley Utility District	N	Y	Closed	8"	GW
13	Palmer Plantation MUD #1 & #2	to	Quail Valley Utility District	N	Y	Closed	12"	GW
14	Quail Valley Utility District	to	Thunderbird Utility District #2	N	Y	Closed	8"	GW
15	Quail Valley Utility District	to	Thunderbird Utility District #2	N	Y	Closed	8"	GW
16	Quail Valley Utility District	to	Thunderbird Utility District #2	N	Y	Closed	6"	GW
17	Quail Valley Utility District	to	Thunderbird Utility District #1	N	Y	Closed	8"	GW
18	Quail Valley Utility District	to	Thunderbird Utility District #1	N	Y	Closed	8"	GW
19	Quail Valley Utility District	to	Thunderbird Utility District #1	N	Y	Closed	6"	GW
20	Thunderbird Utility District	to	First Colony MUD #9	N	Y	Open	12"	GW
21	Fort Bend County MUD #46	to	Fort Bend County MUD #115	N	Y	Open	12"	GW
22	Fort Bend County MUD #115	to	First Colony MUD #9	N	Y	Open	12"	GW
23	First Colony MUD #9	to	City of Sugar Land	N	Y	Open	12"	GW
24	Quail Valley Utility District	to	Fort Bend WC&ID No. 2	N	Y	Closed	8"	SW
25	Fort Bend County MUD #42	to	First Colony MUD #9	N	Y	Open	12"	GW
26	Meadowcreek MUD	to	Quail Valley Utility District	N	Y	Closed	8"	GW
27	Meadowcreek MUD	to	Quail Valley Utility District	N	Y	Closed	12"	GW
28	Meadowcreek MUD	to	Quail Valley Utility District	N	Y	Closed	12"	GW
29	Meadowcreek MUD	to	Fort Bend County MUD #26	N	Y	Closed	8"	GW
30	Fort Bend County MUD #26	to	Thunderbird Utility District	N	Y	Closed	8"	GW
31	Fort Bend County MUD #26	to	Blue Ridge West MUD	Y	Y	Closed	12"	GW
32	Blue Ridge West MUD	to	Fort Bend County MUD #26	Y	Y	Closed	12"	GW
33	Fort Bend County MUD #42	to	Quail Valley Utility District	N	Y	Closed	12"	GW
34	Fort Bend County MUD #42	to	Quail Valley Utility District	N	Y	Closed	8"	GW
35	Fort Bend County MUD #42	to	Quail Valley Utility District	N	Y	Closed	12"	GW
36	Fort Bend County MUD #42	to	First Colony MUD #9	N	Y	Open	12"	GW
37	Blue Ridge West MUD	to	Fort Bend County WC&ID No. 2	Y	Y	Closed	10"	SW

Table 1-11
Existing Water System Interconnects

	District		District	Metered Connection (Y or N)	Valved Connection (Y or N)	Valve Position (Open or Closed)	Size	Water Type
38	Harris County MUD #122	to	Fort Bend County WC&ID No. 2	Y	Y	Open	12"	SW
39	Harris County MUD #122	to	City of Houston	Y	Y	Closed	12"	SW
40	Southwest Harris County MUD #1	to	Harris County WC&ID - Fondren Road	N	Y	Closed	6"	GW
41	Southwest Harris County MUD #1	to	City of Houston	Y	Y	Open	12"	SW
42	Harris County WC&ID - Fondren Road	to	City of Houston	Y	Y	Open	12"	SW
43	Southwest Harris County MUD #1	to	Harris County WC&ID - Fondren Road	Y	Y	Closed	8"	GW

As more systems change from groundwater sources to surface water sources, the interconnects between the systems should be evaluated. Fort Bend County WC&ID #2 has recently converted from groundwater sources to surface water sources, and the City of Sugar Land is in the process of converting to surface water sources. The disinfection residual in the distribution system for systems using surface water sources is generally chloramines. Many of the systems that utilize groundwater sources use free chlorine in their distribution system. An interconnection between a distribution systems utilizing free chlorine with one utilizing chloramines is not advisable since the disinfection residual in the distribution system can no longer be tracked correctly once the chemicals are mixed.

Therefore, interconnects to either Fort Bend County WC&ID #2 or City of Sugar Land would be advisable only with systems that utilize chloramines in their distribution system. The Technical Memorandum for Task IV will include further discussion on the potential disinfection conversion from free chlorine to chloramines at some of the utility districts within the Study area, including the associated costs for conversion.

Water System Storage

Storage was also evaluated throughout the City's water system with regard to other potential improvements in efficiency and/or safety. The TCEQ has specific requirements with regard to minimum provided ground storage and elevated or pressure storage for water systems in Texas. TCEQ has a minimum requirement of 200 gallons of total storage per connection, with half of the storage capacity (100 gallons per connection) being provided either as elevated storage (from an elevated storage tank) or as pressure storage (from a hydropneumatic tank).

Two issues were observed in the review of water storage in the existing utility district WTPs located throughout the Study area. The first issue is that insufficient ground storage was available at several of the WTPs though construction and active operation of interconnections with nearby systems can alleviate the demand for individual ground storage in many cases.

A second issue is the observation that almost all of the existing WTPs in the Study area utilize pressure storage via hydropneumatic tanks, which tend to be energy-intensive to operate, whereas elevated storage tanks (EST) require very little energy to operate. Currently, only the Blue Ridge West MUD and Quail Valley UD own and operate EST tanks. Further discussion of ground and pressure/elevated storage is included in the Technical Memorandum for Task V.

This Technical Memorandum summarizes the findings of Task III of the City of Missouri City Regional Water and Wastewater Planning Study (the Study). The focus of Task III of the Study is the preparation of Water Distribution System Alternatives for the Study area.

Activities in Task III included the following:

- ✓ Developing a technical memorandum summarizing the water distribution system alternatives for 5-year increments through the year 2040 to serve existing and future growth.

Water Distribution System Alternatives

Water System Interconnection Alternatives

The following proposed water interconnect locations are shown in Exhibit 2-2.

Interconnect First Colony MUD #9 with Fort Bend County MUD #115

The proposed scope for this alternative is a 12-inch water line interconnection from the south portion of First Colony MUD #9 to Fort Bend County MUD #115. This interconnect should provide increased pressure in the southern areas of First Colony MUD #9, as well as increased fire protection.

While Fort Bend County MUD #115 is not anticipated to be converted to treated surface water via the RWTP until Phase III (2025), the conversion from chlorine to chloramines will need to be incorporated into this project if the City decides to complete this project ahead of Phase III of the RWTP.

Table 4-1
First Colony MUD #9 & Fort Bend County MUD #115 Interconnect Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	12-Inch Wet Connect	EA	2	$2,500.00	$5,000.00
2	12-Inch C-900 PVC Water line by Trenchless	LF	100	$200.00	$20,000.00
3	12-Inch C-900 PVC Water line by Open Cut	LF	20	$150.00	$3,000.00
4	Chloramine Conversion, including new flow control and chemical feed building, chemical feed and control system	LS	1	$400,000.00	$400,000.00
Subtotal					$428,000.00
Contingencies (20%)					$86,000.00
Engineering & Testing (18%)					$93,000.00
Total Estimated Capital Cost					**$607,000.00**

Notes:
1 - This estimate does not include costs for acquisition of Easements from property owners.
2 - This estimate does not include costs for dewatering of the water line or the bore pits.

Mustang Bayou WTP System and Sienna Plantation System Interconnect No. 2

The proposed scope is a 16 and/or 12-inch waterline interconnection from Vicksburg Drive to Christus Drive along SH 6. This interconnection would provide a second interconnection between the two systems and provide future service to currently undeveloped property along SH 6. This interconnection should further improve operation of both systems for more consistent pressures, water quality, and fire protection. Construction should completed adjacent to undeveloped areas as well to avoid future conflicts as the area develops. These improvements could potentially result in needing minor upgrades to plant facilities to fully realize the benefits.

Table 4-2
Mustang Bayou & Sienna Plantation Interconnect No. 2 Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	16 inch water line	LF	2,150	$33.00	$70,950.00
2	12 inch water line	LF	4,362	$28.00	$122,136.00
3	Bore of 18 inch steel casing (includes casing pipe only)	LF	775	$350.00	$271,250.00
4	Trench Safety & Testing of Water line	LF	7,287	$2.00	$14,574.00
5	Utility Spoils (includes Disposal adjacent to water line construction)	CY	1,200	$2.50	$3,000.00
6	Water meter for Interconnect	EA	1	$25,000.00	$25,000.00
7	Butterfly or Gate Valves	EA	7	$2,500.00	$17,500.00
8	Flushing Valves	EA	18	$2,200.00	$39,600.00
Subtotal					$564,000.00
Contingencies (20%)					$113,000.00
Engineering & Testing (18%)					$122,000.00
Total Estimated Capital Cost					**$799,000.00**

Notes:
1 - This estimate does not include costs for acquisition of Easements from property owners.
2 - This estimate assumes there is adequate room for the water line to fit within the existing Right-of-Way (ROW.)
3 - This estimate assumes there are no conflicts with the existing dry utilities within the SH6 ROW.
4 - This estimate assumes the scope of construction will be approved by TXDOT.
5 - This estimate does not include costs for dewatering of the water line or the bore pits.
6 - This estimate assumes there are no conflicts with existing potential jurisdictional wetlands. Permitting costs are not included.

Mustang Bayou WTP System and Sienna Plantation System Interconnect No. 3

The proposed scope is a 12-inch waterline along Trammel Fresno Road from SH 6 to Sienna Parkway. This interconnection would provide the third interconnection between the two water distribution systems and allow the existing residential acreage lot development south of Trammel Fresno to be converted off their existing individual well systems. This interconnection should further improve operation of both systems for more consistent pressures, water quality, and fire protection. These improvements could potentially result in needing minor upgrades to plant facilities to fully realize the benefits.

Table 4-3
Mustang Bayou & Sienna Plantation Interconnect No. 3 Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	12 inch water line	LF	3,403	$28.00	$95,284.00
2	Bore of 18 inch steel casing across SH6 (includes casing pipe only)	LF	230	$350.00	$80,500.00
3	12 inch steel water line across Oyster Creek to be bored	LF	550	$325.00	$178,750.00
4	Dewatering of bore pit for Oyster Creek Bore	EA	2	$20,000.00	$40,000.00
5	Trench Safety & Testing of Water line	LF	3,953	$2.00	$7,906.00
6	Utility Spoils (includes Disposal adjacent to water line construction)	CY	1,000	$2.50	$2,500.00
7	Water meter for Interconnect	EA	1	$25,000.00	$25,000.00
8	Butterfly or Gate Valves	EA	7	$2,500.00	$17,500.00
9	Flushing Valves	EA	16	$2,200.00	$35,200.00
Subtotal					$483,000.00
Contingencies (20%)					$96,600.00
Engineering & Testing (18%)					$104,500.00
Total Estimated Capital Cost					**$683,500.00**

Notes:
1 - This estimate does not include any costs for acquisition of Easements from property owners.
2 - This estimate assumes there is adequate room for the water line to fit within the existing ROW.
3 - This estimate assumes there are no conflicts with the existing dry utilities within the SH6 ROW.
4 - This estimate assumes there are no conflicts with the existing dry utilities within the Trammel Fresno ROW.
5 - This estimate assumes there are no conflicts with existing potential jurisdictional wetlands. Permitting costs are not included.
6 - This estimate does not include any costs for dewatering of the water line only the bore pits at Oyster Creek.

Sienna Plantation Water System Internal Interconnect

The proposed scope is a 12-inch waterline along SH 6 between the commercial development at Sienna Parkway and the commercial development at Sienna Ranch Road. This interconnection should improve operation of both systems for more consistent pressures, water quality, and fire protection. These improvements could potentially result in needing minor upgrades to plant facilities to fully realize the benefits.

Table 4-4
Sienna Plantation Internal Interconnect Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	12 inch water line	LF	950	$28.00	$26,600.00
2	12 inch steel water line across Oyster Creek (by bore)	LF	550	$325.00	$178,750.00
3	Dewatering of bore pit for Oyster Creek Bore	EA	2	$20,000.00	$40,000.00
4	18 inch bore across SPLID levee (includes casing and no carrier pipe)	LF	131	$375.00	$49,125.00
5	Trench Safety & Testing of Water line	LF	1,500	$2.00	$3,000.00
6	Utility Spoils (includes Disposal adjacent to water line construction)	CY	1,000	$2.50	$2,500.00
7	Concrete collar for crossing levee	EA	2	$5,000.00	$10,000.00
8	Butterfly or Gate Valves	EA	2	$2,500.00	
9	Flushing Valves	EA	6	$2,200.00	$13,200.00
Subtotal					$323,000.00
Contingencies (20%)					$65,000.00
Engineering & Testing (18%)					$70,000.00
Total Estimated Capital Cost					**$458,000.00**

Notes:
1 - This estimate does not include costs for acquisition of Easements from property owners.
2 - This estimate assumes there is adequate room for the water line to fit within the existing ROW.
3 - This estimate assumes there are no conflicts with the existing dry utilities within the SH6 ROW.
4 - This estimate assumes there are no conflicts with existing potential jurisdictional wetlands. Permitting costs are not included.
5 - This estimate does not include any costs for dewatering of the water line only the bore pits at Oyster Creek.

Sienna Plantation System and Palmer Plantation System Interconnect No. 1

This proposed project includes a 12-inch water line interconnect across SH 6. This interconnection would provide the only emergency interconnection between the Sienna system and the Palmer Plantation system. The benefit would be for emergency conditions and would provide both systems with a backup water supply if a problem ever occurred.

Table 4-5
Sienna Plantation & Palmer Plantation Interconnect No. 1 Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	12 inch water line	LF	300	$28.00	$8,400.00
2	Bore of 18 inch steel casing across SH6 (includes casing pipe only)	LF	300	$350.00	$105,000.00
3	Trench Safety & Testing of Water line	LF	300	$2.00	$600.00
4	Utility Spoils (includes Disposal adjacent to water line construction	CY	50	$2.50	$125.00
5	Concrete collar for crossing levee	EA	2	$5,000.00	$10,000.00
6	Butterfly or Gate Valves	EA	2	$2,500.00	$5,000.00
7	Water meter for Interconnect	EA	1	$25,000.00	$25,000.00
8	Chloramine Conversion of Palmer Plantation	LS	2	$250,000.00	$500,000.00
Subtotal					$655,000.00
Contingencies (20%)					$131,000.00
Engineering & Testing (18%)					$141,500.00
Total Estimated Capital Cost					**$927,500.00**

Notes:
1 - This estimate assumes there is adequate room for the water line to fit within the existing ROW.
2 - This estimate assumes there are no conflicts with the existing dry utilities within the SH6 ROW.
3 - This estimate assumes there are no conflicts with any existing potential jurisdictional wetlands. Permitting costs are not included.
4 - This estimate does not include costs for dewatering of the water line or the bore pits.

Silver Ridge Development and Sienna Plantation Water System Interconnect No. 1

This proposed project includes extending a 12-inch water line across Sienna Parkway to the Silver Ridge development. This would provide a source of treated surface water, once Sienna Plantation MUD #1 converts to surface water, to the Silver Ridge residents as this system is currently operated on a community well system.

Typically, the TCEQ requires that a community supplied by a community well distribution system be converted over to treated surface water when it becomes available to the community. However, as many of the service areas within the Study area will continue to remain on groundwater, it has not been determined whether converting the Silver Ridge system over to treated surface water can be accomplished efficiently and/or cost-effectively. Therefore, a more detailed evaluation (preferably including modeling) of the Silver Ridge system would need to be completed to confirm whether or not the existing Sienna Plantation water system in the area could provide adequate volumes and pressure for the Silver Ridge development. In addition, a cost analysis would need to be performed to compare potential revenues with the cost of improvements within the Silver Ridge system to determine if interconnecting the system to Sienna Plantation is worthwhile provided the TCEQ ultimately does not require it.

Table 4-6
Silver Ridge Development & Sienna Plantation Interconnect No. 1 Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	12 inch water line	LF	150	$40.00	$6,000.00
2	18 inch steel water line casing across SH6	LF	150	$350.00	$52,500.00
3	16 inch x 12 inch tapping sleeve and valve	EA	1	$3,000.00	$3,000.00
4	Dewatering of bore pit	EA	2	$8,000.00	$16,000.00
5	Trench Safety & Testing of Water line	LF	150	$2.00	$300.00
6	Butterfly or Gate Valves	EA	2	$2,500.00	$5,000.00
7	Water meter for Interconnect	EA	1	$25,000.00	$25,000.00
8	Utility Spoils (includes Disposal adjacent to water line construction)	CY	50	$2.50	$125.00
Subtotal					$108,000.00
Contingencies (20%)					$22,000.00
Engineering & Testing (18%)					$24,000.00
Total Estimated Capital Cost					**$154,000.00**

Notes:
1 - This estimate assumes there is adequate room for the water line to fit within the existing ROW.
2 - This estimate assumes there are no conflicts with the existing dry utilities within the Sienna Parkway ROW.
3 - This estimate does not include running of line pipe within the Silver Ridge Development.
4 - This estimate does not include costs for increased plant capacity which may be required to service the development.

Fort Bend County MUD #149 & Sienna Plantation MUD #1 Interconnect No. 1

This proposed project includes extending a 12-inch water line across the Flat Bank Creek Diversion Channel between the Sienna Plantation and Riverstone water systems along Sienna Springs Blvd. This would provide an additional source of water to both systems. In order to connect to Sienna Plantation MUD #1, chloramine conversion would be required prior to startup of the proposed interconnection. After the surface water conversion, operation of the interconnection should be able to provide additional pressure maintenance between the two systems.

Table 4-7
Fort Bend County MUD #149 & Sienna Plantation MUD #1 Interconnect No. 1
Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	12-Inch Wet Connect	EA	2	$2,500.00	$5,000.00
2	12-Inch Steel Water line by Pipe Bridge	LF	500	$300.00	$150,000.00
3	12-Inch C-900 PVC Water line by Open Cut	LF	20	$125.00	$2,500.00
4	Chloramine Conversion of Riverstone WP	EA	1	$250,000.00	$250,000.00
Subtotal					$408,000.00
Contingencies (20%)					$82,000.00
Engineering & Testing (18%)					$89,000.00
Total Estimated Capital Cost					**$579,000.00**

Notes:
1 - This estimate does not include costs for acquisition of Easements from property owners.
2 - This estimate assumes there are no conflicts with any existing potential jurisdictional wetlands. Permitting costs are not included.

Blue Ridge West Municipal Utility District

In this project an existing interconnection already exists, though it has been used in the past only for emergency purposes. Therefore, completion of this project would only require the permanent opening of the interconnection between Fort Bend County MUD #26 and Blue Ridge West, which is located at the intersection of Texas Parkway and Settegast Blvd.

Blue Ridge West Municipal Utility District

In this project an existing interconnection already exists, though it has been used in the past only for emergency purposes. Therefore, completion of this project would only require the permanent opening of the 10-inch interconnection between Fort Bend County WC&ID No.2 and Blue Ridge West MUD located at the intersection of Texas Parkway at Independence Road. Prior to permanently opening this interconnection Blue Ridge West MUD would be required to convert to chloramines.

Fort Bend County MUD No. 7 & 48

Fort Bend County MUD #s 47 & 48 have finalized a water consolidation agreement with the City. This agreement involved permanently opening the 12-inch interconnection between the two water systems supplied by the Vicksburg WTP and the Mustang Bayou WTP.

Interconnect Mustang Bayou and Sienna Plantation

In this project an interconnection already exists, though it has been used in the past only for emergency purposes. Therefore, completion of this project would only require the permanent opening of the 24-inch Watts Plantation interconnect between the Mustang Bayou Service area and Sienna Plantation. Additional modeling of the two systems will be required to determine improvements necessary to operate the combined system, as preliminary information from the Sienna Plantation MUD #1 engineer indicates that higher pressures in the Sienna system will only allow water to flow to the Mustang Bayou system.

Interconnect Mustang Bayou and Palmer Plantation

This project includes the construction of a new interconnect between the Mustang Bayou service area and the Palmer Plantation MUD service area at the intersection of Lake Olympia Parkway and the Mustang Bayou Diversion Channel.

Table 4-8
Mustang Bayou & Palmer Plantation Interconnect Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	16-Inch Water Line by Open Cut	LF	1,250	$65.00	$81,250.00
2	16-Inch Water Line by Trenchless	LF	100	$200.00	$20,000.00
3	16-Inch Gate Valve & Box	EA	4	$6,000.00	$24,000.00
4	12-Inch Water Line by Open Cut	LF	1,200	$50.00	$60,000.00
5	12-Inch Water Line by Trenchless	LF	140	$100.00	$14,000.00
6	12-Inch Gate Valve & Box	EA	4	$2,000.00	$8,000.00
7	Connection to Existing Water Line	EA	2	$1,500.00	$3,000.00
Subtotal					$210,000.00
Contingencies (20%)					$42,000.00
Engineering & Testing (18%)					$46,000.00
Total Estimated Capital Cost					**$298,000.00**

Notes:
1 - This estimate does not include costs for acquisition of Easements from property owners.
2 - This estimate assumes there are no conflicts with any existing potential jurisdictional wetlands. Permitting costs are not included.

Interconnect Mustang Bayou and Quail Valley Utility District

This project includes the construction of a new interconnect between the Mustang Bayou service area and Quail Valley UD service area by extending a water main along the proposed future Vicksburg Blvd. to the City Regional Park.

Table 4-9
Mustang Bayou & Quail Valley Interconnect Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	12-Inch Water Line by Open Cut	LF	2,000	$50.00	$100,000.00
2	12 inch steel water line across Oyster Creek (by bore)	LF	150	$325.00	$48,750.00
3	Dewatering of bore pit for Oyster Creek Bore	EA	2	$20,000.00	$40,000.00
4	12-Inch Gate Valve & Box	EA	6	$2,000.00	$12,000.00
5	Connection to Existing Water Line	EA	2	$1,500.00	$3,000.00
Subtotal					$204,000.00
Contingencies (20%)					$41,000.00
Engineering & Testing (18%)					$44,000.00
Total Estimated Capital Cost					**$289,000.00**

Notes:
1 - This estimate does not include costs for acquisition of Easements from property owners.
2 - This estimate assumes there are no conflicts with any existing potential jurisdictional wetlands. Permitting costs are not included.
3 - This estimate does not include any costs for dewatering of the water line only the bore pits at Mustang Bayou.

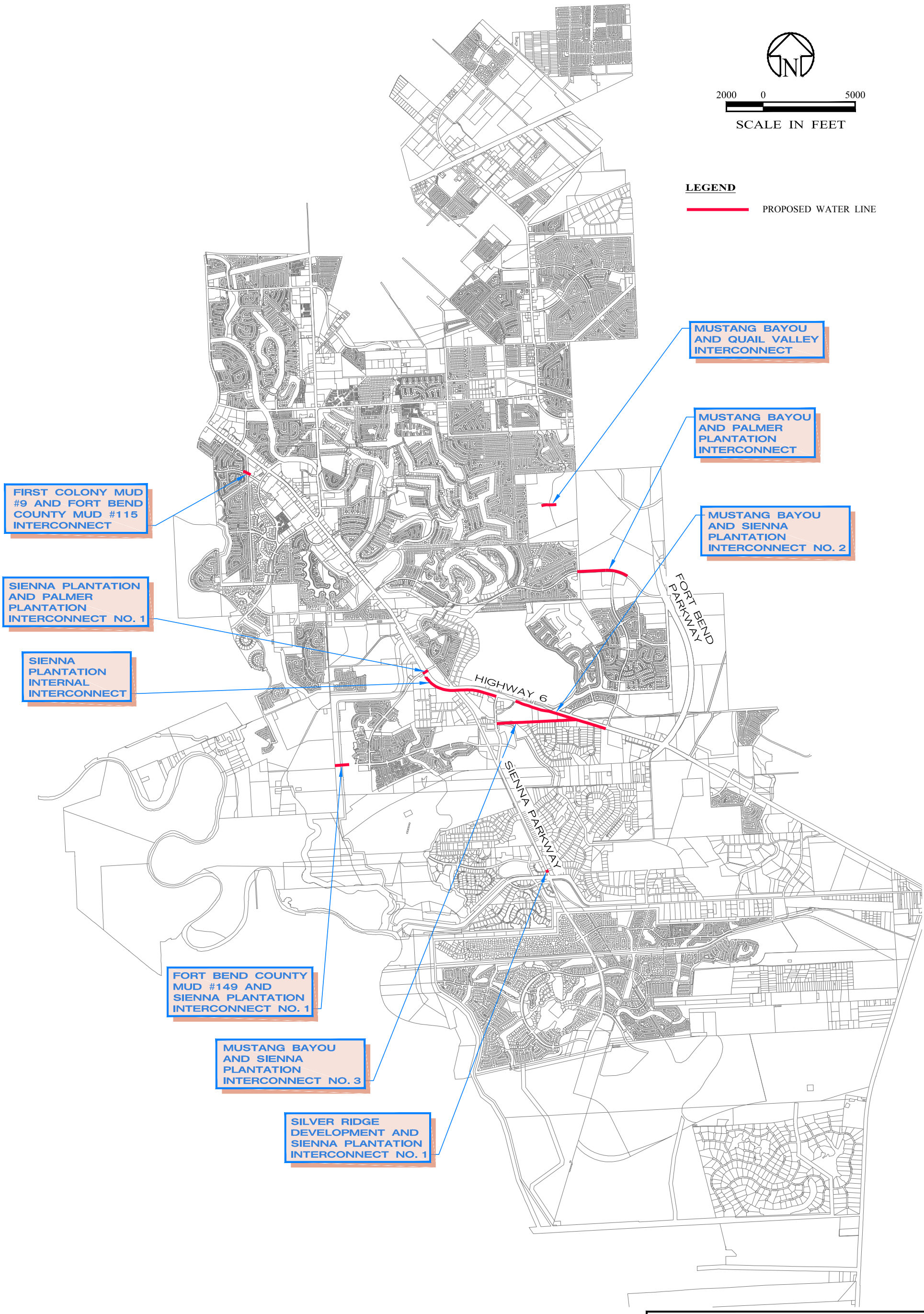


EXHIBIT 2-2
PROPOSED WATER INTERCONNECTS

2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/18/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151

Water System Storage Alternatives

The City requested an evaluation of potential new elevated storage tank (EST) locations in order to provide a more hydraulic-oriented elevated storage system, as opposed to continuing operation of the pressure-driven storage system. In order to compare the life cycle costs of a hydropneumatic pressure tank (HPT) versus that for an EST, the operating process of each system and the components required for each system is discussed. An EST requires only the feed pressure from the incoming water to lift water into the elevated tank. Therefore, during an emergency if the nearby WTPs have backup power, then the EST will be filled and will continue operation.

A typical HPT system consists of an outer metal shell, inner bladder and an air compressor system. When the HPT needs to be filled, nearby pumps fill the tank with water. Air compressors are used to maintain a specific tank pressure which keeps the inner bladder in compression to provide a specific discharge pressure when the HPT lets water out into the distribution system. Similar to the EST system, an HPT still requires water from a nearby source, which would require backup power at the water source. However, backup power is also needed for the HPT system to operate the air compressors necessary to maintain tank pressure.

In addition, the typical useful life is fairly different for the two tank systems. Older types of ESTs (such as legged tank, ellipsoid, etc.) were traditionally all constructed of welded steel and typically had a useful life of 20-30 years, without completing a major rehabilitation of the interior and exterior of the tank. Newer and more common tank designs include a composite tank, which normally consists of a concrete ring structure for the tower, and uses a tradition welded steel bowl for the tank. The useful life of Composite tanks is frequently 30-50 years. The concrete structure typically lasts 50 years without major rehabilitative work and the bowl normally requires major rehabilitation every 30 years.

On the other hand, HPT systems commonly last between 10-20 years, depending primarily on the quality of the inner bladder. The type of HPT tanks used in many smaller, developer-driven WTPs or booster pump stations generally have an average useful life of 15 years. Due to the low cost of HPT tanks, it is common to see a complete HPT tank replacement rather than seeing an HPT tank cut open to replace internal components and then re-welded together.

Capital and O&M costs have been developed to assist in comparing potential HPT to an EST as shown in Table 2-1. One proposed storage location (Sienna Plantation No. 1 WTP) is used for the cost example. These costs were developed to provide a comparison between both tank types only.

In developing the costs for both a new HPT and an EST system, the sizing for each system was determined based on TCEQ Chapter 290 design criteria for water systems, including 100 gallons per connection for an EST tank, and 20 gallons per connection for an HPT tank. The number of connections served by the Sienna Plantation No. 1 WTP is approximately 12,500. Therefore, a 1,250,000 gallon (1.25 MG) EST or 250,000 gallons of HPT storage would be required.

An example calculation for a storage tank at Sienna Plantation WTP No. 1 is as follows:

- Connections served 12,500;
- TCEQ total storage required is 200 gallons per connection with 100 gallons per connection provided by elevated storage or 20 gallons per connection provided as pressure storage;
- 12,500 connections x 100 gallons per connection (elevated storage requirement) = 1,250,000 gallons with EST capacity = 1.25 MG;
- 12,500 connections x 20 gallons per connection (pressure storage requirement) = 250,000 gallons with HPT capacity = 250,000 gallons.

While the EST could be installed in one location, there are no WTP sites large enough in the Study area to support a 250,000 gallon HPT. The existing HPTs range in size from 5,000-25,000 gallons. Therefore, a maximum tank size of 25,000 gallons was used, knowing that HPTs would need to continue to be located at multiple WTP sites to provide enough space for the tanks. The proposed HPT and EST life cycle costs are shown in Table 2-1.

Table 2-1
Cost Comparison for HPT and EST Systems

Item	Description	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
1	Construct a new 1.25 MG EST, including piping, SCADA and high service pump station (HSPS) modifications and site work	$3,250,000	$4,602,000	$12,500	$4,848,000
2	Construct 10 new 25,000 gallon HPT tanks, including piping, SCADA and HSPS modifications, site work and emergency backup power improvements	$4,500,000	$6,372,000	$98,000	$8,293,000

Notes:
1 - Assumes no offsite collection improvements are required.
2 - Assumes that no other major capital improvements would be necessary during the project life.
3 - Assumes a 30-yr improvement life, at an interest rate of 3%.
4 - The HPT estimate assumes constructing HPT tanks at roughly 5 WTP sites, with two tanks at each site.
5 - The HPT estimate assumes replacing the HPTs once during the 30-yr period.
6 - The HPT O&M cost allows for operation of the feed pumps, air compressors and backup generators at each WTP site

When reviewing ESTs as compared to HPTs with a 15-yr operating life, the savings in constructing an EST is clear. However, if the HPTs were rehabilitated instead of being replaced, the cost difference is reduced, though it still appears to be more cost effective to construct an EST (Refer to Table 2-2).

Table 2-2
Supplemental Cost Comparison for HPT and EST Systems

Item	Description	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
1	Construct a new 1.25 MG EST, including piping, SCADA and HSPS modifications and site work	$3,250,000	$4,602,000	$12,500	$4,848,000
2	Construct 10 new 25,000 gallon HPT tanks, including piping, SCADA and HSPS modifications, site work and emergency backup power improvements	$3,500,000	$4,956,000	$98,000	$6,877,000

Notes:
1 - Assumes no offsite collection improvements are required.
2 - Assumes that no other major capital improvements would be necessary during the project life.
3 - Assumes a 30-yr improvement life, at an interest rate of 3%.
4 - The HPT estimate assumes constructing HPT tanks at roughly 5 WTP sites, with two tanks at each site.
5 - The HPT estimate assumes rehabilitating the HPTs once during the 30-yr period.
6 - The HPT O&M cost allows for operation of the feed pumps, air compressors and backup generators at each WTP site

Based on the costs shown in Table 2-1 and 2-2, construction of new ESTs throughout the City should provide a reduction in total elevated/pressure storage costs.

Proposed locations for new ESTs are based on engineering experience and coordination with existing WTP locations to determine feasible areas for a new EST. While the ideal location to construct an EST would be at an existing WTP site, it is best to locate an EST where sufficient open space (fall-down area) is available in case of a failure of the EST. Even though EST failures have an extremely low probability of collapse, when considering installation of ESTs in an area that has a potential for subsidence, it is generally a good idea to distance new ESTs from nearby residences if possible.

Therefore, the WTPs listed in Table 2-3 are not recommended for consideration of adding an EST, unless other more feasible property may be available in that system area.

Table 2-3 WTPs Not Recommended for EST Addition with Determining Factor	
WTP	**Reason this WTP is NOT a recommended location for a new EST**
Fort Bend County MUD #46	Houses within potential fall-down area
Thunderbird UD System 1 WTP No. 1	Major thoroughfare within potential fall-down area
Fort Bend County MUD #115	Houses and businesses within potential fall-down area
First Colony County MUD #9	Insufficient space within WTP site
Fort Bend County MUD #42	Insufficient space within WTP site
Quail Valley UD WTP No. 3	EST already located at this site
Meadowcreek MUD WTP	Located close to existing EST
Quail Valley UD WTP No. 1	Insufficient space within WTP site
Harris County WC&ID – Fondren Road WTP No. 1	Houses and businesses within potential fall-down area
Southwest Harris County MUD #1 WTP	Houses within potential fall-down area
Blue Ridge West MUD WTP No. 1	Located close to existing EST
Fort Bend County MUD #26 WTP	Located close to existing EST
Thunderbird UD System 2 WTP No. 1	Major thoroughfare within potential fall-down area
Palmer Plantation MUD No. 1 WTP	Houses within potential fall-down area

The recommended ESTs and their locations are described in the following subsections. A map of the proposed EST locations is shown in Exhibit 2-3.

New EST at Sienna Plantation No. 1 WTP

Phase I of the RWTP will provide treated surface water to roughly 12,500 connections in the southern part of the Study area, requiring elevated storage of roughly 1.25 million gallons (MG). Therefore, this project would include the construction of a new 1.25 MG EST at the existing Sienna Plantation No. 1 WTP site. This project would also include the modification of the existing high service pump station to allow for reusing the high service pumps to lift water into the EST in the event that the plant needed to temporarily revert back to groundwater usage. It is anticipated that the discharge pressure could be maintained at the RWTP to provide sufficient pressure to fill the new EST. Costs for the EST are based on the construction of a composite-type tank.

Table 4-10
Sienna Plantation WTP #1 EST Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	New 1.25 MG Composite Elevated Storage Tank	GAL	1,250,000	$2.50	$3,125,000.00
2	Piping Modifications and Sitework	LS	1	$50,000.00	$50,000.00
3	High Service Pumping Modifications	LS	1	$50,000.00	$50,000.00
4	SCADA System for New EST	LS	1	$25,000.00	$25,000.00
Subtotal					$3,250,000.00
Contingencies (20%)					$650,000.00
Engineering & Testing (18%)					$702,000.00
Total Estimated Capital Cost					**$4,602,000.00**

Notes:
1 - This estimate does not include costs for acquisition of Easements from property owners.

New EST at Mustang Bayou WTP

Phase II of the RWTP will provide treated surface water to approximately 5,000 connections in the eastern part of the Study area, requiring elevated storage of roughly 0.5 MG. Therefore, this project would include the construction of a new 0.5 MG EST at the existing Mustang Bayou WTP site. This project would also include the modification of the existing high service pump station to allow for reusing the high service pumps to lift water into the EST in the event that the plant needed to temporarily revert back to groundwater usage. It is anticipated that the discharge pressure could be maintained at the RWTP to provide sufficient pressure to fill the new EST. Costs for the EST are based on the construction of a composite-type tank.

Table 4-11
Mustang Bayou WTP EST Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	New 0.5 MG Composite Elevated Storage Tank	GAL	500,000	$2.50	$1,250,000.00
2	Piping Modifications and Sitework	LS	1	$50,000.00	$50,000.00
3	High Service Pumping Modifications	LS	1	$50,000.00	$50,000.00
4	SCADA System for New EST	LS	1	$25,000.00	$25,000.00
Subtotal					$1,375,000.00
Contingencies (20%)					$275,000.00
Engineering & Testing (18%)					$297,000.00
Total Estimated Capital Cost					**$1,947,000.00**

Notes:
1 - This estimate does not include costs for acquisition of Easements from property owners.

New EST at Fort Bend County MUD #149 WTP

Phase II and Phase III of the RWTP will also provide treated surface water to approximately 17,500 connections in the western part of the Study area, requiring elevated storage of roughly 1.75 MG. Therefore, a 1.75 MG EST is proposed for the existing Fort Bend County MUD #149 WTP site. This project would also include the modification of the existing high service pump station to allow for reusing the high service pumps to lift water into the EST in the event that the plant needed to temporarily revert back to groundwater usage. It is anticipated that the discharge pressure could be maintained at the RWTP to provide sufficient pressure to fill the new EST. Costs for the EST are based on the construction of a composite-type tank.

Table 4-12
Fort Bend County MUD #149 WTP EST Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	New 1.75 MG Composite Elevated Storage Tank	GAL	1,750,000	$2.50	$4,375,000.00
2	Piping Modifications and Sitework	LS	1	$50,000.00	$50,000.00
3	High Service Pumping Modifications	LS	1	$50,000.00	$50,000.00
4	SCADA System for New EST	LS	1	$25,000.00	$25,000.00
Subtotal					$4,500,000.00
Contingencies (20%)					$900,000.00
Engineering & Testing (18%)					$972,000.00
Total Estimated Capital Cost					**$6,372,000.00**

Notes:
1 - This estimate does not include any costs for acquisition of Easements from property owners.

New EST at Palmer Plantation MUD No. 2 WTP

Elevated storage can provide pressure-sustaining benefits in the eastern part of the Study area, including supplementing pressures in Palmer Plantation MUD No.2, Fort Bend County MUD #s 47 & 48 and Quail Valley UD. Therefore, this project would include the construction of a new 1.00 MG EST at the existing Palmer Plantation MUD No. 2 WTP site. This project would also include the modification of the existing high service pump station to allow for reusing the high service pumps to lift water into the EST in the event that the plant needed to temporarily revert back to groundwater usage. It is anticipated that the discharge pressure could be maintained at the RWTP to provide sufficient pressure to fill the new EST. Costs for the EST are based on the construction of a composite-type tank.

Table 4-13 Palmer Plantation MUD No. 2 WTP EST Cost Estimate					
Item	**Description**	**Unit**	**Qty**	**Unit Cost**	**Total Cost**
1	New 1.0 MG Composite Elevated Storage Tank	GAL	1,000,000	$2.50	$2,500,000.00
2	Piping Modifications and Sitework	LS	1	$50,000.00	$50,000.00
3	High Service Pumping Modifications	LS	1	$50,000.00	$50,000.00
4	SCADA System for New EST	LS	1	$25,000.00	$25,000.00
Subtotal					$2,625,000.00
Contingencies (20%)					$525,000.00
Engineering & Testing (18%)					$567,000.00
Total Estimated Capital Cost					**$3,717,000.00**
Notes: 1 - This estimate does not include costs for acquisition of Easements from property owners.					

New EST at Thunderbird Utility District System 1 WTP No. 2

Elevated storage can provide pressure sustaining benefits in the central part of the Study area, including supplementing pressures in the Thunderbird UD area, Palmer Plantation MUD #2, Quail Valley UD and Fort Bend County MUD #46. Therefore, this project would include the construction of a new 1.00 MG EST at the existing Thunderbird UD System 1 WTP No. 2 site. This project would also include the modification of the existing high service pump station to allow for reusing the high service pumps to lift water into the EST in the event that the plant needed to temporarily revert back to groundwater usage. It is anticipated that the discharge pressure could be maintained at the RWTP to provide sufficient pressure to fill the new EST. Costs for the EST are based on the construction of a composite-type tank.

Table 4-14 Thunderbird UD System 1 WTP No. 2 EST Cost Estimate					
Item	**Description**	**Unit**	**Qty**	**Unit Cost**	**Total Cost**
1	New 1.0 MG Composite Elevated Storage Tank	GAL	1,000,000	$2.50	$2,500,000.00
2	Piping Modifications and Sitework	LS	1	$50,000.00	$50,000.00
3	High Service Pumping Modifications	LS	1	$50,000.00	$50,000.00
4	SCADA System for New EST	LS	1	$25,000.00	$25,000.00
Subtotal					$2,625,000.00
Contingencies (20%)					$525,000.00
Engineering & Testing (18%)					$567,000.00
Total Estimated Capital Cost					**$3,717,000.00**
Notes: 1 - This estimate does not include costs for acquisition of Easements from property owners.					

New EST at Harris County WC&ID - Fondren Road WTP No. 2

Elevated storage can provide pressure sustaining benefits in the north part of the Study area, including supplementing pressures in the Harris County WC&ID – Fondren Road area, the Southwest Harris County MUD #1 area and the WC&ID #2 area. Therefore, this project would include the construction of a new 0.5 MG EST at the existing Harris County WC&ID – Fondren Road WTP No. 2 site. This project would also include the modification of the existing high service pump station to allow for reusing the high service pumps to lift water into the EST in the event that the plant needed to temporarily revert back to groundwater usage. It is anticipated that the discharge pressure could be maintained at the RWTP to provide sufficient pressure to fill the new EST. Costs for the EST are based on the construction of a composite-type tank.

Table 4-15
Harris County WC&ID - Fondren Road WTP No. 2 EST Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	New 0.5 MG Composite Elevated Storage Tank	GAL	500,000	$2.50	$1,250,000.00
2	Piping Modifications and Sitework	LS	1	$50,000.00	$50,000.00
3	High Service Pumping Modifications	LS	1	$50,000.00	$50,000.00
4	SCADA System for New EST	LS	1	$25,000.00	$25,000.00
Subtotal					$1,375,000.00
Contingencies (20%)					$275,000.00
Engineering & Testing (18%)					$297,000.00
Total Estimated Capital Cost					**$1,947,000.00**

Notes:
1 - This estimate does not include costs for acquisition of Easements from property owners.

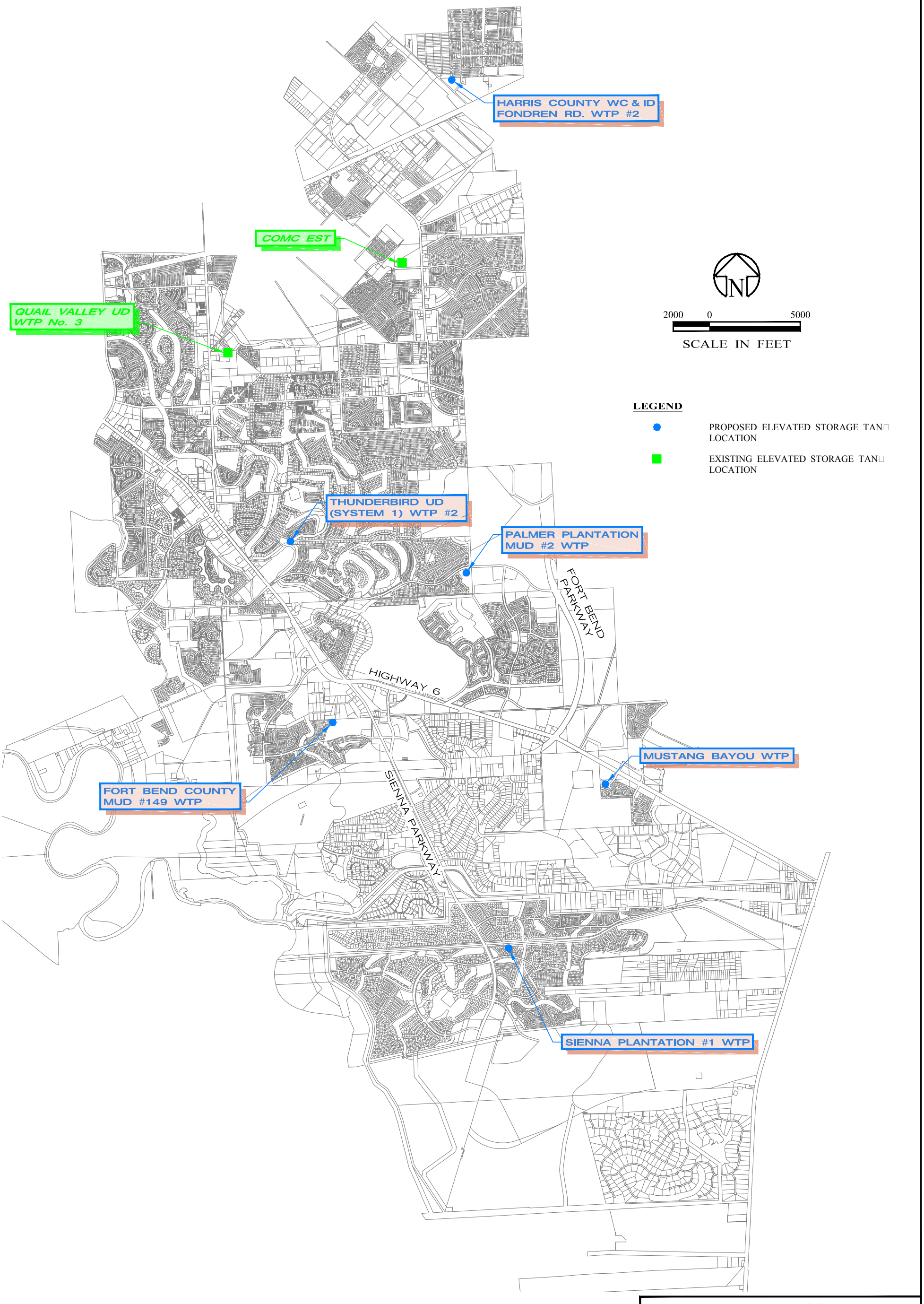


EXHIBIT 2-3
EXISTING AND PROPOSED ELEVATED STORAGE TANK LOCATIONS
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/17/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151

This Technical Memorandum (TM) summarizes the findings of Task IV of the City of Missouri City Regional Water and Wastewater Planning Study (the Study). The focus of Task IV of the Study is the preparation of water treatment system alternatives for the Study area.

Activities in Task IV included the following:

- ✓ Determine useful life of each facility, if possible;
- ✓ Determine treatment capacity;
- ✓ Determine available capacity;
- ✓ Evaluate potential for regional water treatment;
- ✓ Incorporate Groundwater Reduction Plan improvements into study;
- ✓ Develop water demand by service areas over the 30-year planning horizon;
- ✓ Develop anticipated opinions of probable cost; and,
- ✓ Prepare a technical memorandum summarizing the findings.

Water Demand for the 30-Year Planning Period

As discussed in TM II, the current water demand is 12.4 million gallons per day (MGD) for the Study area with a projected water demand in year 2040 of 26.7 MGD and a build-out demand of 27.3 MGD. Table 4-1 shows the current and projected water demand for each utility district and the total for the Study area.

Table 4-1
Current and Projected Monthly Water Demand

District	Average Usage Per Connection Per Month (Gallons)	Current Water Demand (2010)	2015	2020	2025	2030	2035	2040	Build Out Water Demand
Sienna Plantation Management District	64,350	4,440,150	5,405,400	9,652,500	14,478,750	19,305,000	24,131,250	28,957,500	29,150,550
Sienna Plantation MUD #1	81,425	1,465,650	1,465,650	1,547,075	1,628,500	1,709,925	1,872,775	2,035,625	2,035,625
Sienna Plantation MUD #2	14,618	26,078,512	26,078,512	26,078,512	26,078,512	26,078,512	26,078,512	26,078,512	26,078,512
Sienna Plantation MUD #3	14,618	35,887,190	35,887,190	35,887,190	35,887,190	35,887,190	35,887,190	35,887,190	35,887,190
Sienna Plantation MUD #4, 5, 6, 7	14,618	0	8,770,800	38,006,800	81,860,800	125,714,800	146,180,000	146,180,000	146,180,000
Sienna Plantation MUD #10	14,618	20,114,368	26,253,928	29,177,528	32,101,128	35,024,728	35,565,594	35,565,594	35,565,594
Sienna Plantation MUD #12	14,618	2,207,318	3,435,230	7,996,046	15,889,766	20,801,414	21,035,302	21,035,302	21,035,302

Table 4-1
Current and Projected Monthly Water Demand

District	Average Usage Per Connection Per Month (Gallons)	Current Water Demand (2010)	2015	2020	2025	2030	2035	2040	Build Out Water Demand
Sienna Plantation MUD #13	14,618	0	0	2,411,970	6,431,920	10,451,870	14,471,820	17,453,892	17,453,892
Fort County Bend MUD #129	22,008	22,338,120	32,197,704	34,112,400	34,112,400	34,112,400	34,112,400	34,112,400	34,112,400
Fort Bend County MUD #149	11,873	1,484,125	11,516,810	20,184,100	20,184,100	20,184,100	20,184,100	20,184,100	20,184,100
Blue Ridge West MUD	11,538	28,775,772	28,879,614	28,925,766	28,925,766	28,925,766	28,925,766	28,925,766	28,948,842
First Colony MUD #9	12,372	33,119,844	33,738,444	34,357,044	34,975,644	35,594,244	36,212,844	36,831,444	40,827,600
Fort Bend County MUD #115	22,008	12,060,384	12,478,536	12,764,640	12,764,640	12,764,640	12,764,640	12,764,640	12,764,640
Fort Bend County MUD #26	8,393	12,455,212	12,455,212	12,505,570	12,589,500	12,673,430	12,757,360	12,841,290	18,002,985
Fort Bend County MUD #42	12,825	16,710,975	18,057,600	19,327,275	19,327,275	19,327,275	19,327,275	19,327,275	19,327,275
Fort Bend County MUD #46	16,620	12,814,020	15,955,200	17,201,700	17,201,700	17,201,700	17,201,700	17,201,700	17,833,260
Fort Bend County MUD #47	12,783	6,813,339	10,545,975	12,041,586	12,041,586	12,041,586	12,041,586	12,041,586	12,783,000
Fort Bend County MUD #48	12,783	8,104,422	8,193,903	9,152,628	10,699,371	12,233,331	13,767,291	15,301,251	17,512,710
Fort Bend County MUD #49	26,448	8,992,320	9,415,488	9,627,072	9,785,760	9,918,000	10,050,240	10,182,480	10,473,408
Meadowcreek MUD	8,762	7,780,656	8,174,946	8,262,566	8,350,186	8,437,806	8,525,426	8,613,046	8,630,570
Palmer Plantation MUD #1	26,448	15,842,352	17,984,640	18,566,496	18,698,736	18,830,976	18,963,216	19,095,456	21,105,504
Palmer Plantation MUD #2	14,003	11,384,439	12,210,616	12,518,682	12,658,712	12,798,742	12,938,772	13,078,802	14,003,000
Quail Valley Utility District	10,940	48,387,620	48,387,620	48,475,140	49,383,160	49,383,160	49,383,160	49,383,160	49,383,160
Thunderbird Utility District	10,344	19,819,104	19,819,104	19,881,168	19,984,608	20,088,048	20,191,488	20,294,928	20,543,184
Mustang Bayou USA	11,873	7,705,577	15,909,820	24,339,650	32,769,480	36,141,412	36,141,412	36,141,412	37,732,394
Mustang Bayou USA Phase 2	11,873	0	0	16,206,645	43,217,720	70,228,795	97,239,870	107,984,935	107,984,935

Table 4-1
Current and Projected Monthly Water Demand

District	Average Usage Per Connection Per Month (Gallons)	Current Water Demand (2010)	2015	2020	2025	2030	2035	2040	Build Out Water Demand
Harris County MUD #122	8,190	3,357,900	3,931,200	4,504,500	5,094,180	5,675,670	5,847,660	5,847,660	5,847,660
Southwest Harris County MUD #1	5,310	2,798,370	3,632,040	4,471,020	5,310,000	6,143,670	6,982,650	6,982,650	6,982,650
Harris County WC&ID - Fondren Road	6,750	6,864,750	7,614,000	8,451,000	9,510,750	10,354,500	10,570,500	10,570,500	10,570,500
Total Monthly Water Demand (Gallons)		377,802,489	438,395,182	526,634,269	631,941,840	728,032,690	789,351,799	810,900,096	828,940,442
Total Water Demand (MGD)		**12.4**	**14.4**	**17.3**	**20.8**	**23.9**	**26.0**	**26.7**	**27.3**

Existing Treatment Facilities

The existing water production facilities vary throughout the Study area. This is largely because each entity was created and developed at different times, with different growth rates, and with different design criteria. The various ages, technologies, and design methods can also be attributed to these reasons. The data for the existing infrastructure described herein were developed from information provided by each utility district, the City's GIS database, and from the Texas Commission on Environmental Quality (TCEQ).

However, more detailed information on the age, condition, and remaining useful life of the individual water plants was not readily available during the development of this Study. Data that was collected and considered on the existing water wells and water treatment plants (WTP) is presented in this section.

Groundwater Wells

The majority of the water supplied to the utility districts within the Study area comes from groundwater. Currently only a few of the northern most utility districts are receiving surface water from the City of Houston, which include Harris County WC&ID - Fondren Road, Southwest Harris County MUD #1 and Harris County MUD #122. Almost all of the districts operate their own well as a means to supply this groundwater. There are a total of 28 existing public wells within the planning area. Data on the wells was obtained from the Joint GRP and

the utility districts and is presented in Table 4-2. A map of these wells is contained in Exhibit 1-3. The wells located in Fort Bend County are identified by the FBSD well number and the wells located in Harris County are identified by the TWDB state well number.

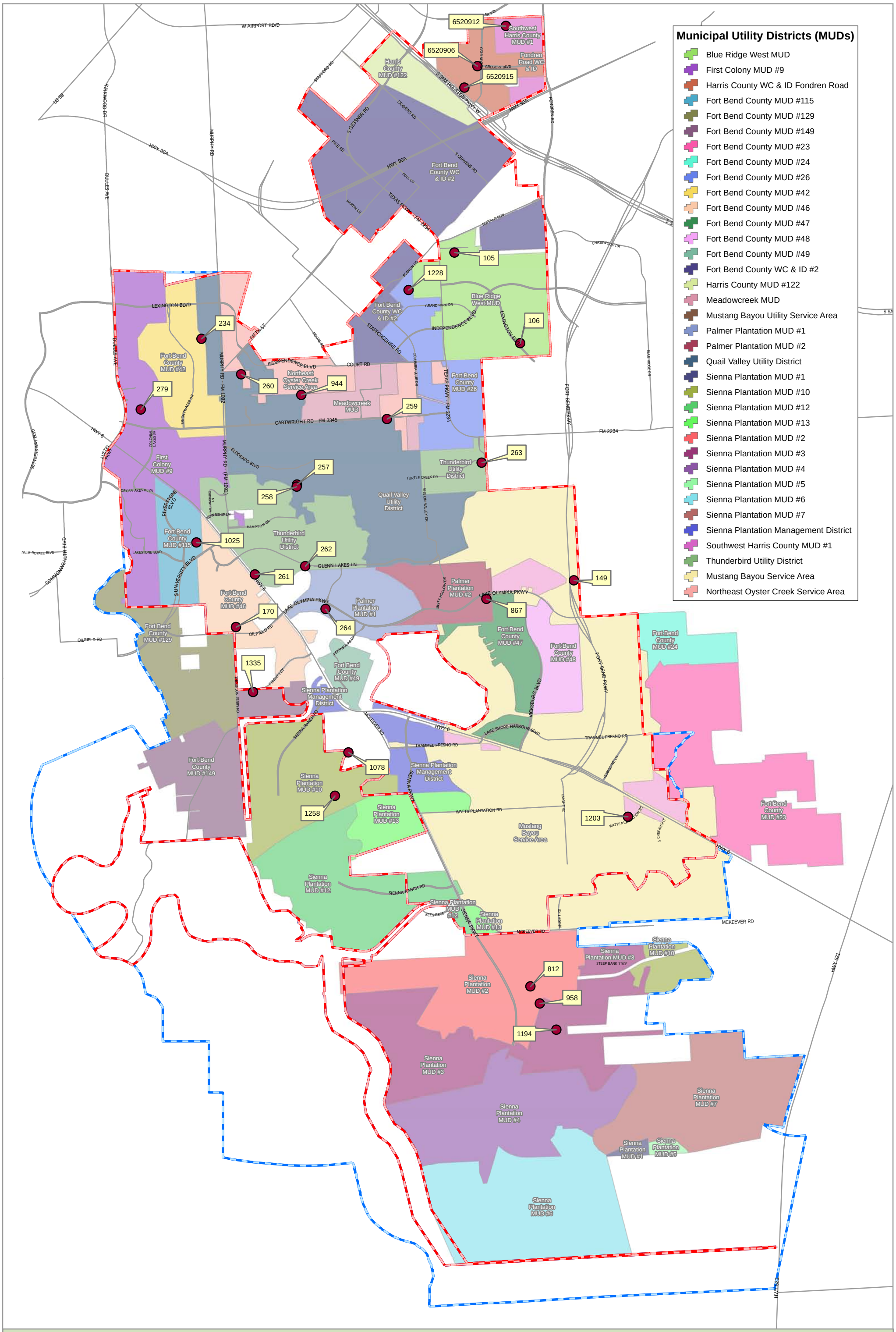

Municipal Utility Districts (MUDs)
Blue Ridge West MUD
First Colony MUD #9
Harris County WC & ID Fondren Road
Fort Bend County MUD #115
Fort Bend County MUD #129
Fort Bend County MUD #149
Fort Bend County MUD #23
Fort Bend County MUD #24
Fort Bend County MUD #26
Fort Bend County MUD #42
Fort Bend County MUD #46
Fort Bend County MUD #47
Fort Bend County MUD #48
Fort Bend County MUD #49
Fort Bend County WC & ID #2
Harris County MUD #122
Meadowcreek MUD
Mustang Bayou Utility Service Area
Palmer Plantation MUD #1
Palmer Plantation MUD #2
Quail Valley Utility District
Sienna Plantation MUD #1
Sienna Plantation MUD #10
Sienna Plantation MUD #12
Sienna Plantation MUD #13
Sienna Plantation MUD #2
Sienna Plantation MUD #3
Sienna Plantation MUD #4
Sienna Plantation MUD #5
Sienna Plantation MUD #6
Sienna Plantation MUD #7
Sienna Plantation Management District
Southwest Harris County MUD #1
Thunderbird Utility District
Mustang Bayou Service Area
Northeast Oyster Creek Service Area
6520912
6520906
6520915
105
1228
106
234
260
944
279
259
263
257
258
1025
262
261
170
264
149
867
1335
1078
1258
1203
812
958
1194
Southwest Harris County MUD #1
Fondren Road WC & ID
Harris County MUD #122
Fort Bend County WC & ID #2
Blue Ridge West MUD
Fort Bend County MUD #42
Northeast Oyster Creek Service Area
Meadowcreek MUD
Fort Bend County MUD #26
First Colony MUD #9
Thunderbird Utility District
Quail Valley Utility District
Fort Bend County MUD #115
Fort Bend County MUD #46
Fort Bend County MUD #129
Palmer Plantation MUD #1
Palmer Plantation MUD #2
Fort Bend County MUD #47
Fort Bend County MUD #48
Fort Bend County MUD #24
Fort Bend County MUD #49
Sienna Plantation Management District
Fort Bend County MUD #149
Sienna Plantation MUD #10
Sienna Plantation MUD #13
Mustang Bayou Service Area
Fort Bend County MUD #23
Sienna Plantation MUD #12
Sienna Plantation MUD #3
Sienna Plantation MUD #2
Sienna Plantation MUD #7
Sienna Plantation MUD #4
Sienna Plantation MUD #1
Sienna Plantation MUD #5
Sienna Plantation MUD #6
W AIRPORT BLVD
US 59
KIRKWOOD DR
HWY 90A
MURPHY RD
DULLES AVE
STAFFORD RD
S GESSNER RD
CRAVENS RD
PIKE RD
S CRAVENS RD
BULL LN
MARTIN LN
TEXAS PKWY - FM 2234
S SAM HOUSTON PKWY W
GREGORY BLVD
FONDREN RD
BUFFALO RUN
CHASEWOOD DR
SCANLIN RD
STAFFORDSHIRE RD
GRAND PARK DR
INDEPENDENCE BLVD
LEXINGTON BLVD
LEXINGTON BLVD
FIFTH ST
MOORE RD
COURT RD
COLUMBIA BLUE DR
TEXAS PKWY - FM 2234
BLUE RIDGE DR
FORT BEND PKWY
FM 2234
LEXINGTON BLVD
BRIGHTWATER DR
MURPHY RD - FM 1092
CARTWRIGHT RD - FM 3345
HWY 6
AUSTIN PKWY
COLONIAL LAKES DR
ELDORADO BLVD
TURTLE CREEK DR
MISSION VALLEY DR
SETTLERS WAY BLVD
CROSSLAKES BLVD
RIVERSTONE BLVD
WILLAMSBURG LN
TOWNSHIP LN
HAMPTON DR
PALM ROYALE BLVD
LAKESTONE BLVD
COMMONWEALTH BLVD
S UNIVERSITY BLVD
HWY 6
GLENN LAKES LN
MISTY HOLLOW DR
LAKE OLYMPIA PKWY
LAKE OLYMPIA PKWY
OILFIELD RD
OILFIELD RD
PENINSULA DR
KNIGHT CT
THOMPSON FERRY RD
SIENNA RANCH RD
MCKEEVER RD
HWY 6
LAKE SHORE HARBOUR BLVD
TRAMMEL FRESNO RD
TRAMMEL FRESNO RD
VICKSBURG BLVD
FORT BEND PKWY
AUBURNMEWE LN
SIENNA PKWY
KNIGHT RD
WATTS PLANTATION RD
WATTS PLANTATION RD
S CREEKMONT
HWY 6
MCKEEVER RD
SIENNA RANCH RD
SIENNA PKWY
KNIGHT RD
SEES PASE
STEEP BANK TRCE
HWY 521
HWY 521
Map By:
GIS Division
October 2011
Exhibit 1-3
Public Water Wells
Legend
Water Wells
City Limits Line
ETJ Line
Geographic Coordinate System North American Datum 1983 (NAD83)
0 2,000 4,000 6,000 8,000
Feet
The information on this map is provided and maintained by various agencies, including county departments, municipal governments, state and federal agencies. No guarantee is given as to the accuracy or currency of any of the data. The map is designed to serve as a secondary representation of real property found within this jurisdiction, and is compiled from the recorded deeds, plats, and other public records, which are primary sources for this public information. Users of this map are hereby notified that these primary sources should be consulted for verification of the information presented here. The data layers do not take the place of a legal survey or other primary source documentation. The county and its vendors assume no legal responsibility for the information on this map.

Table 4-2
Existing Water Wells

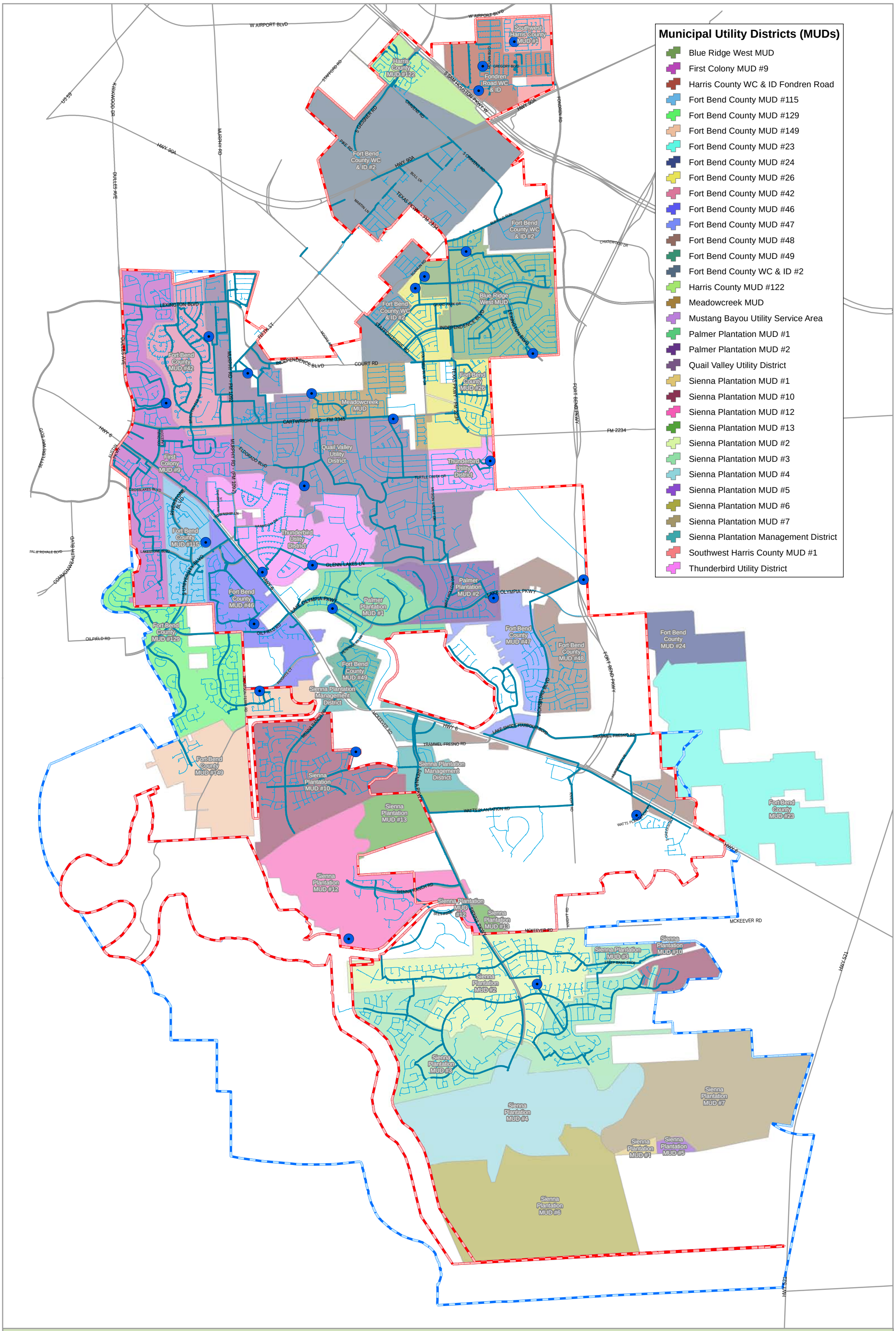
	District	Well #	Location	Drill Date	Depth	Tested GPM	Rated GPM
1	Sienna Plantation MUD #1	812	Murray Ct.	N/A	N/A	N/A	N/A
2	"	958	McMahon Way	N/A	N/A	N/A	N/A
3	"	1194	Scanlan Trace	7/20/2005	1930	1200	1200
4	"	1078	Mckever Rd.	1/15/2004	1311	1566	1500
5	"	1258	7738 ½ Fallen Leaf	7/23/2008	1930	1520	1500
6	Blue Ridge West MUD	105	1415 FM 2234	1/10/1975	1262	1461	1400
7	"	106	903 Manor Glen	1980	772	542	500
8	First Colony MUD #9	279	Ringrose Dr.	5/15/1984	1205	2170	2100
9	Fort Bend MUD #115	1025	20425 University Blvd.	9/12/2001	923	1510	1905
10	Fort Bend MUD #149	1335	5603 1/2 Rising Walk Lane	11/18/2009	1140	0	1711
11	Fort Bend MUD #26	1228	1812 Fresh Meadows	1/9/2006	1150	1694	1600
12	Fort Bend MUD #42	234	1819 1/2 Lake Winds	10/23/1984	1092	1595	1700
13	Fort Bend MUD #46	170	4835 Thompson Ferry Rd.	5/17/1985	1065	1000	1000
14	Fort Bend MUD #47 & #48	149	Senior Rd.	10/24/1983	600	1000	1000
15	Meadowcreek MUD	944	3100 N. Park	9/11/2000	1106	815	800
16	Palmer Plantation MUD #1	264	4335 Crown Valley	5/13/1983	1225	1168	1000
17	Palmer Plantation MUD #2	867	1603 Lake Olympia Pkwy	1983	1225	1200	1200
18	Quail Valley Utility District	257	2935 Blue Lakes Ln.	1977	1320	1300	2100
19	"	258	2935 Blue Lakes Ln.	1969	1200	0	500
20	"	259	2143 Cartwright	1972	1077	1353	1400
21	"	260	1930 Rothwell	1978	1325	2252	2300
22	Thunderbird Utility District	261	6605 Highway 6	1972	1074	1170	1200
23	"	262	3003 Glenn Lakes Dr.	1976	1157	849	850
24	"	263	1455 Turtle Creek	1975	1314	674	800
25	Southwest Harris County MUD #1	6520912	7843 La Rochelle	5/13/1980	772	520	500
26	Harris County WC&ID - Fondren Road	6520909	11802 McClain	11/12/1970	1167	1234	1260
27	"	6520915	13455 Beltway 8	3/13/1987	980	855	850
28	Missouri City	1203	Watts Plantation Dr.	9/1/2005	1384	2163	2200

Water Treatment

There are currently 24 WTPs operating within the Study area. In addition to these the City is currently constructing a regional WTP (RWTP) located in Sienna Plantation. This plant will begin operations in 2012. Exhibit 1-4 shows the location of the existing WTPs within the Study area. Total water treatment capacity currently available is 49.54 MGD. All of the existing WTPs use groundwater as a source. The smallest WTP is Fort Bend County MUD #149 (0.648 MGD) while the largest belongs to the Quail Valley Utility District (QVUD) with a total capacity of 8.524 MGD. Table 4-3 shows the existing WTPs for the Study area.

Table 4-3
Existing Water Treatment Plants

Number	Name	Location	Current Permitted Capacity
1	Blue Ridge West MUD WTP #1	1415 FM 2234	3.168 MGD
2	Blue Ridge West MUD WTP #2	903 Manor Glen	
3	First Colony MUD #9 WTP	Ringrose Dr.	3.024 MGD
4	Fort Bend County MUD #26 WTP	1812 Fresh Meadows	2.728 MGD
5	Fort Bend County MUD #42 WTP	1819 1/2 Lake Winds	2.304 MGD
6	Fort Bend County MUD #46 WTP	4835 Thompson Ferry Rd.	1.440 MGD
7	Fort Bend County MUD #115 WTP	20425 University Blvd.	2.174 MGD
8	Fort Bend County MUD #149 WTP	Maverick Bend Ln.	0.648 MGD
9	Harris County WC&ID - Fondren Road WTP #1	11802 1/2 McClain Blvd.	3.760 MGD
10	Harris County WC&ID - Fondren Road WTP #2	9380 S. Sam Houston Pkwy. W.	
11	Meadowcreek MUD WTP	3100 N. Park	1.158 MGD
12	Mustang Bayou WTP	Watts Plantation	3.159 MGD
13	Palmer Plantation MUD #1 WTP	4335 Crown Valley	2.138 MGD
14	Palmer Plantation MUD #2 WTP	1603 Lake Olympia Pkwy.	1.728 MGD
15	Quail Valley Utility District WTP #1	2935 Blue Lakes Ln.	8.524 MGD
16	Quail Valley Utility District WTP #2	2143 Cartwright	
17	Quail Valley Utility District WTP #3	1930 Rothwell	
18	Sienna WTP #1	Murray Ct.	7.380 MGD
19	Sienna WTP #2	Mckeever	
20	Southwest Harris County MUD #1 WTP	7843 Larochelle Cr.	0.748 MGD
21	Thunderbird Utility District (System 1) WTP #1	6605 Highway 6	3.060 MGD
22	Thunderbird Utility District (System 1) WTP #2	3003 Glenn Lakes Dr.	
23	Thunderbird Utility District (System 2) WTP #1	1455 Turtle Creek	0.959 MGD
24	Vicksburg Joint Powers WTP	2775 Senior Rd.	1.440 MGD
Total Permitted Capacity = 49.540 MGD			


Municipal Utility Districts (MUDs)
Blue Ridge West MUD
First Colony MUD #9
Harris County WC & ID Fondren Road
Fort Bend County MUD #115
Fort Bend County MUD #129
Fort Bend County MUD #149
Fort Bend County MUD #23
Fort Bend County MUD #24
Fort Bend County MUD #26
Fort Bend County MUD #42
Fort Bend County MUD #46
Fort Bend County MUD #47
Fort Bend County MUD #48
Fort Bend County MUD #49
Fort Bend County WC & ID #2
Harris County MUD #122
Meadowcreek MUD
Mustang Bayou Utility Service Area
Palmer Plantation MUD #1
Palmer Plantation MUD #2
Quail Valley Utility District
Sienna Plantation MUD #1
Sienna Plantation MUD #10
Sienna Plantation MUD #12
Sienna Plantation MUD #13
Sienna Plantation MUD #2
Sienna Plantation MUD #3
Sienna Plantation MUD #4
Sienna Plantation MUD #5
Sienna Plantation MUD #6
Sienna Plantation MUD #7
Sienna Plantation Management District
Southwest Harris County MUD #1
Thunderbird Utility District
W AIRPORT BLVD
US 59
KIRKWOOD DR
HWY 90A
MURPHY RD
DULLES AVE
STAFFORD RD
S GESSNER RD
CRAVENS RD
PIKE RD
BULL LN
MARTIN LN
TEXAS PKWY - FM 2234
S SAM HOUSTON PKWY W
GREGORY BLVD
FONDREN RD
BUFFALO RUN
CHASEWOOD DR
SCANLIN RD
GRAND PARK DR
INDEPENDENCE BLVD
LEXINGTON BLVD
STAFFORDSHIRE RD
FIFTH ST
MOORE RD
COURT RD
MURPHY RD - FM 1092
CARTWRIGHT RD - FM 3345
FM 2234
FORT BEND PKWY
HWY 6
AUSTIN PKWY
SETTLERS WAY BLVD
ELDORADO BLVD
TURTLE CREEK DR
MISSION VALLEY DR
ROSSLAKES BLVD
RIVERSTONE BLVD
TOWNSHIP LN
HAMPTON DR
GLENN LAKES LN
PALM ROYALE BLVD
COMMONWEALTH BLVD
LAKESTONE BLVD
S UNIVERSITY BLVD
RIVER PL
LAKE OLYMPIA PKWY
OILFIELD RD
PENNA TRAIL
KIMBRIS CT
MCKEEVER RD
PENNA RANCH DR
TRAMMEL FRESNO RD
LAKE SHORE HARBOUR BLVD
VICKSBURG BLVD
SIENNA PKWY
WATTS PLANTATION RD
KNIGHT RD
GREENSIDE DR
SIENNA RANCH RD
BEES FORK
STEEP BANK TRCE
HWY 521
Map By:
GIS Division
October 2011
Exhibit 1-4
Water Distribution System
Legend
Waterlines
Under 12 Inches
12 Inches or Larger
Water Treatment Plants
City Limits Line
ETJ Line
Geographic Coordinate System North American Datum 1983 (NAD83)
0 2,000 4,000 6,000 8,000 Feet
The information on this map is provided and maintained by various agencies, including county departments, municipal governments, state and federal agencies. No guarantee is given as to the accuracy or currency of any of the data. The map is designed to serve as a secondary representation of real property found within this jurisdiction, and is compiled from the recorded deeds, plats, and other public records, which are primary sources for this public information. Users of this map are hereby notified that these primary sources should be consulted for verification of the information presented here. The data layers do not take the place of a legal survey or other primary source documentation. The county and its vendors assume no legal responsibility for the information on this map.

Water System Storage

Storage was also evaluated throughout the City's water system with regard to other potential improvements in efficiency and/or safety. The TCEQ has specific requirements with regard to minimum provided ground storage and elevated or pressure storage for water systems in Texas. TCEQ has a minimum requirement of 200 gallons of total storage per connection, with half of the storage capacity (100 gallons per connection) being provided either as elevated storage (from an elevated storage tank) or as pressure storage (from a hydropneumatic tank).

Two issues were observed in the review of water storage in the existing utility district WTPs located throughout the Study area. The first issue is that insufficient ground storage was available at several of the WTPs though construction and active operation of interconnections with nearby systems can alleviate the demand for individual ground storage in many cases.

A second issue is the observation that almost all of the existing WTPs in the Study area utilize pressure storage via hydropneumatic tanks, which tend to be energy-intensive to operate, whereas elevated storage tanks (EST) require very little energy to operate. Currently, only the Blue Ridge West MUD and Quail Valley UD own and operate EST tanks. Further discussion of ground and pressure/elevated storage is included in the Technical Memorandum for Task V.

Current City Water Regionalization Plans

The Joint GRP group has identified a plan for which as a whole, the participants will meet the groundwater reduction requirements set forth by the FBCSD. In working toward meeting the Joint GRP groundwater usage reduction goals, the City has already begun to implement a few projects to regionalize some of the utility services in the Study area. These plans include the City directly providing water services to a portion of the residents as well as a plan to combine the operation of the City's Mustang Bayou USA with two other utility districts. Additional details of these plans are discussed below.

RWTP

The participants of the Joint GRP group have determined that the most cost-effective means of meeting the requirements set forth by the FBCSD is a complete conversion from groundwater to surface water in a portion of the City's service area, while leaving the remaining service area on ground water supplies. Initially, those utility districts located in the southern portion of the City and its ETJ are converting from groundwater to surface water to achieve the 30% reduction in groundwater usage required by 2013. As the 60% reduction requirement is approached in 2025, additional utility districts will be converted to surface water, generally moving northward on the system.

The initial RWTP size is 10 MGD (Phase I), which is anticipated to meet the City's required maximum demand through 2018, at which time the RWTP is intended to be expanded. Exhibit 2-1 identifies the initial converting utility districts, which will generally consist of Sienna Plantation MUDs. The first phase of the RWTP is currently under construction and is anticipated to be fully operational by the first of the year in 2012.

The City anticipates two additional conversion phases. Phase 2 is anticipated to consist of converting Sienna MUD #s 1, 4, 5, 6 and 7, Fort Bend County MUD #s 46, 47, 48, and 149, and the Mustang Bayou USA. Phase 3 is anticipated to consist of converting Fort Bend County MUD #s 129 and 115. Exhibit 2-1 identifies the converting entities as part of Phase 2 and Phase 3.

Costs for Recommended Regional Water Treatment Plant – Phase II

The project would include an 11.1 MGD expansion to increase the total RWTP capacity to 21.1 MGD to accommodate the increased water demand and growth in the Study area. Costs include the construction of a new membrane filtration system and a new RO system.

Table 4-4
RWTP Phase II Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	RWTP Phase II	LS	1	$25,000,000.00	$25,000,000.00
Subtotal					$25,000,000.00
Contingencies (20%)					$5,000,000.00
Engineering & Testing (18%)					$5,400,000.00
Total Estimated Capital Cost					**$35,400,000.00**

Costs for Recommended Regional Water Treatment Plant – Phase III

This project includes the Phase III expansion of the City's new RWTP. The project would include an additional 12.2 MGD expansion to bring the total RWTP capacity to 33.3 MGD to accommodate the increased water demand and growth in the Study area. Costs include the construction of a new membrane filtration system and a new RO system.

Table 4-5
RWTP Phase III Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	RWTP Phase II	LS	1	$30,000,000.00	$30,000,000.00
Subtotal					$30,000,000.00
Contingencies (20%)					$6,000,000.00
Engineering & Testing (18%)					$6,480,000.00
Total Estimated Capital Cost					**$42,480,000.00**

Costs for Recommended Transmission Line Projects – Phase II

The project would include approximately 11.5 miles of transmission line to deliver treated surface water from the City's RWTP to the Mustang Bayou WTP, the Vicksburg WTP, the future Sienna WTP No. 3, and the Fort Bend County MUD #149 WTP. Cost estimates are based on a PVC transmission line.

Table 4-6
RWTP Phase II Transmission Lines Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	Transmission Line to Mustang Bayou WTP	LF	18,850	$160.00	$3,016,000.00
2	Transmission Line to Vicksburg WTP	LF	15,720	$160.00	$2,515,200.00
3	Transmission Line to Future Sienna WTP No. 3	LF	13,525	$160.00	$2,164,000.00
4	Transmission Line to Fort Bend County MUD #149 WTP	LF	13,075	$160.00	$2,092,000.00
Subtotal					$9,787,200.00
Contingencies (20%)					$1,957,440.00
Engineering & Testing (18%)					$2,114,000.00
Total Estimated Capital Cost					**$13,850,000.00**

Notes:
1 - This estimate does not include costs for acquisition of easements from property owners.
2 - This estimate does not include costs for permitting with City, State, or private entities.
3 - This estimate does not include permitting for jurisdictional wetlands.
4 - Preliminary lengths were estimated without the benefit of a field survey. Additional conflicts may arise during final design.

Costs for Recommended Transmission Line Projects – Phase III

The project would include approximately 2.25 miles of transmission line to delivery treated surface water from the City's RWTP to the Fort Bend County MUD #115 WTP. Cost estimates are based on a PVC transmission line.

Table 4-7
RWTP Phase III Transmission Lines Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	Transmission Line to Fort Bend County MUD #115 WTP	LF	11,875	$160.00	$1,900,000.00
Subtotal					$1,900,000.00
Contingencies (20%)					$380,000.00
Engineering & Testing (18%)					$410,400.00
Total Estimated Capital Cost					**$2,690,000.00**

Notes:
1 - This estimate does not include costs for acquisition of easements from property owners.
2 - This estimate does not include costs for permitting with City, State, or private entities.
3 - This estimate does not include permitting for jurisdictional wetlands.
4 - Preliminary lengths were estimated without the benefit of a field survey. Additional conflicts may arise during final design.

Mustang Bayou USA/Fort Bend County MUD #47/Fort Bend County MUD #48

Mustang Bayou USA is supplied water from the Mustang Bayou WTP owned by the City. Fort Bend County MUD #47 and Fort Bend County MUD #48 are supplied water from the Vicksburg Joint Powers WTP. Currently, Fort Bend County MUD #47 and Fort Bend County MUD #48 are interconnected and operate as one system. A plan has been identified to combine the Mustang Bayou USA and Fort Bend County MUD #47 and Fort Bend County MUD #48. By combining the two systems the overall system capacity is greater and each water plant makes up in areas where the other is lacking. The infrastructure for combining these systems has been constructed, and once the interconnect valve between the two systems is opened the two systems should operate as one combined system. This project was recently completed with an agreement between the City and the two utility districts.

Additional Water Treatment System Improvements

As the City begins looking at ways to consolidate the various utility district distribution systems into one single, or several larger distribution systems, additional improvements to the various systems are likely. This subsection discusses the impacts to the various utility district plants that will convert completely to treated surface water as a result of the new RWTP. The following subsection cover the various system improvements needed throughout the utility district systems.

Type of Finished Water

The majority of the utility districts within the Study area have historically utilized groundwater as the supply source. In recent years, several of the neighboring utility districts with connection to utility districts in the City have converted to surface water sources (e.g., City of Houston and Fort Bend County WC&ID #2). The City is also constructing a new RWTP that will treat surface water. From the Joint GRP plan, the City is required to meet a reduction in groundwater usage by a minimum of 30% by 2013 and 60% by 2025. To meet the 60% reduction requirement will require two expansions; the first in 2018 that will increase total treatment capacity to 21.1 MGD and a second expansion in 2025 to increase total treatment capacity to 33.3 MGD.

As a result, over the course of the next 15 years, the water supply source for some utility districts will remain unchanged and some utility districts will convert to surface water supplies. Utility districts whose supply source will remain unchanged will continue to operate in the same way while utility districts systems that will switch to treated surface water will begin operating their plants as a storage and booster pump station only.

Disinfection Modifications

Currently all of the utility districts within the City, with the exception of Harris County MUD #122, Southwest Harris County MUD #1, and Harris County WC & ID - Fondren Rd., are treating groundwater with the use of free chlorine for disinfection. With the construction of the City's RWTP, the utility districts converting to treated surface water must change from free chlorine to chloramines in the distribution system. This is important to note because any utility districts with an interconnection to a utility district operating on a treated surface water source must also convert to use chloramines. Converting to chloramines is necessary because the mixture of free chlorine and chloramines in the distribution system results in a loss of measurable disinfectant residual, which can increase the risk to the health of the City's residents.

The cost to convert to chloramines for a typical utility district WTP consisting of a groundwater well, ground storage, high service pumps, hydropneumatic tank and free chlorine disinfection is approximately $250,000 for a liquid ammonium sulfate (LAS) chemical feed and control system. However, this cost is representative only for the chemical feed system and a small building to house the system which is appropriate for utility districts not receiving surface water directly. For the utility districts anticipated to receive treated surface water directly from the new RWTP, additional flow control improvements will be necessary (including a new automated flow control valve system, flow control building and flow control and chemical feed control PLC), at an approximate cost of $400,000 per utility district facility.

For the consolidation projects identified in this report, if a utility district is proposed to be connected to a utility district that is currently supplied surface water or a utility district that will be converted to surface water in a future phase of the City's RWTP, a more detailed cost for the chloramines conversion has been included in the cost estimates. Even though these costs have been included in the overall project cost estimate, the Joint GRP group has discussed the potential for the GRP to pay for the chloramine conversion of the districts receiving surface water as part of the RWTP.

This Technical Memorandum (TM) summarizes the findings of Task V of the City of Missouri City Regional Water and Wastewater Planning Study (the Study). The focus of Task V of the Study is the preparation of water operation alternatives for the Study area.

Activities in Task V included the following:

- ✓ Determine potential operational scenarios for a single large WTP as compared to multiple smaller WTPs;
- ✓ Determine anticipated operational costs for each scenario; and
- ✓ Prepare a technical memorandum summarizing the findings.

Comparison of O&M Costs for Small Surface WTPs (SWTPs) Versus Regional SWTPs

In evaluating the WTPs, multiple plant issues were reviewed that could impact O&M costs, such as the age and condition of the structures and equipment, type of ground storage used, type of elevated or pressure storage used, water demand as compared to treatment capacity and type of control systems to reduce power consumption and O&M effort. From these issues, typical O&M costs are developed for new WTPs of various sizes, ages and operating efficiencies. The anticipated O&M costs for the existing 24 WTPs as compared to a single, regional WTP and as compared to several regional facilities. The following sections cover the basis for development of O&M costs and the comparisons of the various WTPs in the Study area.

Development of O&M Costs

The Environmental Protection Agency (EPA) developed cost curves for various types of WTPs, including accounting for type of process, whether a treatment facility was based on treating groundwater or surface water, and flow loading. At the time, factors such as energy efficiency and level of automation from control systems had very little impact on the cost curves, as control components such as variable frequency drives were being used in a very limited percentage of the operating WTPs. As a result, the original EPA cost curves for WTP O&M have been updated and revised over the years to develop more current cost projections. The O&M cost models used in this Study were developed using EPA updated cost curves as a basis, with revisions made for newer treatment technologies such as membrane filtration and improvements in efficiency-enhancing technologies such as variable frequency drives and automated control systems.

The majority of the WTPs in the Study area consist of GWTPs. Because the plants are designed quickly for rapid implementation at a WTP site and frequently are located in areas where limited groundwater flow can be produced in a small area, GWTPs are not typically well suited for regional WTP demands. For example, the Sienna Plantation No. 1 WTP can produce treated

groundwater at a maximum demand of roughly 3,000 gallons per minute (gpm), or 4.3 MGD, though that maximum flow rate can only be accomplished using a combination of onsite and offsite wells. As another example, the Sienna Plantation No. 2 WTP can produce treated groundwater at a maximum demand of roughly 2,000 gpm, or 2.9 MGD, though that maximum flow rate can also only be accomplished using a combination of onsite and offsite wells. As a result, when considering demands proposed for the new RWTP, such as 10 MGD, 20 MGD and 30 MGD, it is typically not feasible to construct a single regional GWTP capable of meeting this demand, so surface water supplies must be used.

As discussed previously, the Joint GRP has set requirements for minimum levels of reduction in groundwater usage with a 60% reduction requirement by 2025. Therefore, since a portion of the GWTPs in the City will need to convert to surface water, the comparison of small versus large WTPs should be based on the cost to operate a single, regional SWTP as compared to converting some of the existing utility districts GWTPs into SWTPs to meet the Joint GRP groundwater reduction requirements. This analysis assumes adequate surface water is available for purchase or the rights thereof.

Unfortunately, the location of many of the proposed converting GWTPs are a substantial distance from a raw surface water source. Therefore, along with constructing new surface water treatment systems (typically including coagulation, flocculation, sedimentation, filtration and disinfection) at these WTPs, a raw water pump station would need to be constructed near the Brazos River or GCWA canals, and raw water would need to be pumped to each new SWTP. In addition, due to the raw water quality from the Brazos River, the most efficient form of treatment capable of meeting current and future state and federal drinking water regulations is membrane filtration.

In considering small SWTPs compared to large SWTPs, the projected annual O&M cost for a brand new, 0.1 MGD membrane filtration SWTP is roughly $98,000, while a 1.0 MGD facility would be about $560,000 and a 10.0 MGD facility would be roughly $4,156,000. As the size of the WTP increases, economies of scale impact the O&M cost, and the O&M cost per gallon continues to drop with an increasingly larger SWTP.

To compare O&M costs for one regional SWTP as compared to multiple, small SWTPs, conceptual O&M costs were developed for similar-sized membrane filtration SWTPs that would be required to provide treatment of surface water in the areas associated with each proposed phase of the City's new RWTP. The costs also include the pumping required to transfer raw water to each of the smaller facilities. Conceptual O&M costs for the new RWTP (Phase I) as compared to multiple, small SWTPs are listed in Table 5-1.

Table 5-1 O&M Costs Comparison for Phase I RWTP		
Project Description	**Flow Capacity (MGD)**	**Conceptual Annual O&M Cost**
Sienna Plantation No. 1 SWTP	4.32	$2,036,000
Sienna Plantation No. 2 SWTP	2.88	$1,436,000
RWTP	2.80	$1,357,000
Total	**10.0**	**$4,829,000**
City RWTP (Phase I)	**10.0**	**$4,235,000**

Conceptual O&M costs have also been prepared for Phase II of the City's RWTP along with proposed small SWTPs that would be required if a regional SWTP was not constructed in the southern part of the City. The costs also include the pumping required to transfer raw water to each of the smaller facilities. Conceptual O&M costs for the new RWTP (Phase I and II) as compared to multiple, small SWTPs are listed in Table 5-2.

Table 5-2 O&M Cost Comparison for Phase II RWTP		
Project Description	**Flow Capacity (MGD)**	**Conceptual Annual O&M Cost**
Sienna Plantation No. 1 SWTP	4.32	$2,036,000
Sienna Plantation No. 2 SWTP	2.88	$1,436,000
Mustang Bayou SWTP	2.75	$1,405,000
Vicksburg SWTP	9.91	$4,459,000
RWTP	1.24	$655,000
Total	**21.1**	**$9,991,000**
City RWTP (Phase II)	**21.1**	**$8,103,000**

In reviewing O&M cost comparisons of small SWTPs compared to the City's new RWTP in Phase I, the cost difference between the two options does not appear to be significant. In Phase II, a larger cost difference is observed. However, for either Phase I or II, the 30-year O&M cost difference is roughly $18,000,000; likewise, in Phase II, the 30-year O&M cost difference is approximately $56,000,000. In conclusion, since greater economies of scale can be obtained with larger facilities, it stands to reason that a RWTP approach can be accomplished at a substantially reduced life cycle cost as compared to constructing multiple, small SWTPs that would be compliant with the GRP's groundwater reduction requirements set for 2013 and 2025.

RWTP Phase I

The City is currently under construction of Phase I of a new RWTP. Phase I will provide a total treatment capacity of 10.0 MGD. The Phase I facility includes construction of a new 10.0 MGD membrane filtration system along with supporting facilities. In addition, transmission lines are also being constructed to send treated surface water to the two Sienna Plantation GWTPs that will be converting to surface water. Phase I is anticipated to be online by spring 2012.

RWTP Phase II Expansion

Two additional expansions are proposed for the City's new RWTP. This project would include the construction of a new 11.1 MGD (21.1 MGD total) membrane filtration system and potentially a new reverse osmosis (RO) treatment system, if necessary, to meet state and federal drinking water regulations as the quality of the raw surface water from the Brazos River is anticipated to decline in quality in the future. In addition to the membrane filtration and RO system, additional support facilities will also be constructed at the RWTP. Similar to Phase I, additional transmission lines will be constructed to the utility district systems being converted to surface water in Phase II per the GRP plan. These improvements are projected to be online by 2018.

RWTP Phase III Expansion

This project would include the Phase III expansion of a new 12.2 MGD (33.3 MGD total) membrane filtration system and potentially a new RO treatment system, if necessary to meet state and federal drinking water regulations. In addition to the membrane filtration and RO system, additional support facilities will also be constructed at the RWTP. Similar to Phase I and II, additional transmission lines will be constructed to the utility district systems being converted to surface water in Phase III per the GRP plan. These improvements are projected to be online by 2025.

Water System Storage Alternatives

The City also requested an evaluation of potential new elevated storage tank (EST) locations in order to provide a more hydraulic-oriented elevated storage system, as opposed to continuing operation of the pressure-driven storage system. In order to compare the life cycle costs of a hydropneumatic pressure tank (HPT) versus that for an EST, the operating process of each system and the components required for each system is discussed. An EST requires only the feed pressure from the incoming water to lift water into the elevated tank. Therefore, during an emergency if the nearby WTPs have backup power, then the EST will be filled and will continue operation.

A typical HPT system consists of an outer metal shell, inner bladder and an air compressor system. When the HPT needs to be filled, nearby pumps fill the tank with water. Air compressors are used to maintain a specific tank pressure which keeps the inner bladder in compression to provide a specific discharge pressure when the HPT lets water out into the distribution system. Similar to the EST system, an HPT still requires water from a nearby source, which would require backup power at the water source. However, backup power is also needed for the HPT system to operate the air compressors necessary to maintain tank pressure.

In addition, the typical useful life is fairly different for the two tank systems. Older types of ESTs (such as legged tank, ellipsoid, etc.) were traditionally all constructed of welded steel and typically had a useful life of 20-30 years, without completing a major rehabilitation of the interior and exterior of the tank. Newer and more common tank designs include a composite tank, which normally consists of a concrete ring structure for the tower, and uses a tradition welded steel bowl for the tank. The useful life of Composite tanks is frequently 30-50 years. The concrete structure typically lasts 50 years without major rehabilitative work and the bowl normally requires major rehabilitation every 30 years.

On the other hand, HPT systems commonly last between 10-20 years, depending primarily on the quality of the inner bladder. The type of HPT tanks used in many smaller, developer-driven WTPs or booster pump stations generally have an average useful life of 15 years. Due to the low cost of HPT tanks, it is common to see a complete HPT tank replacement rather than seeing an HPT tank cut open to replace internal components and then re-welded together.

Capital and O&M costs have been developed to assist in comparing potential HPT to an EST as shown in Table 5-3. One proposed storage location (Sienna Plantation No. 1 WTP) is used for the cost example. These costs were developed to provide a comparison between both tank types only.

In developing the costs for both a new HPT and an EST system, the sizing for each system was determined based on TCEQ Chapter 290 design criteria for water systems, including 100 gallons per connection for an EST tank, and 20 gallons per connection for an HPT tank. The number of connections served by the Sienna Plantation No. 1 WTP is approximately 12,500. Therefore, a 1,250,000 gallon (1.25 MG) EST or 250,000 gallons of HPT storage would be required.

An example calculation for a storage tank at Sienna Plantation WTP No. 1 is as follows:

- Connections served 12,500;
- TCEQ total storage required is 200 gallons per connection with 100 gallons per connection provided by elevated storage or 20 gallons per connection provided as pressure storage;

- 12,500 connections x 100 gallons per connection (elevated storage requirement) = 1,250,000 gallons with EST capacity = 1.25 MG;

- 12,500 connections x 20 gallons per connection (pressure storage requirement) = 250,000 gallons with HPT capacity = 250,000 gallons.

While the EST could be installed in one location, there are no WTP sites large enough in the Study area to support a 250,000 gallon HPT. The existing HPTs range in size from 5,000-25,000 gallons. Therefore, a maximum tank size of 25,000 gallons was used, knowing that HPTs would need to continue to be located at multiple WTP sites to provide enough space for the tanks. The proposed HPT and EST life cycle costs are shown in Table 5-3.

Table 5-3
Cost Comparison for HPT and EST Systems

Item	Description	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
1	Construct a new 1.25 MG EST, including piping, SCADA and high service pump station (HSPS) modifications and site work	$3,250,000	$4,602,000	$12,500	$4,848,000
2	Construct 10 new 25,000 gallon HPT tanks, including piping, SCADA and HSPS modifications, site work and emergency backup power improvements	$4,500,000	$6,372,000	$98,000	$8,293,000

Notes:
1 - Assumes no offsite collection improvements are required.
2 - Assumes that no other major capital improvements would be necessary during the project life.
3 - Assumes a 30-yr improvement life, at an interest rate of 3%.
4 - The HPT estimate assumes constructing HPT tanks at roughly 5 WTP sites, with two tanks at each site.
5 - The HPT estimate assumes replacing the HPTs once during the 30-yr period.
6 - The HPT O&M cost allows for operation of the feed pumps, air compressors and backup generators at each WTP site

When reviewing ESTs as compared to HPTs with a 15-yr operating life, the savings in constructing an EST is clear. However, if the HPTs were rehabilitated instead of being replaced, the cost difference is reduced, though it still appears to be more cost effective to construct an EST (Refer to Table 5-4).

Table 5-4
Supplemental Cost Comparison for HPT and EST Systems

Item	Description	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
1	Construct a new 1.25 MG EST, including piping, SCADA and HSPS modifications and site work	$3,250,000	$4,602,000	$12,500	$4,848,000
2	Construct 10 new 25,000 gallon HPT tanks, including piping, SCADA and HSPS modifications, site work and emergency backup power improvements	$3,500,000	$4,956,000	$98,000	$6,877,000

Notes:
1 - Assumes no offsite collection improvements are required.
2 - Assumes that no other major capital improvements would be necessary during the project life.
3 - Assumes a 30-yr improvement life, at an interest rate of 3%.
4 - The HPT estimate assumes constructing HPT tanks at roughly 5 WTP sites, with two tanks at each site.
5 - The HPT estimate assumes rehabilitating the HPTs once during the 30-yr period.
6 - The HPT O&M cost allows for operation of the feed pumps, air compressors and backup generators at each WTP site

Based on the costs shown in Table 5-3 and 5-4, construction of new ESTs throughout the City should provide a reduction in total elevated/pressure storage costs.

Proposed locations for new ESTs are based on engineering experience and coordination with existing WTP locations to determine feasible areas for a new EST. While the ideal location to construct an EST would be at an existing WTP site, it is best to locate an EST where sufficient open space (fall-down area) is available in case of a failure of the EST. Even though EST failures have an extremely low probability of collapse, when considering installation of ESTs in an area that has a potential for subsidence, it is generally a good idea to distance new ESTs from nearby residences if possible.

Therefore, the WTPs listed in Table 5-5 are not recommended for consideration of adding an EST, unless other more feasible property may be available in that system area.

Table 5-5 WTPs Not Recommended for EST Addition with Determining Factor	
WTP	**Reason this WTP is NOT a Recommended Location for a New EST**
Fort Bend County MUD #46	Houses within potential fall-down area
Thunderbird UD System 1 WTP No. 1	Major thoroughfare within potential fall-down area
Fort Bend County MUD #115	Houses and businesses within potential fall-down area
First Colony County MUD #9	Insufficient space within WTP site
Fort Bend County MUD #42	Insufficient space within WTP site
Quail Valley UD WTP No. 3	EST already located at this site
Meadowcreek MUD WTP	Located close to existing EST
Quail Valley UD WTP No. 1	Insufficient space within WTP site
Harris County WC&ID – Fondren Road WTP No. 1	Houses and businesses within potential fall-down area
Southwest Harris County MUD #1 WTP	Houses within potential fall-down area
Blue Ridge West MUD WTP No. 1	Located close to existing EST
Fort Bend County MUD #26 WTP	Located close to existing EST
Thunderbird UD System 2 WTP No. 1	Major thoroughfare within potential fall-down area
Palmer Plantation MUD No. 1 WTP	Houses within potential fall-down area

The recommended ESTs and their locations are described in the following subsections. A map of the proposed EST locations is shown in Exhibit 2-3.

New EST at Sienna Plantation No. 1 WTP

Phase I of the RWTP will provide treated surface water to roughly 12,500 connections in the southern part of the Study area, requiring elevated storage of roughly 1.25 million gallons (MG). Therefore, this project would include the construction of a new 1.25 MG EST at the existing Sienna Plantation No. 1 WTP site. This project would also include the modification of the existing high service pump station to allow for reusing the high service pumps to lift water into the EST in the event that the plant needed to temporarily revert back to groundwater usage. It is anticipated that the discharge pressure could be maintained at the RWTP to provide sufficient pressure to fill the new EST. Costs for the EST are based on the construction of a composite-type tank.

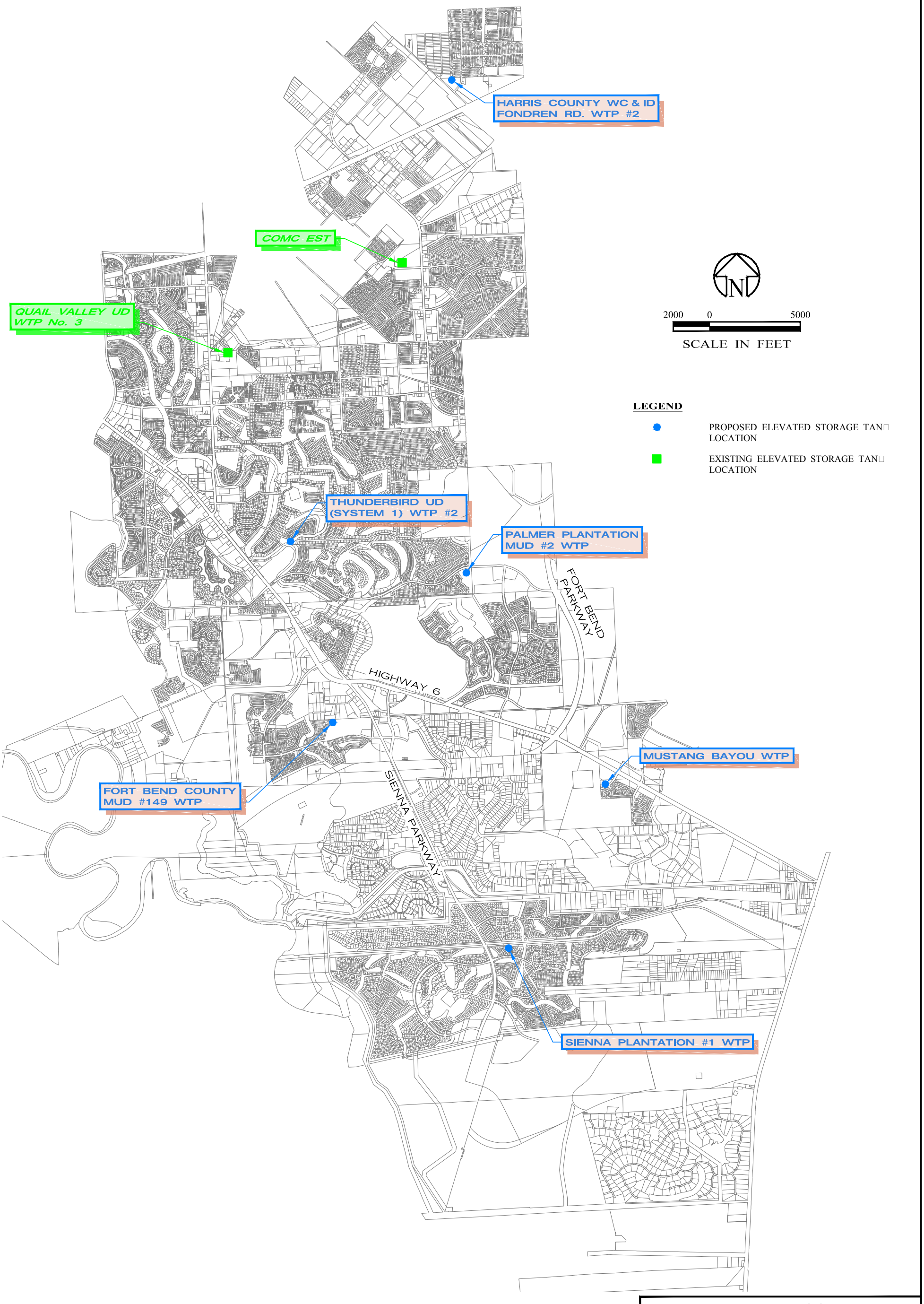


EXHIBIT 2-3
EXISTING AND PROPOSED ELEVATED STORAGE TANK LOCATIONS
2011 REGIONAL WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 10/17/2011

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151

Table 5-6 Sienna Plantation WTP #1 EST Cost Estimate					
Item	**Description**	**Unit**	**Qty**	**Unit Cost**	**Total Cost**
1	New 1.25 MG Composite Elevated Storage Tank	GAL	1,250,000	$2.50	$3,125,000.00
2	Piping Modifications and Sitework	LS	1	$50,000.00	$50,000.00
3	High Service Pumping Modifications	LS	1	$50,000.00	$50,000.00
4	SCADA System for New EST	LS	1	$25,000.00	$25,000.00
Subtotal					$3,250,000.00
Contingencies (20%)					$650,000.00
Engineering & Testing (18%)					$702,000.00
Total Estimated Capital Cost					**$4,602,000.00**
Notes: 1 - This estimate does not include costs for acquisition of Easements from property owners.					

New EST at Mustang Bayou WTP

Phase II of the RWTP will provide treated surface water to approximately 5,000 connections in the eastern part of the Study area, requiring elevated storage of roughly 0.5 MG. Therefore, this project would include the construction of a new 0.5 MG EST at the existing Mustang Bayou WTP site. This project would also include the modification of the existing high service pump station to allow for reusing the high service pumps to lift water into the EST in the event that the plant needed to temporarily revert back to groundwater usage. It is anticipated that the discharge pressure could be maintained at the RWTP to provide sufficient pressure to fill the new EST. Costs for the EST are based on the construction of a composite-type tank.

Table 5-7 Mustang Bayou WTP EST Cost Estimate					
Item	**Description**	**Unit**	**Qty**	**Unit Cost**	**Total Cost**
1	New 0.5 MG Composite Elevated Storage Tank	GAL	500,000	$2.50	$1,250,000.00
2	Piping Modifications and Sitework	LS	1	$50,000.00	$50,000.00
3	High Service Pumping Modifications	LS	1	$50,000.00	$50,000.00
4	SCADA System for New EST	LS	1	$25,000.00	$25,000.00
Subtotal					$1,375,000.00
Contingencies (20%)					$275,000.00
Engineering & Testing (18%)					$297,000.00
Total Estimated Capital Cost					**$1,947,000.00**
Notes: 1 - This estimate does not include costs for acquisition of Easements from property owners.					

New EST at Fort Bend County MUD #149 WTP

Phase II and Phase III of the RWTP will also provide treated surface water to approximately 17,500 connections in the western part of the Study area, requiring elevated storage of roughly 1.75 MG. Therefore, a 1.75 MG EST is proposed for the existing Fort Bend County MUD #149 WTP site. This project would also include the modification of the existing high service pump station to allow for reusing the high service pumps to lift water into the EST in the event that the plant needed to temporarily revert back to groundwater usage. It is anticipated that the discharge pressure could be maintained at the RWTP to provide sufficient pressure to fill the new EST. Costs for the EST are based on the construction of a composite-type tank.

Table 5-8
Fort Bend County MUD #149 WTP EST Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	New 1.75 MG Composite Elevated Storage Tank	GAL	1,750,000	$2.50	$4,375,000.00
2	Piping Modifications and Sitework	LS	1	$50,000.00	$50,000.00
3	High Service Pumping Modifications	LS	1	$50,000.00	$50,000.00
4	SCADA System for New EST	LS	1	$25,000.00	$25,000.00
Subtotal					$4,500,000.00
Contingencies (20%)					$900,000.00
Engineering & Testing (18%)					$972,000.00
Total Estimated Capital Cost					**$6,372,000.00**

Notes:
1 - This estimate does not include any costs for acquisition of Easements from property owners.

New EST at Palmer Plantation MUD No. 2 WTP

Elevated storage can provide pressure-sustaining benefits in the eastern part of the Study area, including supplementing pressures in Palmer Plantation MUD No. 2, Fort Bend County MUD #s 47 & 48 and Quail Valley UD. Therefore, this project would include the construction of a new 1.00 MG EST at the existing Palmer Plantation MUD No. 2 WTP site. This project would also include the modification of the existing high service pump station to allow for reusing the high service pumps to lift water into the EST in the event that the plant needed to temporarily revert back to groundwater usage. It is anticipated that the discharge pressure could be maintained at the RWTP to provide sufficient pressure to fill the new EST. Costs for the EST are based on the construction of a composite-type tank.

Table 5-9 Palmer Plantation MUD No. 2 WTP EST Cost Estimate					
Item	**Description**	**Unit**	**Qty**	**Unit Cost**	**Total Cost**
1	New 1.0 MG Composite Elevated Storage Tank	GAL	1,000,000	$2.50	$2,500,000.00
2	Piping Modifications and Sitework	LS	1	$50,000.00	$50,000.00
3	High Service Pumping Modifications	LS	1	$50,000.00	$50,000.00
4	SCADA System for New EST	LS	1	$25,000.00	$25,000.00
Subtotal					$2,625,000.00
Contingencies (20%)					$525,000.00
Engineering & Testing (18%)					$567,000.00
Total Estimated Capital Cost					**$3,717,000.00**
Notes: 1 - This estimate does not include costs for acquisition of Easements from property owners.					

New EST at Thunderbird Utility District System 1 WTP No. 2

Elevated storage can provide pressure sustaining benefits in the central part of the Study area, including supplementing pressures in the Thunderbird UD area, Palmer Plantation MUD #2, Quail Valley UD and Fort Bend County MUD #46. Therefore, this project would include the construction of a new 1.00 MG EST at the existing Thunderbird UD System 1 WTP No. 2 site. This project would also include the modification of the existing high service pump station to allow for reusing the high service pumps to lift water into the EST in the event that the plant needed to temporarily revert back to groundwater usage. It is anticipated that the discharge pressure could be maintained at the RWTP to provide sufficient pressure to fill the new EST. Costs for the EST are based on the construction of a composite-type tank.

Table 5-10 Thunderbird UD System 1 WTP No. 2 EST Cost Estimate					
Item	**Description**	**Unit**	**Qty**	**Unit Cost**	**Total Cost**
1	New 1.0 MG Composite Elevated Storage Tank	GAL	1,000,000	$2.50	$2,500,000.00
2	Piping Modifications and Sitework	LS	1	$50,000.00	$50,000.00
3	High Service Pumping Modifications	LS	1	$50,000.00	$50,000.00
4	SCADA System for New EST	LS	1	$25,000.00	$25,000.00
Subtotal					$2,625,000.00
Contingencies (20%)					$525,000.00
Engineering & Testing (18%)					$567,000.00
Total Estimated Capital Cost					**$3,717,000.00**
Notes: 1 - This estimate does not include costs for acquisition of Easements from property owners.					

New EST at Harris County WC&ID – Fondren Road WTP No. 2

Elevated storage can provide pressure sustaining benefits in the north part of the Study area, including supplementing pressures in the Harris County WC&ID – Fondren Road area, the Southwest Harris County MUD #1 area and the WC&ID #2 area. Therefore, this project would include the construction of a new 0.5 MG EST at the existing Harris County WC&ID – Fondren Road WTP No. 2 site. This project would also include the modification of the existing high service pump station to allow for reusing the high service pumps to lift water into the EST in the event that the plant needed to temporarily revert back to groundwater usage. It is anticipated that the discharge pressure could be maintained at the RWTP to provide sufficient pressure to fill the new EST. Costs for the EST are based on the construction of a composite-type tank.

Table 5-11
Harris County WC&ID - Fondren Road WTP No. 2 EST Cost Estimate

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	New 0.5 MG Composite Elevated Storage Tank	GAL	500,000	$2.50	$1,250,000.00
2	Piping Modifications and Sitework	LS	1	$50,000.00	$50,000.00
3	High Service Pumping Modifications	LS	1	$50,000.00	$50,000.00
4	SCADA System for New EST	LS	1	$25,000.00	$25,000.00
Subtotal					$1,375,000.00
Contingencies (20%)					$275,000.00
Engineering & Testing (18%)					$297,000.00
Total Estimated Capital Cost					**$1,947,000.00**

Notes:
1 - This estimate does not include costs for acquisition of Easements from property owners.

This Technical Memorandum summarizes the findings of Task VI of the City of Missouri City Regional Water and Wastewater Planning Study (the Study). The focus of Task VI of the Study is the determination of sewerage system flows for the Study area.

Activities in Task VI included the following:

- ✓ Delineate Service Areas;
- ✓ Develop wastewater production factors;
- ✓ Develop wastewater peaking factors, if possible;
- ✓ Compare and discuss differences between population projections if any;
- ✓ Develop wastewater production by service areas over the 30-year planning horizon;
- ✓ Develop a map showing existing wastewater collection and treatment facilities;
- ✓ Determine existing wastewater treatment plant (WWTP) and wastewater collection system capacities;
- ✓ Determine condition and remaining useful life, if possible, of existing WWTPs and wastewater collection systems; and
- ✓ Prepare a technical memorandum summarizing the findings.

Service Areas

The Study, in geographic terms, includes the current City limits of Missouri City, as well as its ETJ. As stipulated by Chapter 42 of the Texas Local Government Code, based on city population size, Missouri City's ETJ extends 3.5 miles beyond the City limits. Within the Study area there are 30 participating utility districts. Exhibit 1-2 shows the Study area and participants and delineates the service area of each participating utility district. It should be noted that Fort Bend County MUD #23 and #24 are not included since they are outside of the City's ETJ. Fort Bend County WC&ID #2 is also not included due to the fact that it is in three separate jurisdictions (Missouri City, Stafford and Sugar Land).

Wastewater Production Factors

Per TM II, the expected water demand was obtained by multiplying the number of connections by the average usage per connection per month. The average usage per connection per month was calculated in the Joint GRP by dividing the annual pumpage by the connection count times 12 months. Those districts that are not included in the Joint GRP directly provided their average usage per connection per month.

Wastewater production was estimated as a percentage of the average water demand and was assumed to remain at a constant rate through the Study period. To determine the percentage of wastewater returned to the collection system, the average daily flow of each WWTP was collected from the operators. This average daily flow was divided by the total number of

connections served by each WWTP and converted to a monthly usage per connection. This was divided by the average water usage per connection previously used to determine the water demands. The wastewater demand was determined as a percentage of the water demand. These results are summarized in Table 6-1.

Table 6-1
Wastewater Demand as a Percentage of Water Demand

Wastewater Treatment Plant	Average Daily Wastewater Flow (MGD)	Current Connections Served	Wastewater Average Usage per Connection (GPD)	Wastewater Average Usage per Connection (Gallons/Month)	Water Average Usage per Connection (Gallons/Month)	Percentage of Wastewater Returned to Sewer System
Blue Ridge West MUD WWTP	0.725	2,494	291	8,721	11,538	76%
Fort Bend County MUD #26 WWTP	0.300	1,484	202	6,065	8,393	72%
Harris County MUD #122 WWTP	0.115	410	280	8,415	8,190	103%
Harris County WC&ID - Fondren Rd. WWTP	0.187	1,017	184	5,516	6,750	82%
Mustang Bayou Regional WWTP	0.325	1,816	179	5,369	11,873	45%
Palmer Plantation WWTP	0.325	1,752	186	5,565	22,300	25%
Quail Valley UD WWTP	1.500	7,227	208	6,227	10,015	62%
Sienna North WWTP	0.400	1,445	277	8,304	14,618	57%
Sienna South WWTP	1.100	4,408	250	7,486	14,618	51%
Steep Bank/Flat Bank Regional WWTP	1.500	6,439	233	6,989	16,285	43%
Southwest Harris County MUD #1 WWTP	0.100	527	190	5,693	5,310	107%
Total		**29,019**				
Average			**225**	**6,759**	**11,808**	**57%**

The average wastewater flow is approximately 60 percent of the water demand. This percentage was multiplied by the current and projected water demands from TM II to reach the current and projected wastewater demands. These wastewater demands are presented in Table 6-2.

Table 6-2
Current and Projected Monthly Wastewater Demand

District	% of Water Returned to Sewer Collection System	Current Wastewater Demand (2010)	2015	2020	2025	2030	2035	2040	Build Out Wastewater Demand
Sienna Plantation Management District	60	2,664,090	3,243,240	5,791,500	8,687,250	11,583,000	14,478,750	17,374,500	17,490,330
Sienna Plantation MUD #1	60	879,390	879,390	928,245	977,100	1,025,955	1,123,665	1,221,375	1,221,375
Sienna Plantation MUD #2	60	15,647,107	15,647,107	15,647,107	15,647,107	15,647,107	15,647,107	15,647,107	15,647,107
Sienna Plantation MUD #3	60	21,532,314	21,532,314	21,532,314	21,532,314	21,532,314	21,532,314	21,532,314	21,532,314
Sienna Plantation MUD #4, 5, 6, 7	60	0	5,262,480	22,804,080	49,116,480	75,428,880	87,708,000	87,708,000	87,708,000
Sienna Plantation MUD #10	60	12,068,621	15,752,357	17,506,517	19,260,677	21,014,837	21,339,356	21,339,356	21,339,356
Sienna Plantation MUD #12	60	1,324,391	2,061,138	4,797,628	9,533,860	12,480,848	12,621,181	12,621,181	12,621,181
Sienna Plantation MUD #13	60	0	0	1,447,182	3,859,152	6,271,122	8,683,092	10,472,335	10,472,335
Fort Bend County MUD #129	60	13,402,872	19,318,622	20,467,440	20,467,440	20,467,440	20,467,440	20,467,440	20,467,440
Fort Bend County MUD #149	60	890,475	6,910,086	12,110,460	12,110,460	12,110,460	12,110,460	12,110,460	12,110,460
Blue Ridge West MUD	60	17,265,463	17,327,768	17,355,460	17,355,460	17,355,460	17,355,460	17,355,460	17,369,305
First Colony MUD #9	60	19,871,906	20,243,066	20,614,226	20,985,386	21,356,546	21,727,706	22,098,866	24,496,560
Fort Bend County MUD #115	60	7,236,230	7,487,122	7,658,784	7,658,784	7,658,784	7,658,784	7,658,784	7,658,784
Fort Bend County MUD #26	60	7,473,127	7,473,127	7,503,342	7,553,700	7,604,058	7,654,416	7,704,774	10,801,791
Fort Bend County MUD #42	60	10,026,585	10,834,560	11,596,365	11,596,365	11,596,365	11,596,365	11,596,365	11,596,365
Fort Bend County MUD #46	60	7,688,412	9,573,120	10,321,020	10,321,020	10,321,020	10,321,020	10,321,020	10,699,956
Fort Bend County MUD #47	60	4,088,003	6,327,585	7,224,952	7,224,952	7,224,952	7,224,952	7,224,952	7,669,800
Fort Bend County MUD #48	60	4,862,653	4,916,342	5,491,577	6,419,623	7,339,999	8,260,375	9,180,751	10,507,626
Fort Bend County MUD #49	60	5,395,392	5,649,293	5,776,243	5,871,456	5,950,800	6,030,144	6,109,488	6,284,045
Meadowcreek MUD	60	4,668,394	4,904,968	4,957,540	5,010,112	5,062,684	5,115,256	5,167,828	5,178,342
Palmer Plantation MUD #1	60	9,505,411	10,790,784	11,139,898	11,219,242	11,298,586	11,377,930	11,457,274	12,663,302
Palmer Plantation MUD #2	60	6,830,663	7,326,370	7,511,209	7,595,227	7,679,245	7,763,263	7,847,281	8,401,800
Quail Valley Utility District	60	29,032,572	29,032,572	29,085,084	29,629,896	29,629,896	29,629,896	29,629,896	29,629,896
Thunderbird Utility District	60	11,891,462	11,891,462	11,928,701	11,990,765	12,052,829	12,114,893	12,176,957	12,325,910
Mustang Bayou USA	60	4,623,346	9,545,892	14,603,790	19,661,688	21,684,847	21,684,847	21,684,847	22,639,436
Mustang Bayou USA Phase 2	60	0	0	9,723,987	25,930,632	42,137,277	58,343,922	64,790,961	64,790,961
Harris County MUD #122	60	2,014,740	2,358,720	2,702,700	3,056,508	3,405,402	3,508,596	3,508,596	3,508,596
Southwest Harris County MUD #1	60	1,679,022	2,179,224	2,682,612	3,186,000	3,686,202	4,189,590	4,189,590	4,189,590
Harris County WC&ID - Fondren Road	60	4,118,850	4,568,400	5,070,600	5,706,450	6,212,700	6,342,300	6,342,300	6,342,300
Total Monthly Wastewater Demand (Gallons)		**226,681,493**	**263,037,109**	**315,980,561**	**379,165,104**	**436,819,614**	**473,611,079**	**486,540,058**	**497,364,265**
Total Wastewater Demand (MGD)		**7.5**	**8.6**	**10.4**	**12.5**	**14.4**	**15.6**	**16.0**	**16.4**

Existing and Future Development Areas

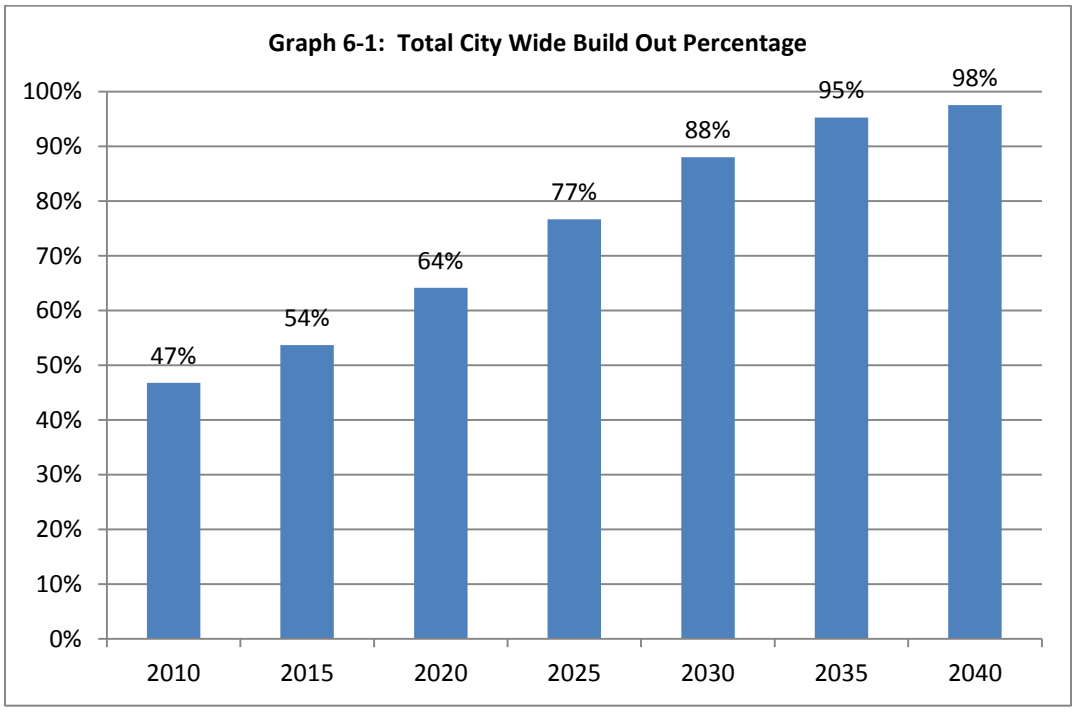
While many of the older neighborhoods in the northern portions of the City are already built out, many of the southern neighborhoods are still rapidly growing. The City Planning Department has established Development Ordinances along with the City's Zoning and Subdivision Ordinances which set the guidelines for future growth and redevelopment within the City. The Planning Department has developed a Comprehensive Plan which designates the pattern and intended character of future development. Table 6-3 presents the projected land area of each character district.

Table 6-3
Missouri City Future Land Use & Character

Designation	Acreage	Percent of Total
Rural	1,120.6	6.8%
Estate	2,048.7	12.4%
Suburban Residential	2,989.8	18.1%
Single-Family Residential	2,703.4	16.4%
Multi-Family Residential	324.2	2.0%
Suburban Commercial	1,005.4	6.1%
Commercial	1,067.3	6.5%
Urban	98.8	0.6%
Business Park	2,213.9	13.4%
Community Facility	486.5	2.9%
Park & Recreation	1,326.1	8.0%
Water	1,144.3	6.9%
Total	16,529	100.0%

The majority of the future development within the City will occur in the southern portion of the City within three major subdivisions. These subdivisions are Riverstone, Sienna Plantation and the Sienna South development. These developments have adopted individual master plans in accordance with the City's Comprehensive Plan. In order to estimate areas of future development for each of the Study's five year increments, copies of these master plans were obtained along with traffic impact analyses and discussions with the City's Planning Department Staff. Using this information Exhibit 1-8 was prepared which shows the project growth areas throughout the City.

A graphic representation of the City-wide build out percentage was also put together based on the projected connection counts presented in TM I. The build out percentage was determined by dividing the build out connection count by each of the five year planning study increments. The current build out percentage of the City is 47% and is estimated to reach 98% by the year 2040. Complete results are presented in Graph 6-1.



Existing Wastewater Facilities

The wastewater infrastructure is similar to the water infrastructure in that each utility district constructs and maintains its own wastewater collection system. However, not all utility districts have an independent WWTP. Some utility districts share capacity in regional WWTPs that are identified in the discussions below.

Existing Wastewater Collection System

The existing wastewater collection system throughout the City consists of approximately 360 miles of gravity lines and 35 miles of force mains. Each utility district is responsible for construction and maintenance of its collection system. Because some of the utility districts share capacity in regional WWTPs, several systems are interconnected. Some of the interconnections are direct gravity lines to a WWTP and some are force mains that transfer wastewater flows from one utility district's lift station into another utility district's collection system to ultimately travel to a regional WWTP. See Exhibit 1-6 for a map of the existing wastewater collection system lines, lift stations and existing system interconnections.

Age, condition, type, and sizing of wastewater lines were evaluated in this study only to the extent of determining necessary improvements when considering potential consolidation alternatives. As with the water systems, further evaluation of the individual wastewater systems would require the development of a City-wide system model, which was not included in the scope of this Study.

One concern brought to our attention during the course of this Study was regarding excessive nutrient loading to the WWTPs. Excessive nutrient loading to WWTPs generally occur in one of two ways. The most common cause of excessive nutrient loading comes from agricultural, commercial and/or industrial wastewater producers, who discharge wastewater with concentrations of nutrients far exceeding those of normal residential wastewater producers. Therefore, when it is determined that a non-residential wastewater producer is discharging wastewater with excessive nutrient loads, either onsite pretreatment requirements should be mandated to that producer, or a pretreatment surcharge needs to be developed for that user, to account for the increased cost of treatment to the specific WWTP as a result of handling that wastewater.

In addition, the TCEQ typically requires a utility-wide pretreatment program to be developed when a utility's wastewater production increases above 5 MGD. In the case of the City, a pre-treatment program would not be required unless multiple utility district WWTPs were consolidated into a single facility. However, since the current total daily wastewater produced within the Study area already exceeds 5 MGD, development of a pretreatment program by the City and coordinated with the various utility districts may help address excessive nutrient loadings in the wastewater system if the excessive nutrient loading is coming from individual wastewater producers.

The second most common cause of excessive nutrient loading in a wastewater system occurs due to overly conservative pipeline design. When designing gravity collection pipelines, a fine balance must be maintained between sizing large enough to handle projected maximum design flows and ensuring that pipelines provide sufficient velocity at lower flow. A minimum pipeline velocity of 2.0 feet per second (ft/s) or greater (per TCEQ Chapter 217 design criteria) usually keeps all of the solids in the wastewater stream entrained in the liquid stream. If solids dropout occurs due to insufficient velocity, the normal nutrient load in the liquid stream is reduced, which makes the WWTP acclimate to a lower loading rate. When flows increase (frequently during the day or during storm events), the solids that had previously dropped out in the pipelines are now moved downstream to the WWTP which results in a nutrient overload at the WWTP.

Existing Wastewater Lift Stations

Wastewater lift stations have been constructed, where needed, to transfer wastewater flows to the various regional WWTPs from service areas that are not feasible for gravity flow to a WWTP. There are a total of 87 wastewater lift stations currently within the Study area. The City owns 8 lift stations throughout the Study area and the remaining lift stations are owned by the utility districts. Age, condition, type, and sizing of wastewater lift stations were evaluated in this Study only to the extent of determining necessary improvements when considering potential consolidation alternatives.

Existing Wastewater Treatment Plants

There are 11 existing WWTPs within the Study area. Two of the regional WWTPs are owned by the City (Steep Bank-Flat Bank and Mustang Bayou). The remaining WWTPs are owned by utility districts. Refer to Table 1-12 for a list of these WWTPs and their current permitted capacities. The service area for each wastewater treatment plant is shown on Exhibit 1-7.

As with many other developer-planned and constructed WWTPs, the majority of the WWTPs in the Study area consist of package treatment plants. Package WWTPs are typically used for small flow (less than 1 MGD) and allow for rapid design and construction. Because package plants are usually designed for a small service area, they are not well suited for larger WWTP demands since multiple treatment trains are usually required for larger demands. For example, the Sienna South Regional WWTP is currently rated for an average flow of 1.2 MGD, though it is based on the operation of 4 simultaneously-operated 0.3 MGD package treatment plants. As a result, the existing Sienna South WWTP has fairly limited treatment flexibility and requires substantially higher than normal daily operation and maintenance (O&M) efforts.

In addition, package treatment plants typically have much shorter operating lives than more conventional or advanced treatment facilities. Most conventional treatment facilities are designed based on using concrete structures, which typically have a 40-50 year operating life, and equipment is designed for 30-40 years of operation. However, in package treatment plants, the anticipated operating life are frequently intended only for 10-20 years, especially when structures are designed using painted carbon steel.

Each WWTP was evaluated in this study with respect to rated capacity versus average loading, treatment performance, remaining useful life of structures and equipment, treatment and potential expansion capabilities, potential for reuse, and observed level of annual O&M efforts. Summary tables comparing current conditions at each WWTP within the Study area are provided. Table 6-4 provides an overview of each WWTP. Table 6-5 contains WWTP process summaries of each WWTP. Table 6-6 lists the current operating parameters at each WWTP.

Table 6-4
Existing WWTPs General Summary

Name	General Location	Adjacent WWTPs	WWTP Age (years)	Operating Entity
Blue Ridge West MUD WWTP	Independence Blvd.	None	25	Southwest Water Company (SWWC)
Fort Bend County MUD #26 WWTP	Lazy Spring Dr	Blue Ridge West MUD WWTP	30	Quail Valley UD
Harris County MUD #122 WWTP	Sunset Lane	None	20	Severn Trent Services
Harris County WC&ID - Fondren Road WWTP	East Hampton Cr	Southwest Harris County MUD #1 WWTP	30	Quail Valley UD
Mustang Bayou Regional WWTP	Trammel Fresno Rd	None	20	SWWC
Palmer Plantation WWTP	Lake Olympia Parkway	Steep Bank / Flat Bank WWTP	25	Quail Valley UD
Quail Valley UD/Thunderbird UD WWTP	Blue Lakes Lane	None	35	Quail Valley UD
Sienna North WWTP	Discovery Lane	None	10	SWWC
Sienna South WWTP	Waters Lake Blvd	None	20	SWWC
Southwest Harris County MUD #1 WWTP	Hwy 90a	Harris County WC&ID	20	Severn Trent Services
Steep Bank/Flat Bank Regional WWTP	Oil Field Rd	Palmer Plantation WWTP	10	Quail Valley UD

Table 6-5
Existing WWTP Treatment Process Summary

Name	Process Type	Solids Handling Type	Effluent Reuse Potential[1] (acre-ft per year)	Recent Rehabilitative Work
Blue Ridge West MUD WWTP	Contact stabilization Package[3]	Aerobic digestion, off-site liquid sludge hauling[2]	1,064	None
Fort Bend County MUD #26 WWTP	Conventional Complete-Mix Activated Sludge (CMAS) Package	Aerobic digestion and off-site liquid sludge hauling[2]	336	Emergency conversion to CMAS
Harris County MUD #122 WWTP	CMAS Package	Aerobic digestion and off-site liquid sludge hauling[2]	224	Cleaning & minor repairs
Harris County WC&ID - Fondren Road WWTP	CMAS Package	Aerobic digestion and off-site liquid sludge hauling[2]	112	Cleaning & minor repairs
Mustang Bayou Regional WWTP	3 CMAS Package Trains	Aerobic digestion and off-site liquid sludge hauling[2]	448	New CMAS train added
Palmer Plantation WWTP	CMAS Conventional	Aerobic digestion and off-site liquid sludge hauling[2]	336	None
Quail Valley UD/Thunderbird UD WWTP	Pure O_2	Belt filter press & off-site dewatering sludge hauling[4]	1,232[5]	Cleaning & minor repairs
Sienna North WWTP	3 CMAS Package Trains	Aerobic digestion and off-site liquid sludge hauling[2]	336	None
Sienna South WWTP	4 CMAS Package Trains	Aerobic digestion and off-site liquid sludge hauling[2]	1,232	None
Southwest Harris County MUD #1 WWTP	CMAS Package	Aerobic digestion and off-site liquid sludge hauling[2]	112	Cleaning & minor repairs
Steep Bank/Flat Bank Regional WWTP	Extended aeration conventional	Belt filter press & off-site dewatering sludge hauling[4]	1,680	Expansion from 1.5-3.0 MGD

Notes:
1 - Available amount listed does not include evaporative losses.
2- This process is energy and O&M intensive.
3- TCEQ prohibits contact-stabilization process for nitrification.
4- This process has low energy and O&M usage.
5 - Currently 0.4 MGD is used via Section 210 authorization for golf course irrigation.

Table 6-6
Existing WWTP Operating Parameters

Name	Current Permitted Capacity (MGD)[1,2]	Current Average Loading (MGD)[3]	Treatment Efficiency[4]
Blue Ridge West MUD WWTP	1.3	0.75	58%
Fort Bend County MUD #26 WWTP	0.5	0.3	60%
Harris County MUD #122 WWTP	0.25	0.1	40%
Harris County WC&ID - Fondren Road WWTP	0.6	0.2	33%
Mustang Bayou Regional WWTP	0.95	0.4	40%
Palmer Plantation WWTP	0.6	0.3	50%
Quail Valley UD/Thunderbird UD WWTP	4.0	1.5	38%
Sienna North WWTP	0.9	0.3	33%
Sienna South WWTP	1.2	1.1+	92%
Southwest Harris County MUD #1 WWTP	0.4	0.1	25%
Steep Bank/Flat Bank Regional WWTP	3.0	1.5	50%
Total	**13.75**	**6.55**	

Notes:
1 - Current permitted design capacity based on current average flow rating from TPDES discharge permit on file with TCEQ. However, in some cases, the permitted treatment capacity may be above the actual treatment capability of a specific WWTP.
2 - The permitted effluent limitations for all WWTPs are 10 milligrams per liter (mg/L) biochemical oxygen demand (BOD), 15 mg/L total suspended solids (TSS) and 2-4 mg/L ammonia (NH_3) (ammonia limit added in this permit cycle for several of the WWTPs). NH_3 limit is anticipated to be tightened to 2 mg/L or less for all WWTPs.
3 - Current average loading based on average daily flow rates to each WWTP. Typical peaking factor for influent flows ranges from 1.5-2.0.
4 - The Treatment Efficiency is based on the percentage of the rated capacity. Optimal efficiency (in utilizing operator effort and in energy and chemical usage) is 60-80% of the plant capacity.

Table 6-7
Projected Life of Existing WWTP

Name	Remaining Life of Structures (years)	Remaining Life of Equipment (years)	Remaining Life of WWTP[1, 2] (years)
Blue Ridge West MUD WWTP	10-15	5-10	5-10
Fort Bend County MUD #26 WWTP	10-15	5-10	5-10
Harris County MUD #122 WWTP	5-10	5-10	5-10
Harris County WC&ID - Fondren Road WWTP	10-15	5-10	5-10
Mustang Bayou Regional WWTP	10-15	10-15	10-15
Palmer Plantation WWTP	10-15	5-10	5-10
Quail Valley UD/Thunderbird UD WWTP	5-10	5-10	5-10
Sienna North WWTP	10-15	10-15	10-15
Sienna South WWTP	5-10	5-10	5-10
Southwest Harris County MUD #1 WWTP	10-15	5-10	5-10
Steep Bank/Flat Bank Regional WWTP	30-40	25-30	25-30

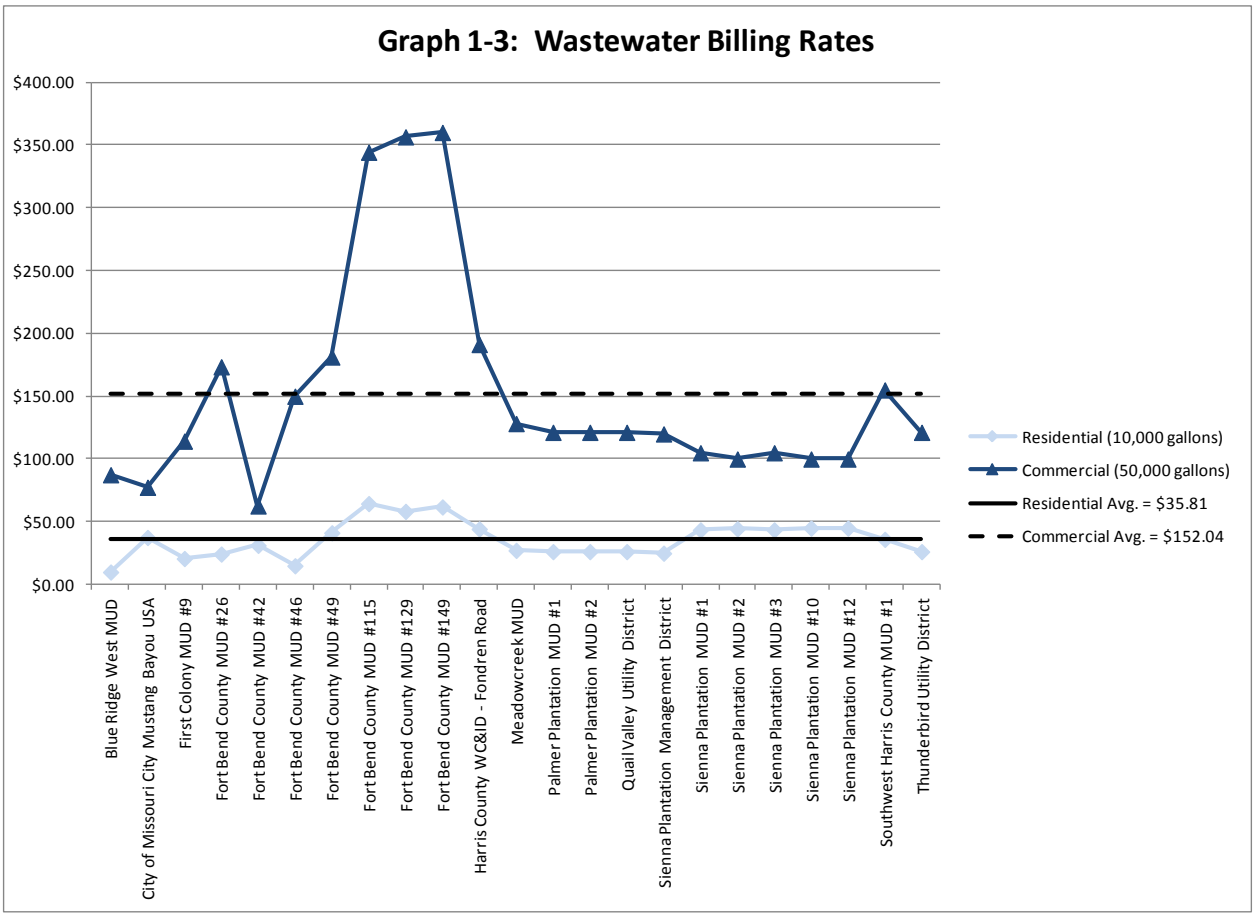
Notes:
1 - Overall WWTP useful life without major WWTP rehabilitation or replacement. Limiting factor for package plants with concrete structures is the equipment. Limiting factors for package plants with steel structures are both the structure and the equipment.
2 - Remaining useful life of each existing WWTP listed above does not take into account capability to meet current and/or future permit limits. For example, Harris County MUD #122 WWTP will likely become noncompliant with its new ammonia permit limit once that permit limit goes into effect next summer. So the remaining useful life for that WWTP is actually shorter than what is shown above.

Current Billing Rates

Each utility district individually sets its rates for water and sewer service. Because each district is currently at a different stage of build out, the rates paid by customers vary within the Study area. Newer utility districts that are still constructing additional facilities as they grow and are also continuing to pay back debt on recently constructed facilities have higher rates than the older utility districts which have been completely built out and have repaid all or a large portion of their debt. Each utility district provided its billing rates from water and wastewater, as well as their average monthly usage and amount billed.

Average Wastewater Billed Usage

The average monthly wastewater usage throughout the Study area was calculated as 10,000 gallons per month for a residential connection and 50,000 gallons per month for a commercial connection. Using the current billing rates for each utility district, the monthly cost for the average usage was calculated to use as a comparison between individual districts. Graph 6-2 show the varying costs in each district for wastewater billing rates, respectively.


Graph 1-3: Wastewater Billing Rates
$400.00
$350.00
$300.00
$250.00
$200.00
$150.00
$100.00
$50.00
$0.00
Blue Ridge West MUD
City of Missouri City Mustang Bayou USA
First Colony MUD #9
Fort Bend County MUD #26
Fort Bend County MUD #42
Fort Bend County MUD #46
Fort Bend County MUD #49
Fort Bend County MUD #115
Fort Bend County MUD #129
Fort Bend County MUD #149
Harris County WC&ID - Fondren Road
Meadowcreek MUD
Palmer Plantation MUD #1
Palmer Plantation MUD #2
Quail Valley Utility District
Sienna Plantation Management District
Sienna Plantation MUD #1
Sienna Plantation MUD #2
Sienna Plantation MUD #3
Sienna Plantation MUD #10
Sienna Plantation MUD #12
Southwest Harris County MUD #1
Thunderbird Utility District
Residential (10,000 gallons)
Commercial (50,000 gallons)
Residential Avg. = $35.81
Commercial Avg. = $152.04

This Technical Memorandum summarizes the findings of Task VII of the City of Missouri City Regional Water and Wastewater Planning Study (the Study). The focus of Task VII of the Study is the preparation of Wastewater Collection System Alternatives for the Study area.

Activities in Task VII included the following:

- ✓ Developing a technical memorandum summarizing the wastewater collection system alternatives for 5-year increments through the year 2040 to serve existing and future growth.

Wastewater Collection System Alternatives

The existing wastewater system utilizes sanitary sewer lift stations where necessary. No recommended regional collection system alternatives have been identified that could provide a cost beneficial alternative to the currently designed systems. However, potential alternatives to the current treatment system locations would include improvements to specific lift stations as necessary to divert flows from one WWTP service area to another. These improvements will be discussed in both this TM and in TM VIII, which will discuss wastewater treatment alternatives.

Improvements Corresponding to Wastewater Treatment System Alternatives

The goal of this section of the Study is to evaluate potential alternatives of consolidating WWTPs where feasible to increase operational efficiency and cost-effectiveness throughout the Study area's wastewater system. For a city the size of Missouri City, it is normal to only have one or two wastewater treatment facilities. Substantial savings in annual O&M costs (and therefore the cost of service for the City's residents) can typically be attained by consolidating to a smaller number of WWTPs.

Several scenarios were developed to determine anticipated capital and O&M costs for various WWTP consolidation scenarios. The first scenario was developed to determine the 30-year life cycle cost to maintain all the existing WWTPs in operation through 2040, along with construction of a new regional WWTP in the Sienna South area. The second, third and fourth scenarios were developed to evaluate various methods of consolidation with the ultimate goal of reducing the total number of active WWTPs to roughly half the current number of operating WWTPs at this time. During the development of Scenarios 1 through 4, it was determined that as the total number of active WWTPs was reduced, economies of scale for capital and O&M cost resulted in a lower life cycle cost. As a result, a fifth scenario was developed with the concept of utilizing one WWTP site to create a super-regional WWTP that would treat the entire wastewater flows for the Study area even at build-out. This TM includes only the capital costs for each scenario, while the O&M costs for this scenario are included in the costs in TM VIII and TM IX.

Wastewater Consolidation Project Scenarios

Following the development of capital costs for each of the existing and proposed WWTP facilities, combinations of WWTP and wastewater collection costs (discussed in TM VIII) were completed for the five consolidation scenarios discussed above.

Projected Capital Cost to Maintain All WWTPs in Operation

This option considers maintaining all existing WWTPs in operation, along with constructing a new south regional WWTP in the Sienna South area. Since the majority of the existing WWTPs are package plants, extensive rehabilitation effort would be needed to maintain many of these plants in continued operation for the next 30 years. Obviously there are several plants that could be somewhat easily consolidated into nearby facilities, so this cost was developed to determine a baseline of cost for the planning area. Additionally, by maintaining all the existing WWTPs, no additional major collection system improvements would need to be completed for this scenario.

Table 7-1
Capital Costs for WWTP Scenario 1

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	Rehab and upgrade HCMUD #1 WWTP, including structure rehab and equipment replacement	Gal	400,000	$6.00	$2,400,000.00
2	Addition of onsite solids dewatering improvements at HCMUD #1 WWTP	Gal	400,000	$0.75	$300,000.00
3	Rehab and upgrade Fondren Road WWTP, including structure rehab and equipment replacement	Gal	600,000	$6.00	$3,600,000.00
4	Addition of onsite solids dewatering improvements at Fondren Road WWTP	Gal	600,000	$0.75	$450,000.00
5	Rehab and upgrade HCMUD #122 WWTP, including structure rehab and equipment replacement	Gal	250,000	$6.00	$1,500,000.00
6	Addition of onsite solids dewatering improvements at HCMUD #122 WWTP	Gal	250,000	$0.75	$187,500.00
7	Rehab and upgrade Blue Ridge WWTP, including structure rehab and equipment replacement	Gal	1,300,000	$6.00	$7,800,000.00
8	Addition of onsite mechanical solids dewatering improvements at Blue Ridge WWTP	Gal	1,300,000	$0.75	$975,000.00
9	Rehab and upgrade FBCMUD #26 WWTP, including structure rehab and equipment replacement	Gal	500,000	$6.00	$3,000,000.00
10	Addition of onsite solids dewatering improvements at FBCMUD #26 WWTP	Gal	500,000	$0.75	$375,000.00
11	Rehab and upgrade QVUD WWTP, including structure rehab and equipment replacement	Gal	1,500,000	$6.00	$9,000,000.00
12	Rehab and upgrade Palmer WWTP, including structure rehab and equipment replacement	Gal	600,000	$6.00	$3,600,000.00
13	Addition of onsite solids dewatering improvements at Palmer WWTP	Gal	600,000	$0.75	$450,000.00
14	Expand and upgrade SB-FB WWTP, including structure rehab and equipment replacement	Gal	3,000,000	$5.00	$15,000,000.00

Table 7-1
Capital Costs for WWTP Scenario 1

Item	Description	Unit	Qty	Unit Cost	Total Cost
15	Expand and upgrade Vicksburg WWTP, including structure rehab and equipment replacement	Gal	1,500,000	$5.00	$7,500,000.00
16	Addition of onsite solids dewatering improvements at Vicksburg WWTP	Gal	950,000	$0.75	$712,500.00
17	Rehab and upgrade Sienna North WWTP, including structure rehab and equipment replacement	Gal	900,000	$6.00	$5,400,000.00
18	Addition of onsite solids dewatering improvements at Sienna North WWTP	Gal	900,000	$0.75	$675,000.00
19	Rehab and upgrade Sienna South WWTP, including structure rehab and equipment replacement	Gal	1,200,000	$6.00	$7,200,000.00
20	Addition of onsite solids dewatering improvements at Sienna South WWTP	Gal	1,200,000	$0.75	$900,000.00
21	Construct new regional WWTP in Sienna South area	Gal	2,300,000	$4.00	$9,200,000.00
				Subtotal	$80,225,000.00
				Contingencies (20%)	$16,045,000.00
				Engineering & Testing (18%)	$17,329,000.00
				TOTAL ESTIMATED CAPITAL COST	$113,599,000.00
				TOTAL ESTIMATED COLLECTION SYSTEM COST	**$0**

Notes:
1-This estimate assumes no offsite collection improvements are required.
2- This estimate assumes that no other major capital improvements would be necessary during the project life.

Projected Capital Cost to Consolidate Utility District Engineer Recommended WWTPs

This option considers consolidating several of the existing WWTPs in operation, along with constructing a new south regional WWTP in the Sienna South area. Since the majority of the existing WWTPs to remain in this scenario are package plants, extensive rehabilitation effort would still be needed. In developing capital costs, consolidated plant costs include new PS and force mains to the regional facilities, and WWTPs intended to remain in this scenario include a budget for rehabilitating and/or upgrading each facility to maintain continued treatment for the next 30 years.

Table 7-2
Capital Costs for WWTP Scenario 2

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	Rehab and upgrade HCMUD #1 WWTP, including structure rehab and equipment replacement	Gal	400,000	$6.00	$2,400,000.00
2	Addition of onsite solids dewatering improvements at HCMUD #1 WWTP	Gal	400,000	$0.75	$300,000.00
3	Rehab and upgrade Fondren Road WWTP, including structure rehab and equipment replacement	Gal	600,000	$6.00	$3,600,000.00
4	Addition of onsite solids dewatering improvements at Fondren Road WWTP	Gal	600,000	$0.75	$450,000.00

Table 7-2
Capital Costs for WWTP Scenario 2

Item	Description	Unit	Qty	Unit Cost	Total Cost
5	Construct a transfer PS at HCMUD #122 WWTP to transfer plant flow to WC&ID #2	LS	1	$125,000.00	$125,000.00
6	6" force main to WC&ID #2	LF	1,200	$25.00	$30,000.00
7	Bore of force main with 10 inch steel casing (includes casing pipe only)	LF	250	$300.00	$75,000.00
8	Expand and upgrade WC&ID #2 WWTP to handle HCMUD #122 flow, including structure rehab and equipment replacement	Gal	250,000	$5.00	$1,250,000.00
9	Expand Blue Ridge WWTP to handle FBCMUD #26 flow, including structure rehab and equipment replacement	Gal	1,800,000	$5.00	$9,000,000.00
11	Construct a transfer PS at FBCMUD #26 WWTP to transfer plant flow to Blue Ridge WWTP	LS	1	$250,000.00	$250,000.00
12	8" force main to Blue Ridge WWTP	LF	5,400	$35.00	$189,000.00
13	Rehab and upgrade QVUD WWTP, including structure rehab and equipment replacement	Gal	1,500,000	$6.00	$9,000,000.00
14	Construct a transfer PS at Palmer WWTP to transfer plant flow to SB-FB WWTP	LS	1	$250,000.00	$250,000.00
15	8" force main to SB-FB WWTP	LF	1,200	$45.00	$54,000.00
16	Bore of force main with 12 inch steel casing (includes casing pipe only)	LF	500	$300.00	$150,000.00
17	Expand and upgrade SB-FB WWTP for growth and to handle Palmer and Sienna North flow, including structure rehab and equipment replacement	Gal	3,500,000	$5.00	$17,500,000.00
18	Expand and upgrade Vicksburg WWTP, including structure rehab and equipment replacement	Gal	1,500,000	$5.00	$7,500,000.00
20	Rehab and upgrade Sienna North WWTP, including structure rehab and equipment replacement	Gal	900,000	$6.00	$5,400,000.00
21	Addition of onsite solids dewatering improvements at Sienna North WWTP	Gal	900,000	$0.75	$675,000.00
22	Construct new transfer pump station at Sienna South WWTP to transfer Sienna South plant flow to the new regional WWTP in Sienna South	LS	1	$250,000.00	$250,000.00
23	12" force main to new South Regional WWTP	LF	12,500	$55.00	$687,500.00
24	Bore of force main with 16 inch steel casing (includes casing pipe only)	LF	1,250	$350.00	$437,500.00
25	Construct new regional WWTP in Sienna South area	Gal	3,500,000	$4.00	$14,000,000.00
				Subtotal	$73,573,000.00
				Contingencies (20%)	$14,714,600.00
				Engineering & Testing (18%)	$15,892,000.00
				TOTAL ESTIMATED CAPITAL COST	$104,179,600.00
				ESTIMATED COLLECTION SYSTEM COST	**$2,498,000.00**

Notes:
1- This estimate assumes that no other major capital improvements would be necessary during the project life.

Projected Total Life Cycle Cost to Consolidate WWTPs Using Quail Valley UD WWTP as a Regional WWTP

This option considers consolidating the existing WWTPs down to a maximum of five plants, including constructing a new south regional WWTP in the Sienna South area. In this scenario, the three northernmost WWTPs would be consolidated into a new regional facility, the central service area would be consolidated between the Quail Valley UD WWTP and the SB-FB WWTP, the eastern area would be covered by the Mustang Bayou WWTP and the southern area would be supported by the new south regional WWTP in the Sienna South area. In developing capital costs, consolidated plant costs include new PSs and force mains to the regional facilities, and WWTPs intended to remain in this scenario include a budget for rehabilitating and/or upgrading each facility to maintain continued treatment for the next 30 years.

Table 7-3
Capital Costs for WWTP Scenario 3

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	Construct new transfer pump station to transfer SWHCMUD #1 plant flow to the nearby Fondren Road WWTP	LS	1	$150,000.00	$150,000.00
2	6" force main to Fondren Road WWTP	LF	1,000	$25.00	$25,000.00
3	Construction of a new regional WWTP at the Fondren Road plant site	Gal	1,500,000	$5.00	$7,500,000.00
4	Construct new transfer pump station to transfer HCMUD #122 plant flow to the Fondren Road WWTP	LS	1	$125,000.00	$125,000.00
5	6" force main to Fondren Road WWTP	LF	8,750	$25.00	$218,750.00
6	Bore of force main with 10 inch steel casing (includes casing pipe only)	LF	250	$400.00	$100,000.00
7	Construct new transfer pump station to transfer Blue Ridge plant flow to the new FBCMUD #26 PS	LS	1	$250,000.00	$250,000.00
8	10" force main to Blue Ridge WWTP	LF	5,400	$45.00	$243,000.00
9	Construct new transfer pump station to transfer both plant flows to the QVUD WWTP	LS	1	$500,000.00	$500,000.00
10	12" force main to Fondren Road WWTP	LF	17,500	$55.00	$962,500.00
11	Bore of force main with 16 inch steel casing (includes casing pipe only)	LF	1,000	$400.00	$400,000.00
12	Expand and upgrade QVUD WWTP for additional flow, including structure rehab and equipment replacement	Gal	3,300,000	$5.00	$16,500,000.00
13	Construct a transfer PS at Palmer WWTP to transfer plant flow to SB-FB WWTP	LS	1	$250,000.00	$250,000.00
14	8" force main to SB-FB WWTP	LF	1,200	$35.00	$42,000.00
15	Bore of force main with 12 inch steel casing (includes casing pipe only)	LF	500	$400.00	$200,000.00
16	Expand and upgrade SB-FB WWTP for growth and to handle Palmer and Sienna North flow, including structure rehab and equipment replacement	Gal	4,500,000	$4.00	$18,000,000.00
17	Expand and upgrade Vicksburg WWTP, including structure rehab and equipment replacement	Gal	1,500,000	$5.00	$7,500,000.00

Table 7-3
Capital Costs for WWTP Scenario 3

Item	Description	Unit	Qty	Unit Cost	Total Cost
19	Construct new transfer pump station at Sienna North WWTP to transfer Sienna North plant flow to the SB-FB WWTP	LS	1	$250,000.00	$250,000.00
20	10" force main to SB-FB WWTP	LF	10,500	$45.00	$472,500.00
21	Bore of force main with 16 inch steel casing (includes casing pipe only)	LF	500	$400.00	$200,000.00
22	Construct new transfer pump station at Sienna South WWTP to transfer Sienna South plant flow to the new regional WWTP in Sienna South	LS	1	$400,000.00	$400,000.00
23	12" force main to new South Regional WWTP	LF	12,500	$55.00	$687,500.00
24	Bore of force main with 16 inch steel casing (includes casing pipe only)	LF	1,250	$400.00	$500,000.00
25	Construct new regional WWTP in Sienna South area	Gal	3,500,000	$4.00	$14,000,000.00
				Subtotal	$69,476,250.00
				Contingencies (20%)	$13,895,250.00
				Engineering & Testing (18%)	$15,007,000.00
				TOTAL ESTIMATED CAPITAL COST	$98,378,500.00
				ESTIMATED COLLECTION SYSTEM COST	**$5,976,250.00**

Notes:
1- This estimate assumes that no other major capital improvements would be necessary during the project life.

Projected Total Life Cycle Cost to Consolidate WWTPs Using Blue Ridge West WWTP as a Regional WWTP

This option also considers consolidating the existing WWTPs down to a maximum of five plants, including constructing a new south regional WWTP in the Sienna South area. In this scenario, the three northernmost WWTPs would be consolidated into an expanded Blue Ridge West WWTP, the central service area would be consolidated between the Quail Valley UD WWTP, the Blue Ridge West WWTP and the SB-FB WWTP, the eastern area would still be covered by the Mustang Bayou WWTP and the southern area would still be supported by the new south regional WWTP in the Sienna South area. In developing capital costs, consolidated plant costs include new PSs and force mains to the regional facilities, and WWTPs intended to remain in this scenario include a budget for rehabilitating and/or upgrading each facility to maintain continued treatment for the next 30 years.

Table 7-4
Capital Costs for WWTP Scenario 4

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	Construct new transfer pump station to transfer SWHCMUD #1 plant flow to the new Fondren Road PS	LS	1	$150,000.00	$150,000.00
2	6" force main to Fondren Road WWTP	LF	1,000	$25.00	$25,000.00
3	Construct new transfer pump station to transfer HCMUD #122 plant flow to the new Fondren Road PS	LS	1	$125,000.00	$125,000.00

Table 7-4
Capital Costs for WWTP Scenario 4

Item	Description	Unit	Qty	Unit Cost	Total Cost
4	6" force main to Fondren Road WWTP	LF	8,750	$25.00	$218,750.00
5	Bore of force main with 10 inch steel casing (includes casing pipe only)	LF	250	$400.00	$100,000.00
6	Construction of a new pump station at the Fondren Road plant site to transfer all north flows to the Blue Ridge WWTP	LS	1	$250,000.00	$250,000.00
7	8" force main to Blue Ridge WWTP	LF	17,500	$35.00	$612,500.00
8	Bore of force main with 12 inch steel casing (includes casing pipe only)	LF	500	$400.00	$200,000.00
9	Construct new transfer pump station to transfer FBCMUD #26 plant flow to the Blue Ridge WWTP	LS	1	$250,000.00	$250,000.00
10	6" force main to Blue Ridge WWTP	LF	5,400	$25.00	$135,000.00
11	Expand Blue Ridge WWTP for additional flow, including structure rehab and equipment replacement	Gal	3,300,000	$5.00	$16,500,000.00
12	Rehab QVUD WWTP, including structure rehab and equipment replacement	Gal	1,500,000	$6.00	$9,000,000.00
13	Construct a transfer PS at Palmer WWTP to transfer plant flow to SB-FB WWTP	LS	1	$250,000.00	$250,000.00
14	8" force main to SB-FB WWTP	LF	1,200	$35.00	$42,000.00
15	Bore of force main with 12 inch steel casing (includes casing pipe only)	LF	500	$400.00	$200,000.00
16	Expand and upgrade SB-FB WWTP for growth and to handle Palmer and Sienna North flow, including structure rehab and equipment replacement	Gal	4,500,000	$4.00	$18,000,000.00
17	Expand and upgrade Vicksburg WWTP, including structure rehab and equipment replacement	Gal	1,500,000	$5.00	$7,500,000.00
19	Construct new transfer pump station at Sienna North WWTP to transfer Sienna North plant flow to the SB-FB WWTP	LS	1	$250,000.00	$250,000.00
20	10" force main to SB-FB WWTP	LF	10,500	$45.00	$472,500.00
21	Bore of force main with 16 inch steel casing (includes casing pipe only)	LF	500	$400.00	$200,000.00
22	Construct new transfer pump station at Sienna South WWTP to transfer Sienna South plant flow to the new regional WWTP in Sienna South	LS	1	$400,000.00	$400,000.00
23	12" force main to new South Regional WWTP	LF	12,500	$55.00	$687,500.00
24	Bore of force main with 16 inch steel casing (includes casing pipe only)	LF	1,250	$400.00	$500,000.00
25	Construct new regional WWTP in Sienna South area	Gal	3,500,000	$4.00	$14,000,000.00
				Subtotal	$70,068,250.00
				Contingencies (20%)	$14,013,650.00
				Engineering & Testing (18%)	$15,135,000.00
				TOTAL ESTIMATED CAPITAL COST	$99,216,900.00
				ESTIMATED COLLECTION SYSTEM COST	**$5,068,250.00**

Notes:
1- This estimate assumes that no other major capital improvements would be necessary during the project life.

Projected Total Life Cycle Cost to Consolidate WWTPs into a New Super Regional Facility at the Steep Bank – Flat Bank WWTP

This option considers consolidating all of the existing WWTPs into a super-regional treatment facility, including incorporating flows from the new Sienna South area. In developing capital costs, consolidated plant costs include new PSs and force mains to the regional facilities, and WWTPs intended to remain in this scenario include a budget for expanding and upgrading to maintain continued treatment for the next 30 years.

Table 7-5
Capital Costs for WWTP Scenario 5

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	Construct new transfer pump station to transfer SWHCMUD #1 plant flow to the new Fondren Road PS	LS	1	$150,000.00	$150,000.00
2	6" force main to Fondren Road WWTP	LF	1,000	$25.00	$25,000.00
3	Construct new transfer pump station to transfer HCMUD #122 plant flow to the new Fondren Road PS	LS	1	$125,000.00	$125,000.00
4	6" force main to Fondren Road WWTP PS	LF	8,750	$25.00	$218,750.00
5	Bore of force main with 10 inch steel casing (includes casing pipe only)	LF	250	$300.00	$75,000.00
6	Construction of a new pump station at the Fondren Road plant site to transfer all north flows to the Blue Ridge WWTP	LS	1	$250,000.00	$250,000.00
7	8" force main to Blue Ridge WWTP	LF	17,500	$35.00	$612,500.00
8	Bore of force main with 12 inch steel casing (includes casing pipe only)	LF	500	$350.00	$175,000.00
9	Construct a new transfer pump station at the Blue Ridge WWTP to transfer north plant flows to the new FBCMUD #26 WWTP PS	LS	1	$500,000.00	$500,000.00
10	12" force main to FBCMUD #26 WWTP PS	LF	5,400	$55.00	$297,000.00
11	Construct new transfer pump station at FBCMUD #26 WWTP to transfer all northeast plant flows to the new Palmer WWTP PS	LS	1	$500,000.00	$500,000.00
12	14" force main to Palmer WWTP	LF	22,500	$65.00	$1,462,500.00
13	Bore of force main with 20 inch steel casing (includes casing pipe only)	LF	1,000	$400.00	$400,000.00
14	Construct new transfer pump station at QVUD WWTP to transfer plant flow to the SB-FB WWTP	LS	1	$250,000.00	$250,000.00
15	10" force main to SB-FB WWTP	LF	10,000	$45.00	$450,000.00
16	Construct new reuse pump station at SB-FB WWTP to transfer 0.5 MGD reuse flow to the QVUD Lake	LS	1	$150,000.00	$150,000.00
17	6" force main to QVUD Lake	LF	10,000	$25.00	$250,000.00
18	Construct new transfer pump station at Vicksburg WWTP to transfer plant flow to the new Palmer WWTP PS	LS	1	$250,000.00	$250,000.00
19	10" force main to Palmer WWTP	LF	13,750	$45.00	$618,750.00
20	Construct a transfer PS at Palmer WWTP to transfer plant flows to SB-FB WWTP	LS	1	$750,000.00	$750,000.00
21	18" force main to SB-FB WWTP	LF	1,200	$90.00	$108,000.00

Table 7-5
Capital Costs for WWTP Scenario 5

Item	Description	Unit	Qty	Unit Cost	Total Cost
22	Bore of force main with 24 inch steel casing (includes casing pipe only)	LF	500	$500.00	$250,000.00
23	Construct new transfer pump station in Sienna South Development to transfer Sienna South flow to new Sienna South WWTP PS	LS	1	$500,000.00	$500,000.00
24	12" force main to new Sienna South WWTP PS	LF	12,500	$55.00	$687,500.00
25	Bore of force main with 16 inch steel casing (includes casing pipe only)	LF	1,250	$400.00	$500,000.00
26	Construct new transfer pump station at Sienna South WWTP to transfer Sienna South plant flow to the new Sienna North WWTP PS	LS	1	$750,000.00	$750,000.00
27	16" force main to new Sienna North WWTP PS	LF	37,500	$75.00	$2,812,500.00
28	Bore of force main with 20 inch steel casing (includes casing pipe only)	LF	1,000	$400.00	$400,000.00
29	Construct new transfer pump station at Sienna North WWTP to transfer south plant flows to the SB-FB WWTP	LS	1	$1,000,000.00	$1,000,000.00
30	18" force main to SB-FB WWTP	LF	10,500	$150.00	$1,575,000.00
31	Bore of force main with 24 inch steel casing (includes casing pipe only)	LF	500	$500.00	$250,000.00
32	Expand and upgrade SB-FB WWTP for growth and to handle remaining plant flows, including structure rehab and equipment replacement	Gal	14,000,000	$3.00	$42,000,000.00
				Subtotal	$58,342,500.00
				Contingencies (20%)	$11,668,500.00
				Engineering & Testing (18%)	$12,602,000.00
				TOTAL ESTIMATED CAPITAL COST	$82,613,000.00
				ESTIMATED COLLECTION SYSTEM COST	**$16,342,500.00**

Notes:
1- This estimate assumes that no other major capital improvements would be necessary during the project life.

Multiple advantages and several potential disadvantages relate to utilization of the SB-FB facility as a super-regional WWTP, including, but not limited to:

- Advantages
    - Lowest life cycle cost of the various scenarios;
    - Largest existing treatment site in the Study area, provides adequate space for expanding upwards of 16.4 MGD if using more efficient treatment processes;
    - Reduced cost for monitoring and reporting for monthly discharge monitoring reports (DMR) and annual sludge reporting;

- Reduced environmental impact by limiting discharge to one receiving stream instead of multiple streams (TCEQ and TWDB prefer consolidating WWTP discharges whenever feasible);

- Potential for capturing all the City's current and future effluent produced to increase total bed and banks water rights;

- Cost to utilize additional reclaimed water for bed and banks permit via a single treatment facility may be less than cost to purchase additional water rights elsewhere for future SWTP expansions;

- If bed and banks water rights are not pursued, can provide a greater single source opportunity for marketing reclaimed water supply;

- Potentially lower wastewater rates due to economies of scale for treatment cost and lower O&M via a single treatment facility; and

- The existing administration for each utility district could still be maintained even though treatment would occur at only one location.

- Disadvantages

  - There may be existing debt service that would need to be incorporated into the costing scenarios discussed earlier in Section 4, that could impact the direction taken in the consolidation scenarios;

  - Consolidation to a super-regional WWTP would require extensive coordination with the utility districts to operate and maintain multiple rate structures; and

  - There could be a perceived loss of ownership and control of the local WWTPs by the utility districts.

Since the SB-FB WWTP is currently in the best condition of all the existing WWTP facilities, the work needed at this facility would be based on expansions to incorporate offsite WWTP flows, which could be constructed over multiple phases as needed to incorporate the wastewater flows from the offsite WWTPs at a rate of several WWTP consolidations every five years. The total projected capital cost (in 2011 dollars) for this recommended scenario is $82,613,000, including contingency and engineering (Refer to Table 7-5). Implementation of this scenario is not expected to be completed all at once. In fact, implementation of the recommended consolidation scenario to consolidate all the existing and proposed WWTP service areas into a single super regional WWTP would be best completed in phases over a period of time. By

implementing this scenario in a phased approach, the City could accomplish consolidation at a controlled pace that balances well with project funding demands from the water system and with the benefit of observing the impact to overall wastewater system performance and net change in O&M costs. An implementation plan has been developed and is included here in additional detail.

- Current – 11 WWTPs in Operation
- 2010-2015 – 9 WWTPs in Operation
    - Consolidate HCMUD #122 flow into Harris County WC&ID-Fondren Rd WWTP (addition of 0.1 MGD current flow), PS to be sized for build-out conditions;
    - Consolidate Palmer Plantation flow into SB-FB WWTP (addition of 0.3 MGD current flow), PS to be sized for future consolidation flows; and
    - Consolidate Sienna North flow into SB-FB WWTP (addition of 0.3 MGD current flow), PS to be sized for future consolidation flows.
- 2015-2020 – 7 WWTPs in Operation
    - Construct a 4.0 MGD expansion at SB-FB WWTP to incorporate additional consolidation flow;
    - Consolidate Fort Bend County MUD #26 flow into Palmer Plantation WWTP PS, going ultimately to SB-FB WWTP (addition of 0.3 MGD current flow), PS to be sized for future consolidation flows; and
    - Consolidate Sienna South flow into Sienna North WWTP PS, going ultimately to SB-FB WWTP (addition of 1.1 MGD current flow), PS to be sized for future consolidation flows.
- 2020-2025 – 4 WWTPs in Operation
    - Construct a 4.0 MGD expansion at SB-FB WWTP to incorporate additional consolidation flow;
    - Consolidate Blue Ridge West flow into Fort Bend County MUD #26 WWTP PS, going ultimately to SB-FB WWTP (addition of 0.75 MGD current flow), PS to be sized for future consolidation flows;

  - Consolidate Sienna South flow into Sienna South WWTP PS, going ultimately to SB-FB WWTP (addition of 0.0 MGD current flow), PS to be sized for buildout conditions;

  - Consolidate Quail Valley UD flow into SB-FB WWTP (addition of 1.5 MGD current flow), PS to be sized for build-out conditions; and

  - Construct 0.5 MGD reuse pumping system at SB-FB to send reclaimed water back to Quail Valley UD for use at the golf course.

- 2025-2030 – 2 WWTPs in Operation

  - Construct a 4.0 MGD expansion at SB-FB WWTP to incorporate additional consolidation flow;

  - Consolidate Harris County WC&ID-Fondren Rd flow into Blue Ridge West WWTP PS, going ultimately to SB-FB WWTP (addition of 0.2 MGD current flow), PS to be sized for future consolidation flows; and

  - Consolidate Harris County MUD #122 flow into Harris County WC&ID-Fondren Rd WWTP PS, going ultimately to SB-FB WWTP (addition of 0.1 MGD current flow), PS to be sized for build-out conditions.

- 2030-2035 – 1 WWTP in Operation

  - Construct a 4.0 MGD expansion at SB-FB WWTP to incorporate additional consolidation flow; and

  - Consolidate Mustang Bayou flow into Palmer Plantation WWTP PS, going ultimately to SB-FB WWTP (addition of 0.4 MGD current flow), PS to be sized for build-out conditions.

In addition, the timing of WWTP improvements also must coincide with growth in each area to maintain compliance with the TCEQ's 75/90 Rule. Therefore, it is important to plan improvements at the proposed super regional WWTP (SB-FB WWTP) with careful coordination with planned transfers of consolidated plant flows from other service areas. The proposed wastewater improvements are shown in Exhibit 4-1. A proposed wastewater improvements timeline (by individual year) is shown in Table 7-6 corresponds to the project implementation schedule (developed in 5-year increments) discussed previously.

HARRIS COUNTY MUD #122 WWTP

HARRIS COUNTY WC&ID FONDREN ROAD WWTP

SOUTHWEST HARRIS COUNTY MUD #1 WWTP

FORT BEND COUNTY MUD #26 WWTP

QUAIL VALLEY UD WWTP

BLUE RIDGE WEST MUD WWTP

PALMER PLANTATION WWTP

STEEP BANK - FLAT BANK WWTP

MUSTANG BAYOU WWTP

SIENNA NORTH WWTP

SIENNA SOUTH WWTP

FUTURE SIENNA WWTP

FORT BEND PARKWAY

HIGHWAY 6

SIENNA PARKWAY

1, 2, 3, 4, 5

2, 3, 4

N

2000 0 5000

SCALE IN FEET

LEGEND

- PROPOSED WASTEWATER COLLECTION
- PROPOSED REUSE TRANSFER LINE
- EXISTING WWTP LOCATIONS
- PROPOSED WWTP LOCATION
- (#) PROJECT NUMBER BASED ON 5-YEAR IMPROVEMENTS SCHEDULE DISCUSSED IN SECTION 7

EXHIBIT 4-1
PROPOSED IMPROVEMENTS LAYOUT FOR SUPER REGIONAL WWTP SCENARIO

2011 REGIONAL
WATER AND WASTEWATER PLANNING STUDY
CITY OF MISSOURI CITY, TEXAS

10-5052 01/27/2012

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560 Firm Registration No. 1151

Table 7-6

Projected Timeline for WWTP Improvements

Year	Project Completed	Projected Flow Loading at Super Regional WWTP (MGD) [1]	Flow Loading - Based on the Percent of Super Regional WWTP Capacity [2]	Improvements Required [3]
2011	-	-	-	-
2012	Reroute Harris County MUD #122 WWTP to Harris County WC&ID-Fondren Rd WWTP	-	-	-
2013	Construct new transfer PS at Palmer Plantation WWTP and transfer all plant flow to SB-FB WWTP	1.89	63%	Initiate planning for SB-FB WWTP expansion
2014	Construct new transfer PS at Sienna North WWTP and transfer all plant flow to SB-FB WWTP	2.30	77%	**Initiate design for SB-FB expansion**
2015	-	2.37	79%	-
2016	**Construct 4.0 MGD expansion at SB-FB WWTP**	2.45	35%	-
2017	Construct new transfer PS at Fort Bend County MUD #26 WWTP and transfer all plant flow to Palmer Plantation WWTP PS	2.92	42%	-
2018	Construct new transfer PS at Sienna South WWTP and transfer all plant flow to Sienna North WWTP PS	4.11	59%	-
2019	-	4.24	61%	-
2020	-	4.38	63%	Initiate planning for SB-FB WWTP expansion
2021	Construct new transfer PS at Quail Valley UD WWTP and transfer all plant flow to SB-FB WWTP	6.02	86%	**Initiate design for SB-FB expansion**
2022	**Construct 4.0 MGD expansion at SB-FB WWTP**	6.21	56%	-
2023	Construct new transfer PS at Blue Ridge West WWTP and transfer all plant flow to Fort Bend County MUD #26 WWTP PS	7.50	68%	Initiate planning for SB-FB WWTP expansion
2024	Construct new transfer PS in Sienna South development and transfer all plant flow to Sienna South WWTP PS	8.49	77%	**Initiate design for SB-FB expansion**
2025	-	8.77	80%	-
2026	Construct new transfer PS at Harris County WC&ID-Fondren Rd WWTP and transfer all plant flow to Blue Ridge West WWTP PS	9.74	89%	-
2027	**Construct 4.0 MGD expansion at SB-FB WWTP**	10.05	67%	-
2028	Construct new transfer PS at Fort Bend County MUD #1 WWTP and transfer all plant flow to Harris County WC&ID-Fondren Rd WWTP PS	10.56	70%	-
2029	-	10.90	73%	Initiate planning for SB-FB WWTP expansion
2030	-	11.24	75%	**Initiate design for SB-FB expansion**

Table 7-6

Projected Timeline for WWTP Improvements

Year	Project Completed	Projected Flow Loading at Super Regional WWTP (MGD) [1]	Flow Loading - Based on the Percent of Super Regional WWTP Capacity [2]	Improvements Required [3]
2031	Construct new transfer PS at Mustang Bayou WWTP and transfer all plant flow to Palmer Plantation WWTP PS	12.37	82%	-
2032	-	12.77	85%	-
2033	-	13.18	88%	-
2034	-	13.60	91%	-
2035	**Construct 4.0 MGD expansion at SB-FB WWTP**	14.04	74%	-
2036	-	14.48	76%	-
2037	-	14.95	79%	-
2038	-	15.43	81%	-
2039	-	15.92	84%	-
2040	-	16.43	86%	-

Notes:
1 - This flow loading is based on 3% growth in each service area, except those areas already built out, such as Quail Valley UD and Sienna South.
2 - The percent capacity is based on the total projected loading at the Super Regional WWTP, allowing for the existing 3 MGD treatment capacity plus additional expansions of 4 MGD each.
3 - Recommended years to initiate planning/design/construction based on maintaining compliance with the TCEQ's 75/90 Rule.

A full cash flow analysis was developed for the wastewater improvements (Refer to Table 7-7) to provide a basis for comparison of existing/future WWTP O&M costs, along with the impact of the potential debt service to be incurred from consolidating the various existing WWTPs. A cumulative loss/gain analysis was also completed and was included in Table 4-40 which reflects a potential net gain in revenue from wastewater fees during the course of the project due to reduced WWTP O&M cost as each existing WWTP consolidates into the proposed super regional WWTP.

Annual debt service costs were developed based on a 30-year period at an interest rate of 3%. Revenue generated is based on the billing data provided by the utility districts (also referenced in Section 1), which reflects an average residential wastewater charge of $3.58 per 1,000 gallons. In addition, the available revenue to offset WWTP O&M and debt service was based on an assumption of 75% allocation of wastewater revenues for WWTP operations allowing for the remaining 25% for wastewater collection O&M and administration O&M. The revenue is anticipated to increase at an approximate annual growth rate of 3% to match development growth in the City. Therefore, as wastewater flows increase, the revenues generated from wastewater service fees should also increase.

Based on the potential revenue/cost streams evaluated, it appears that the savings in O&M by consolidating WWTPs may allow for the wastewater revenues to start paying for the O&M and debt service as early as 2021 (the first year with an annual net gain of revenue), using the implementation schedule included in this Section. However, depending on actual current O&M costs attributed to each WWTP, the likely "break even" point in the proposed implementation schedule could happen earlier or later than 2021.

Table 7-7

Projected Cash Flow Analysis for Proposed Wastewater Improvements

Year	Wastewater Improvements Project	Annual Debt Service Cost for WWTP Projects [1]	Total O&M Cost for Super Regional WWTP and Transfer PS Operation [2]	Total O&M Cost for Existing WWTP Operations [2]	Total Annual Cost for Wastewater Improvements and Operations	Total Annual Revenue for Utility Districts for WWTP Operations [3]	Cumulative Net Loss/Gain During Project
2011	-	-	-	$6,261,000	$6,261,000	$6,371,000	$110,000
2012	Reroute Harris County MUD #122 WWTP to Harris County WC&ID-Fondren Rd WWTP	$4,219,000	$397,000	$5,662,000	$10,278,000	$6,575,000	($3,593,000)
2013	Construct new transfer PS at Palmer Plantation WWTP and transfer all plant flow to SB-FB WWTP	$4,219,000	$508,000	$5,207,000	$9,934,000	$6,786,000	($6,741,000)
2014	Construct new transfer PS at Sienna North WWTP and transfer all plant flow to SB-FB WWTP	$4,219,000	$630,000	$4,802,000	$9,651,000	$7,004,000	($9,388,000)
2015	-	$4,219,000	$653,000	$4,971,000	$9,843,000	$7,229,000	($12,002,000)
2016	Construct 4.0 MGD expansion at SB-FB WWTP	$4,219,000	$488,000	$5,145,000	$9,852,000	$7,461,000	($14,393,000)
2017	Construct new transfer PS at Fort Bend County MUD #26 WWTP and transfer all plant flow to Palmer WWTP PS	$4,219,000	$621,000	$4,551,000	$9,391,000	$7,700,000	($16,084,000)
2018	Construct new transfer PS at Sienna South WWTP and transfer all plant flow to Sienna North WWTP PS	$4,219,000	$872,000	$3,282,000	$8,373,000	$7,947,000	($16,510,000)
2019	-	$4,219,000	$903,000	$3,397,000	$8,519,000	$8,202,000	($16,827,000)
2020	-	$4,219,000	$935,000	$3,516,000	$8,670,000	$8,465,000	($17,032,000)
2021	Construct new transfer PS at Quail Valley UD WWTP and transfer all plant flow to SB-FB WWTP	$4,219,000	$1,294,000	$2,472,000	$7,985,000	$8,736,000	($16,281,000)
2022	Construct 4.0 MGD expansion at SB-FB WWTP	$4,219,000	$1,187,000	$2,559,000	$7,965,000	$9,016,000	($15,230,000)
2023	Construct new transfer PS at Blue Ridge West WWTP and transfer all plant flow to Fort Bend County MUD #26 WWTP PS	$4,219,000	$1,523,000	$1,718,000	$7,460,000	$9,305,000	($13,385,000)
2024	Construct new transfer PS in Sienna South development and transfer all plant flow to Sienna South WWTP PS	$4,219,000	$1,742,000	$1,779,000	$7,740,000	$9,603,000	($11,522,000)

Table 7-7

Projected Cash Flow Analysis for Proposed Wastewater Improvements

Year	Wastewater Improvements Project	Annual Debt Service Cost for WWTP Projects [1]	Total O&M Cost for Super Regional WWTP and Transfer PS Operation [2]	Total O&M Cost for Existing WWTP Operations [2]	Total Annual Cost for Wastewater Improvements and Operations	Total Annual Revenue for Utility Districts for WWTP Operations [3]	Cumulative Net Loss/Gain During Project
2025	-	$4,219,000	$1,803,000	$1,842,000	$7,864,000	$9,911,000	($9,475,000)
2026	Construct new transfer PS at Harris County WC&ID-Fondren Rd WWTP and transfer all plant flow to Blue Ridge West WWTP PS	$4,219,000	$1,991,000	$1,463,000	$7,673,000	$10,229,000	($6,919,000)
2027	Construct 4.0 MGD expansion at SB-FB WWTP	$4,219,000	$2,061,000	$1,515,000	$7,795,000	$10,557,000	($4,157,000)
2028	Construct new transfer PS at Fort Bend County MUD #1 WWTP and transfer all plant flow to Harris County WC&ID-Fondren Rd WWTP PS	$4,219,000	$2,039,000	$1,338,000	$7,596,000	$10,895,000	($858,000)
2029	-	$4,219,000	$2,111,000	$1,385,000	$7,715,000	$11,244,000	$2,671,000
2030	-	$4,219,000	$2,185,000	$1,434,000	$7,838,000	$11,604,000	$6,437,000
2031	Construct new transfer PS at Mustang Bayou WWTP and transfer all plant flow to Palmer Plantation WWTP PS	$4,219,000	$2,390,000	$0	$6,609,000	$11,976,000	$11,804,000
2032	-	$4,219,000	$2,474,000	$0	$6,693,000	$12,360,000	$17,471,000
2033	-	$4,219,000	$2,561,000	$0	$6,780,000	$12,756,000	$23,447,000
2034	-	$4,219,000	$2,651,000	$0	$6,870,000	$13,165,000	$29,742,000
2035	Construct 4.0 MGD expansion at SB-FB WWTP	$4,219,000	$2,316,000	$0	$6,535,000	$13,587,000	$36,794,000
2036	-	$4,219,000	$2,398,000	$0	$6,617,000	$14,022,000	$44,199,000
2037	-	$4,219,000	$2,482,000	$0	$6,701,000	$14,471,000	$51,969,000
2038	-	$4,219,000	$2,569,000	$0	$6,788,000	$14,935,000	$60,116,000
2039	-	$4,219,000	$2,659,000	$0	$6,878,000	$15,413,000	$68,651,000
2040	-	$4,219,000	$2,753,000	$0	$6,972,000	$15,907,000	$77,586,000
Total Debt Service (Principal and Interest)		**$122,351,000**					

Notes:
1 - This debt service cost is based on a 30-year payment period.
2 - This O&M cost includes a 3.5% annual cost escalation factor to account for anticipated increases in inflation in the future.
3 - The WWTP operations revenue based on allocating 75% of the annual wastewater revenue to WWTP operations. Revenue based on average utility district wastewater fee of $3.58 per 1,000 gallons. Revenue increases annually by approximately 3% due to increased development and growth in the City, resulting in a proportional increase in wastewater flows.

This Technical Memorandum summarizes the findings of Task VIII of the City of Missouri City Regional Water and Wastewater Planning Study (the Study). The focus of Task VIII of the Study is the preparation of Wastewater Treatment System Alternatives for the Study area.

Activities in Task VIII included the following:

- ✓ Determine useful life of each facility, if possible;
- ✓ Determine treatment capacity;
- ✓ Determine available capacity;
- ✓ Evaluate potential for regionalization for wastewater treatment;
- ✓ Incorporate existing proposed regionalization improvements into study;
- ✓ Develop wastewater production by service areas over the 30-year planning horizon;
- ✓ Develop anticipated opinions of probable cost;
- ✓ Determine potential for reuse; and,
- ✓ Prepare a technical memorandum summarizing the findings.

Wastewater Treatment System Alternatives

The goal of this section of the Study is to evaluate potential alternatives of consolidating WWTPs where feasible to increase operational efficiency and cost-effectiveness throughout the Study area's wastewater system. For a city the size of Missouri City, it is normal to only have one or two wastewater treatment facilities. Substantial savings in annual O&M costs (and therefore the cost of service for the City's residents) can typically be attained by consolidating to a smaller number of WWTPs.

There are 11 existing WWTPs within the study area, with an additional regional WWTP planned for the southernmost area of the City. Two of the WWTPs are owned by the City (SB-FB and Mustang Bayou). The remaining wastewater treatment plants are owned by utility districts. Refer to Exhibit 1-6 for a map of the existing WWTP locations.

As with many other utility district WWTPs, the majority of the WWTPs in the Study area consist of package treatment plants. Package plants are typically used for low flows and small service areas, and allow for rapid design and construction. Because package plants are designed for smaller flows than conventional treatment facilities, package plants normally have limited flexibility to handle large hydraulic peak flows through the treatment system. Also, the size of each package plant typically provides very limited buffer capacity resulting in a greater potential for pass-through of untreated wastewater during high flow events. In addition, package plants typically include very little process automation such as dissolved oxygen (DO) metering to quickly monitor DO in the treatment process and variable frequency drives to allow for turndown of pumps and blowers to reduce energy usage at lower flows.

Municipal Utility Districts (MUDs)

- Blue Ridge West MUD
- First Colony MUD #9
- Harris County WC & ID Fondren Road
- Fort Bend County MUD #115
- Fort Bend County MUD #129
- Fort Bend County MUD #149
- Fort Bend County MUD #23
- Fort Bend County MUD #24
- Fort Bend County MUD #26
- Fort Bend County MUD #42
- Fort Bend County MUD #46
- Fort Bend County MUD #47
- Fort Bend County MUD #48
- Fort Bend County MUD #49
- Fort Bend County WC & ID #2
- Harris County MUD #122
- Meadowcreek MUD
- Mustang Bayou Utility Service Area
- Palmer Plantation MUD #1
- Palmer Plantation MUD #2
- Quail Valley Utility District
- Sienna Plantation MUD #1
- Sienna Plantation MUD #10
- Sienna Plantation MUD #12
- Sienna Plantation MUD #13
- Sienna Plantation MUD #2
- Sienna Plantation MUD #3
- Sienna Plantation MUD #4
- Sienna Plantation MUD #5
- Sienna Plantation MUD #6
- Sienna Plantation MUD #7
- Sienna Plantation Management District
- Southwest Harris County MUD #1
- Thunderbird Utility District

Map By:
GIS Division
October 2011

Exhibit 1-6
Sanitary Sewer Collection System

Legend

- Waste Water Treatment Plants
- Lift Stations
- Gravity Sanitary Sewer Lines
- City Limits Line
- Force Mains
- ETJ Line

Geographic Coordinate System North American Datum 1983 (NAD83)

0 2,000 4,000 6,000 8,000 Feet

The information on this map is provided and maintained by various agencies, including county departments, municipal governments, state and federal agencies. No guarantee is given as to the accuracy or currency of any of the data. The map is designed to serve as a secondary representation of real property found within this jurisdiction, and is compiled from the recorded deeds, plats, and other public records, which are primary sources for this public information. Users of this map are hereby notified that these primary sources should be consulted for verification of the information presented here. The data layers do not take the place of a legal survey or other primary source documentation. The county and its vendors assume no legal responsibility for the information on this map.

Another disadvantage of package plants is the inherent limitation in operational flexibility when multiple package plants are used to expand treatment capacity versus additional treatment trains in conventional treatment plants. Package plants are normally not well suited for large WWTP demands, such as for flows greater than 1.0 MGD. For example, the Sienna South Regional WWTP is currently rated for an average daily flow of 1.2 MGD, though it is based on the operation of 4 simultaneously-operated 0.3 MGD package treatment plants. As a result, the plant operations staff has observed substantially higher than normal daily O&M efforts to keep the plant in operation and consistently meeting permit limits.

In addition, package treatment plants typically have much shorter operating lives than conventional or advanced treatment facilities. Most conventional treatment facilities use concrete structures, which typically have a 40-50 year operating life and equipment is designed for 30-40 years. However, in package plants the anticipated operating life is frequently intended only for 10-20 years, especially when structures are designed using painted carbon steel. Package plants are usually intended to manage short-term needs, with the goal of constructing more permanent facilities in the future as flows increase.

Each WWTP was evaluated in this Study for potential consolidation by being reviewed with respect to rated capacity versus average loading, treatment performance, remaining useful life of structures and equipment, treatment and potential expansion capabilities, potential for reuse and observed level of annual O&M efforts. Based on the evaluation of each WWTP, alternatives have been developed for potential consolidation of WWTPs to a minimum number of operating facilities. A few consolidation alternatives were developed by the various utility district engineering firms which are also incorporated into this Study.

Since the goal of this section is to determine the needs of the entire wastewater system, several additional in-depth analyses were completed for each service area with the goal of developing additional potential consolidation alternatives. In general, there are 3 basic potential alternatives for each WWTP which are rehabilitation and/or replacement of the WWTP structure and equipment; diversion of the entire plant influent flow to a nearby WWTP; or, expand as a new regional WWTP at the existing site. The advantages and disadvantages of each alternative are discussed in general terms in Table 8-1.

Table 8-1
Advantages & Disadvantages of Consolidation Alternatives

WWTP Alternative	Advantages	Disadvantages
Rehabilitation/Replacement of existing WWTP	Maintain existing operational requirements; provides a treatment backup in case of any problems at an adjacent WWTP.	Overall O&M is typically lower for one combined WWTP than for separate, smaller plants.
Divert WWTP flow to regional WWTP	Increase in treatment efficiency by combining plant flows or may eliminate treatment requirements in this utility district service area; reduce total O&M cost for a combined facility than separate, smaller plants; provides opportunity to establish a newer, more efficient, regional WWTP in another part of the City.	No longer have a treatment backup in case of any problems at adjacent WWTP; would need to adjust administration requirements for billing for both service areas.
Expand to or Construct new regional WWTP at existing site	Increase in treatment efficiency by combining plant flows; reduces total O&M costs for combined, regional facility rather than operating multiple, separate smaller plants; fewer discharge points increases environmental benefits.	Difficult to obtain buy-in with multiple utility districts; would need to adjust administration requirements for billing for the multiple service areas and address fear of loss of control.

Potential alternatives for each WWTP have been developed and are discussed below.

Blue Ridge West MUD WWTP

The Blue Ridge West MUD WWTP was originally a package plant that was built approximately 30 years ago, although Complete-Mix Activated Sludge (CMAS) conventional treatment trains have been added to the plant to replace the original plant over the past 20 years. The WWTP is rated for 1.3 MGD and is operating at 0.75 MGD, or at 58% loading. With the current condition of the structure and equipment, the facility should be expected to continue treating wastewater while meeting permit limits for the next 5-10 years without major replacement of equipment. Since the primary structure is concrete, the structure should be expected to last for another 10+ years. However, the equipment is approaching the end of its useful life and will likely need replacement within the next 5 years.

Diversion to the nearby Fort Bend County MUD #26 WWTP was not considered as diversion of this plant flow to the MUD #26 WWTP would exceed that plant's treatment capacity. However, diversion of this plant flow to the Quail Valley UD WWTP may be accomplished by directing flow to the Fort Bend County MUD #26 WWTP and then pumping from the MUD #26 WWTP on to the Quail Valley UD WWTP. As another option, this plant flow could potentially be diverted to the FBCMUD #26 WWTP and sent further downstream to the SB-FB WWTP. Benefits and disadvantages for each alternative are discussed in Table 8-2. Note that only site-specific advantages and disadvantages are included in this table and subsequent tables for additional alternatives.

Table 8-2 Consolidation Alternatives for Blue Ridge West MUD WWTP		
WWTP Alternative	**Advantages**	**Disadvantages**
Rehabilitation/Replacement of existing WWTP	WWTP is operating at 58% capacity, which is a high operating efficiency.	Requires additional staff to operate this plant and nearby MUD #26 WWTP; existing WWTP as designed and operated will likely have difficulty in consistently meeting effluent limitations for ammonia.
Expand Existing WWTP to develop a new regional WWTP	Establishes new, regional WWTP in north part of City.	Higher cost than diverting to a downstream WWTP; still leaves multiple WWTPs in operation within the City.
Divert WWTP flow to Quail Valley UD WWTP	Eliminate treatment requirements in this utility district service area.	This alternative may not be cost-effective unless the MUD #26 WWTP flow is diverted to this WWTP also; the Quail Valley UD WWTP may not be able to consistently treat this additional flow.
Divert WWTP flow to SB-FB WWTP	**Eliminate treatment requirements in this utility district service area**	**Initial capital cost for transfer pipeline to this facility; this alternative may not be cost-effective unless the nearby WWTPs are considered in this alterative as well.**

Table 8-3 Costs for Blue Ridge West MUD WWTP Alternatives					
Scenario	**Impact to WWTP**	**OPCC**	**Total Capital Cost**	**Annual O&M Cost**	**30-Yr Life Cycle Cost**
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$8,775,000	$12,426,000	$418,000	$20,619,000
Consolidate WWTPs based on MUD engineering firm recommendations	Expand WWTP	$9,000,000	$12,744,000	$577,000	$24,054,000
Consolidate WWTPs using QVUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$493,000	$699,000	$10,700	$909,000
Consolidate WWTPs using BRWMUD WWTP as a regional facility	Expand WWTP	$16,500,000	$23,364,000	$577,000	$34,674,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$797,000**	**$1,129,000**	**$32,000**	**$1,757,000**

The recommended alternative for the Blue Ridge West MUD WWTP is to divert this flow to an offsite WWTP, ultimately to the SB-FB WWTP.

Fort Bend County MUD #26 WWTP

The Fort Bend County MUD #26 WWTP is approximately 30 years old, though it has recently undergone a minor rehabilitation (conversion of contact-stabilization to CMAS process). The WWTP is rated for 0.5 MGD, though it is operating only at 0.3 MGD, or at 60% loading. With the current condition of the structure and equipment, the facility should be expected to continue treating wastewater while meeting permit limits for the next 5-10 years without major replacement of equipment.

Since the primary structure is concrete, the structure should be expected to last for another 10+ years. However, the equipment is approaching the end of its useful life and will likely need replacement within the next 5 years. Benefits and disadvantages for each alternative are discussed in Table 8-4.

Table 8-4
Consolidation Alternatives for Fort Bend County MUD #26 WWTP

WWTP Alternative	Advantages	Disadvantages
Rehabilitation/Replacement of existing WWTP	WWTP is operating at 60% capacity, which is a high operating efficiency.	Requires additional treatment staff to operate this plant and nearby Blue Ridge WWTP. WWTP discharges into a regulated watershed and will likely require additional treatment upgrades to meet effluent limitations.
Divert WWTP Flow to Blue Ridge WWTP	Eliminate treatment requirements in this utility district service area.	Initial capital cost for transfer pipeline to this facility; this alternative may not be cost-effective unless the nearby WWTPs are considered in this alterative as well
Divert WWTP flow to Quail Valley UD WWTP	Eliminate treatment requirements in this utility district service area.	Initial capital cost for transfer pipeline to this facility; this alternative may not be cost-effective unless the nearby WWTPs are considered in this alterative as well
Divert WWTP flow to SB-FB WWTP	**Eliminate treatment requirements in this utility district service area.**	**Initial capital cost for transfer pipeline to this facility; this alternative may not be cost-effective unless the nearby WWTPs are considered in this alterative as well.**

Table 8-5
Costs for Fort Bend County MUD #26 WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$3,375,000	$4,779,000	$220,000	$9,092,000
Consolidate WWTPs based on MUD engineering firm recommendations	Consolidate WWTP into an offsite facility	$439,000	$622,000	$4,100	$703,000
Consolidate WWTPs using QVUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$1,862,500	$2,638,000	$18,500	$3,001,000
Consolidate WWTPs using BRWMUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$385,000	$546,000	$4,100	$627,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$2,362,500**	**$3,346,000**	**$37,000**	**$4,072,000**

The recommended alternative for the Fort Bend County MUD #26 WWTP is to divert this flow to an offsite WWTP, ultimately to the SB-FB WWTP.

Harris County MUD #122 WWTP

The Harris County MUD #122 WWTP is approximately 20 years old, and has not been rehabilitated in quite some time. The WWTP is rated for 0.25 MGD, though it is operating only at 0.1 MGD, or at 40% loading. With the current condition of the structure and equipment and the process design (contact-stabilization secondary biological process), the facility should be expected to continue treating wastewater for the next 5-10 years.

However, it is unlikely that the WWTP will be able to consistently meet its new permit, which now includes an enforced ammonia limit. The contact-stabilization type of treatment process used at this site is intended only for BOD removal and was never intended to remove ammonia. As a result, the contact (aeration) portion of the process has a short hydraulic retention time (HRT), normally between 1-2 hours. The minimum HRT for ammonia removal is usually over 6 hours which only allows for limited ammonia removal.

As an example, the Fort Bend County MUD #26 WWTP had repeated difficulty in meeting its ammonia limit with its existing contact-stabilization process until it was retrofitted into a more conventional CMAS process. Therefore, until the treatment process can be upgraded at the Harris County MUD #122 WWTP, it is unlikely that the plant will be able to consistently meet its new permit limits which will go into effect in the summer of 2012.

Diversion to the nearby Southwest Harris County MUD #1 WWTP was not considered as diversion of this plant flow to the MUD #1 WWTP would put that plant at 75% loading which would cause it to fall under the TCEQ 75/90 rule. Benefits and disadvantages for each alternative are discussed in Table 8-6.

Table 8-6
Consolidation Alternatives for Harris County MUD #122 WWTP

WWTP Alternative	Advantages	Disadvantages
Rehabilitation/Replacement of existing WWTP	Continue operation at this plant as it currently exists.	WWTP is operating at 40% capacity, which is a low operating efficiency; existing WWTP as designed and operated will likely have difficulty in consistently meeting effluent limitations for ammonia.
Divert WWTP flow to Fondren Road WWTP	Regional WWTP in the north part of the City.	Higher cost than diverting to a downstream WWTP; still leaves multiple WWTPs in operation within the City.
Divert WWTP flow to WC&ID #2	Eliminate treatment requirements in this utility district service area.	Potentially higher cost than diverting to a downstream WWTP; still leaves multiple WWTPs in operation within the City; loss of bed and banks reuse credit by diverting to WC&ID #2.
Divert WWTP flow to SB-FB WWTP	**Eliminate treatment requirements in this utility district service area.**	**Initial capital cost for transfer pipeline to this facility; this alternative may not be cost-effective unless the nearby WWTPs are considered in this alterative as well.**

Table 8-7
Cost Estimates for Harris County MUD #122 WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$1,687,500	$2,390,000	$87,000	$4,096,000
Consolidate WWTPs based on MUD engineering firm recommendations	Consolidate WWTP into an offsite facility	$1,480,000	$2,096,000	$89,100	$3,843,000
Consolidate WWTPs using QVUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$443,750	$629,000	$2,100	$671,000
Consolidate WWTPs using BRWMUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$443,750	$629,000	$2,100	$671,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$443,750**	**$629,000**	**$2,100**	**$671,000**

The recommended short-term alternative (0-5 years) for the Harris County MUD #122 WWTP is to complete a minor upgrade and/or rehabilitation to the WWTP to convert the contact-stabilization plant to a conventional CMAS treatment process to better meet the plant's new permit limits. The recommended long-term alternative for the HCMUD #122 WWTP is to divert this flow to an offsite WWTP, ultimately to the SB-FB WWTP.

Harris County WC&ID – Fondren Road WWTP

The Harris County WC&ID – Fondren Road WWTP is approximately 30 years old, though it has recently undergone a minor rehabilitation (cleaning and limited structural/equipment repairs). The WWTP is rated for 0.6 MGD, but it is operating only at 0.2 MGD, or at 33% loading. With the current condition of the structure and equipment, the facility should be expected to continue treating wastewater while meeting permit limits for the next 5-10 years without major replacement of equipment. Since the primary structure is concrete, the structure should be expected to last for another 10+ years. However, the equipment is approaching the end of its useful life and will likely need replacement within the next 5 years.

Diversion to the nearby Southwest Harris County MUD #1 WWTP was not considered since diversion of this plant flow to the MUD #1 WWTP would put that plant at 75% loading, which would cause it to fall under the TCEQ 75/90 rule. In addition the MUD #1 WWTP site is already built out, so expansion of that facility is not likely to be feasible. Benefits and disadvantages for each alternative are discussed in Table 8-8.

Table 8-8 Consolidation Alternatives for Harris County WC&ID – Fondren Road WWTP		
WWTP Alternative	**Advantages**	**Disadvantages**
Rehabilitation/Replacement of existing WWTP	Continue operation at this plant as it currently exists.	WWTP is operating at 33% capacity, which is a low operating efficiency; requires additional staff to operate this plant and the nearby MUD #1 WWTP. WWTP appears to be having increasing mechanical, electrical, and control system issues which further increases O&M costs.
Construct new regional WWTP at this site	Establishes new, regional WWTP in north part of City.	Higher cost than diverting to a downstream WWTP; still leaves multiple WWTPs in operation within the City.
Divert WWTP flow to SB-FB WWTP	**Eliminate treatment requirements in this utility district service area.**	**Initial capital cost for transfer pipeline to this facility; this alternative may not be cost-effective unless the nearby WWTPs are considered in this alterative as well.**

Table 8-9 Costs for Harris County – Fondren Road WWTP Alternatives					
Scenario	**Impact to WWTP**	**OPCC**	**Total Capital Cost**	**Annual O&M Cost**	**30-Yr Life Cycle Cost**
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$4,050,000	$5,735,000	$141,000	$8,499,000
Consolidate WWTPs based on MUD engineering firm recommendations	Rehab WWTP	$4,050,000	$5,735,000	$141,000	$8,499,000
Consolidate WWTPs using QVUD WWTP as a regional facility	Expand WWTP	$7,500,000	$10,620,000	$149,000	$13,541,000
Consolidate WWTPs using BRWMUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$1,062,500	$1,505,000	$9,900	$1,700,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$1,062,500**	**$1,505,000**	**$9,900**	**$1,700,000**

The recommended alternative for the Harris County MUD #122 WWTP is to divert this flow to an offsite WWTP, ultimately to the SB-FB WWTP.

Mustang Bayou Regional WWTP

The Mustang Bayou WWTP is approximately 20 years old. The plant consists of 3 package plant trains, with Train No. 1 being roughly 20 years old, Train No. 2 being roughly 5 years old, and Train No. 3 being about 1 year old. The age and condition of the two newer trains will require only minor work over the next 5-10 years but the oldest train is approaching the end of its useful life. The WWTP is rated for 1.0 MGD, and it is operating at 0.4 MGD, or at 40% loading.

With the current condition of the structure and equipment, the facility can also be expected to continue treating wastewater while meeting permit limits for the next 5-10 years without major replacement of equipment. However, the structure and equipment for the oldest train is

approaching the end of its useful life and will likely need a major rehabilitation and/or replacement of the majority of the structures and equipment within the next 5 years.

Therefore, three alternatives may be feasible for this facility, including rehabilitation and/or replacement of the WWTP structure and equipment over the next 5-10 years, modification of the plant to develop a new regional WWTP at this site or diversion to a downstream WWTP, such as the SB-FB WWTP. Benefits and disadvantages for each alternative are discussed in Table 8-10.

Table 8-10
Consolidation Alternatives for Mustang Bayou Regional WWTP

WWTP Alternative	Advantages	Disadvantages
Rehabilitation/Replacement of existing WWTP	Continue operation at this plant as it currently exists.	WWTP is operating at 40% of capacity which is a low operating efficiency; the existing treatment trains are all package plants which have a limited useful life.
Develop this WWTP into a large, regional WWTP	Provides opportunity to establish a more efficient, regional WWTP in eastern part of the City	Higher cost than diverting to a downstream WWTP; still leaves multiple WWTPs in operation within the City.
Divert WWTP flow to SB-FB WWTP	**Eliminate treatment requirements in this utility district service area**	**Initial capital cost for transfer pipeline to this facility**

Table 8-11
Costs for Mustang Bayou WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Expand WWTP	$8,212,500	$11,629,000	$267,000	$16,863,000
Consolidate WWTPs based on MUD engineering firm recommendations	Expand WWTP	$8,212,500	$11,629,000	$267,000	$16,863,000
Consolidate WWTPs using Quail Valley UD WWTP as a regional facility	Expand WWTP	$8,212,500	$11,629,000	$267,000	$16,863,000
Consolidate WWTPs using Blue Ridge West MUD WWTP as a regional facility	Expand WWTP	$8,212,500	$11,629,000	$267,000	$16,863,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$868,750**	**$1,231,000**	**$19,000**	**$1,604,000**

The recommended alternative for the Mustang Bayou WWTP is to also divert this flow to an offsite WWTP, ultimately to the SB-FB WWTP.

Palmer Plantation WWTP

The Palmer Plantation WWTP is approximately 25 years old, and has not undergone a rehabilitation of the plant. The WWTP is rated for 0.6 MGD, and it is operating at 0.3 MGD, or at 50% loading. With the current condition of the structure and equipment, the facility can also be expected to continue treating wastewater while meeting permit limits for the next 5-10 years

without major replacement of equipment. Since the primary structure is concrete, the structure should be expected to last for another 10-15 years. However, the equipment is approaching the end of its useful life and will likely need replacement within the next 5-10 years. Benefits and disadvantages for both alternatives are discussed in Table 3-7.

Table 8-12
Consolidation Alternatives for Palmer Plantation WWTP

WWTP Alternative	Advantages	Disadvantages
Rehabilitation/Replacement of existing WWTP	Continue operation at this plant as it currently exists.	WWTP discharges into a regulated watershed and will likely require additional treatment upgrades to meet effluent limitations.
Divert WWTP flow to SB-FB WWTP	**Eliminates treatment requirements in this utility district.**	**May be lower cost to divert to nearby Quail Valley UD WWTP.**

Table 8-13
Costs for Palmer Plantation WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$4,050,000	$5,735,000	$169,000	$9,048,000
Consolidate WWTPs based on MUD engineering firm recommendations	Consolidate WWTP into an offsite facility	$454,000	$643,000	$5,000	$742,000
Consolidate WWTPs using Quail Valley UD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$454,000	$643,000	$5,000	$742,000
Consolidate WWTPs using Blue Ridge West MUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$454,000	$643,000	$5,000	$742,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$1,108,000**	**$1,569,000**	**$64,000**	**$2,824,000**

The recommended alternative for the Palmer Plantation WWTP is to divert this flow to an offsite WWTP, ultimately to the SB-FB WWTP.

Quail Valley UD WWTP

The Quail Valley UD WWTP (shared with Thunderbird UD) is approximately 35 years old, though it continually undergoes rehabilitation on an annual basis. The age and condition of the plant require a full plant overhaul, though to date the work completed has been in bits and pieces throughout the plant site. The WWTP is rated for 4.0 MGD, but it is operating only at 1.5 MGD, or at 38% loading. However, while the plant is rated for 4.0 MGD, it is not certain whether this full treatment capacity still exists. For example, the 4.0 MGD rating was based on the original plant design which only required removal of BOD and did not have an enforced ammonia limit

as it currently does. Therefore, it is likely that the effective treatment capacity may be more in the range of 2.0-3.0 MGD.

With the current condition of the structures and equipment, the facility should be expected to continue treating wastewater while meeting permit limits for the next 5-10 years without major replacement of equipment. Since the primary structure is concrete, the structure should be expected to last for another 5+ years. However, the structures and equipment are approaching the end of their respective useful lives and will likely need a major rehabilitation and/or replacement of the majority of the structures and equipment within the next 5 years.

In addition, the treatment process used at the WWTP is a pure oxygen process, which is extremely energy-intensive, especially for the actual flow being treated at the plant. The pure oxygen system produces liquid oxygen, which is injected into the treatment reactors (sealed aeration basins) to maintain a higher biomass concentration to provide treatment of wastewater in a smaller basin with a shorter HRT. Excess liquid oxygen is stored in pressurized tanks onsite, and becomes a safety issue as the tanks age. Considering the age and condition of the equipment, it may be prudent to consider overhauling the treatment plant's secondary process and return to a more conventional form of aerated treatment.

The City would prefer to maintain treatment at this facility mainly because it provides a substantial supply of § 210 reclaimed water for the nearby golf course, so any potential offsite diversions would need to maintain the reclaimed water for irrigation at the golf course. Benefits and disadvantages for each alternative are discussed in Table 8-14.

Table 8-14
Consolidation Alternatives for Quail Valley UD – Thunderbird UD WWTP

WWTP Alternative	Advantages	Disadvantages
Rehabilitation/Replacement of existing WWTP	Continue operation at this plant as it currently exists.	WWTP is operating at 38% capacity, which is a low operating efficiency; requires additional treatment staff to operate this plant and nearby WWTPs. WWTP discharges into a regulated watershed and will likely require additional treatment upgrades to meet effluent limitations.
Develop this WWTP into Regional WWTP	Regional WWTP in the central part of the City.	The facility may not be able to consistently treat additional flow from other utility district areas.
Divert WWTP flow to SB-FB WWTP	**Eliminate treatment requirements in this utility district service area.**	**Initial capital cost for transfer pipeline to this facility.**

Table 8-15
Costs for Quail Valley UD WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$9,000,000	$12,744,000	$620,000	$24,897,000
Consolidate WWTPs based on MUD engineering firm recommendations	Rehab WWTP	$9,000,000	$12,744,000	$620,000	$24,897,000
Consolidate WWTPs using QVUD WWTP as a regional facility	Expand WWTP	$16,500,000	$23,364,000	$649,000	$36,085,000
Consolidate WWTPs using BRWMUD WWTP as a regional facility	Rehab WWTP	$9,000,000	$12,744,000	$620,000	$24,897,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$1,100,000**	**$1,558,000**	**$23,100**	**$2,011,000**

The recommended alternative for the Quail Valley UD WWTP is to divert this flow to an offsite WWTP, ultimately to the SB-FB WWTP. This alternative would also include the construction of a 0.5 MGD reclaimed water pump station and transmission system at the SB-FB WWTP site to provide a continued supply of reclaimed water back to the Quail Valley Country Club.

Sienna Plantation North WWTP

The Sienna Plantation wastewater collection system is divided into two service areas separated by Flat Bank Creek. The regions north of Flat Bank Creek currently are treated with a package plant, Sienna North WWTP. The WWTP is approximately 10 years old and it is rated for 0.9 MGD. It is operating only at 0.3 MGD, or at 33% loading. With the current condition of the structure and equipment, the facility should be expected to continue treating wastewater while meeting permit limits for the next 10-15 years without major replacement of equipment.

Two alternatives may be feasible for this facility, including rehabilitation and/or replacement of the WWTP structure and equipment over the next 10-15 years or diversion of wastewater flow to the SB-FB WWTP. Potential diversion of the plant flow to the nearby Palmer Plantation WWTP was not considered as the Palmer Plantation WWTP is also being evaluated for diversion to the SB-FB WWTP. Benefits and disadvantages for both alternatives are discussed in Table 8-16.

Table 8-16
Consolidation Alternatives for Sienna Plantation North WWTP

WWTP Alternative	Advantages	Disadvantages
Rehabilitation/Replacement of existing WWTP	Continue operation at this plant as it currently exists.	WWTP is operating at 33% of capacity which is a low operating efficiency; requires additional staff to operate this plant and nearby WWTPs.
Divert WWTP flow to SB-FB WWTP	**Eliminate treatment requirements in this utility district service area.**	**Initial capital cost for transfer pipeline to this facility.**

Table 8-17
Costs for Sienna North WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$6,075,000	$8,603,000	$200,000	$12,524,000
Consolidate WWTPs based on MUD engineering firm recommendations	Rehab WWTP	$6,075,000	$8,603,000	$200,000	$12,524,000
Consolidate WWTPs using QVUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$922,500	$1,307,000	$7,400	$1,453,000
Consolidate WWTPs using BRWMUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$922,500	$1,307,000	$7,400	$1,453,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$2,825,000**	**$4,001,000**	**$50,000**	**$4,982,000**

The recommended alternative for the Sienna North WWTP is to divert this flow to an offsite WWTP, ultimately to the SB-FB WWTP.

Sienna Plantation South WWTP

The Sienna Plantation wastewater collection system south of Flat Bank Creek currently is conveyed to a 1.2 MGD package WWTP (Sienna South WWTP). The Sienna South WWTP is approximately 20 years old and is in a fairly dilapidated condition. The WWTP is rated for 1.2 MGD, and it is operating at roughly 1.1 MGD, or at 92% loading. With the current condition of the structure and equipment, the facility should be expected to continue treating wastewater while meeting permit limits for the next 5-10 years without major replacement of equipment.

Two key issues that are related to flow loading need to be addressed with this facility. The WWTP is currently in noncompliance with the TCEQ 75/90 rule. However, since the service area for this WWTP is completely built out this means that additional treatment capacity is not needed for growth. However, the current flow loading also allows for very little buffer for treatment upsets at the plant, so the plant is currently operating right at the edge of its capabilities and excursions from the permit limits could be expected on occasion. Diversion of flows from this WWTP to another WWTP should occur as soon as feasible.

Two alternatives may be feasible for this facility, including rehabilitation and/or replacement of the WWTP structure and equipment over the next 5-10 years or diversion of wastewater flows to an offsite WWTP. Potential diversion of the plant flow to the nearby Sienna North WWTP was not considered as the current flow loading at the Sienna South WWTP would overload the treatment capacity of the Sienna North WWTP. Benefits and disadvantages for each alternative are discussed in Table 8-18.

Table 8-18 Consolidation Alternatives for Sienna Plantation South WWTP		
WWTP Alternative	**Advantages**	**Disadvantages**
Rehabilitation/Replacement of existing WWTP	Continue operation at this plant as it currently exists.	WWTP is operating at 92% of capacity, which is too high to maintain efficiency; requires additional staff to operate this plant and nearby WWTPs.
Divert WWTP flow to SB-FB WWTP	**Eliminate treatment requirements in this utility district service area.**	**Initial capital cost for transfer pipeline to this facility.**

Table 8-19 Costs for Sienna South WWTP Alternatives					
Scenario	**Impact to WWTP**	**OPCC**	**Total Capital Cost**	**Annual O&M Cost**	**30-YR Life Cycle Cost**
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$8,100,000	$11,470,000	$586,000	$22,956,000
Consolidate WWTPs based on MUD engineering firm recommendations	Consolidate WWTP into an offsite facility	$1,375,000	$1,947,000	$9,900	$2,142,000
Consolidate WWTPs using QVUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$1,375,000	$1,947,000	$9,900	$2,142,000
Consolidate WWTPs using BRWMUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$1,375,000	$1,947,000	$9,900	$2,142,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$3,962,500**	**$5,611,000**	**$43,000**	**$6,454,000**

The recommended alternative for the Sienna South WWTP is to divert this flow to an offsite WWTP, ultimately to the SB-FB WWTP.

Southwest Harris County MUD #1 WWTP

The Southwest Harris County MUD #1 WWTP is approximately 20 years old though it has recently undergone a minor rehabilitation (cleaning and minor structural/equipment repairs). The WWTP is rated for 0.4 MGD, but it is operating at 0.1 MGD, or at 25% loading. With the current condition of the structure and equipment, the facility can be expected to continue treating wastewater while meeting permit limits for the next 5-10 years without major replacement of equipment. Since the primary structure is concrete, the structure should be expected to last for another 20+ years. However, the equipment is approaching the end of its useful life and will likely need replacement within the next 10 years.

Therefore, four alternatives may be feasible for this facility, including rehabilitation and/or replacement of the WWTP structure and equipment over the next 5-10 years, diversion of the entire plant influent flow to the nearby Harris County WC&ID – Fondren Road WWTP, diversion of wastewater flow to the nearby WC&ID #2 utility district, or diversion to an

expanded SB-FB WWTP. Benefits and disadvantages for each alternative are discussed in Table 8-20.

Table 8-20
Consolidation Alternatives for Southwest Harris County MUD #1 WWTP

WWTP Alternative	Advantages	Disadvantages
Rehabilitation/Replacement of existing WWTP	Backup in case of any problems at the Harris County - Fondren Road WWTP.	WWTP is operating at 25% capacity, which is a low operating efficiency; requires additional treatment staff to operate this plant and the nearby Harris County - Fondren Road WWTP.
Divert WWTP flow to Fondren Road WWTP	Increase in treatment efficiency by combining plant flows in a Regional WWTP in the north part of the City.	No backup in case of any problems at the Harris County - Fondren Road WWTP.
Divert WWTP flow to WC&ID #2	Eliminate treatment requirements in this utility district service area.	No backup in case of any problems at the WC&ID #2 WWTP.
Divert WWTP flow to SB-FB WWTP	**Eliminate treatment requirements in this utility district service area.**	**Initial capital cost for transfer pipeline to this facility; this alternative may not be cost-effective unless the nearby WWTPs are considered in this alterative as well.**

Table 8-21
Cost Estimates for Southwest Harris County MUD #1 WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$2,700,000	$3,824,000	$75,000	$5,295,000
Consolidate WWTPs based on MUD engineering firm recommendations	Rehab WWTP	$2,700,000	$3,824,000	$75,000	$5,295,000
Consolidate WWTPs using Quail Valley UD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$175,000	$248,000	$3,300	$313,000
Consolidate WWTPs using Blue Ridge West MUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$175,000	$248,000	$3,300	$313,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$175,000**	**$248,000**	**$3,300**	**$313,000**

The recommended alternative for the Southwest Harris County MUD #1 WWTP is to divert this flow to an offsite WWTP, ultimately to the SB-FB WWTP.

SB-FB Regional WWTP

The SB-FB WWTP is approximately 20 years old though it was recently expanded in 2010. The plant is in very good condition and is ready to begin accepting limited flows other facilities. The WWTP is rated for 3.0 MGD, and it is operating only at 1.5 MGD, or at 50% loading. While the plant is rated for 3.0 MGD, the ultimate build-out capacity for the WWTP could be as high as 6.0

MGD if the existing extended aeration secondary process continues to be used. However, if a more efficient treatment process is used, the ultimate capacity for this plant site could easily be expanded to more than 20.0 MGD. Discussion on WWTP process alternatives for this facility is included later in this TM.

With the current condition of the structure and equipment, the facility can be expected to continue treating wastewater while meeting permit limits for the next 25-30 years without major replacement of equipment. However, depending on the flows diverted to this facility, an additional expansion will likely be needed within the next 5-10 years.

Due to the age of the new improvements, only one alternative has been evaluated for this facility which is the expansion of this plant into a new super-regional WWTP at this site. Diversion to nearby WWTPs was not considered since additional flow to nearby WWTPs would exceed those plants' treatment capacities. In addition, the City would prefer to maximize treatment at this facility as it provides the most efficient diversion of effluent for use with a potential bed and banks permit. Advantages and disadvantage for the one alternative are discussed in Table 8-22.

Table 8-22
Consolidation Alternatives for SB-FB WWTP

WWTP Alternative	Advantages	Disadvantages
Develop this WWTP into a large, regional WWTP	**Provides opportunity to establish a more efficient, regional WWTP in western part of the City**	**Difficult to obtain buy-in with multiple utility districts; would need to adjust administration requirements for billing for the multiple service areas and address fear of loss of control**

Table 8-23
Costs for SB-FB WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Expand WWTP	$15,000,000	$21,240,000	$395,000	$28,983,000
Consolidate WWTPs based on MUD engineering firm recommendations	Expand WWTP	$17,500,000	$24,780,000	$377,000	$32,170,000
Consolidate WWTPs using QVUD WWTP as a regional facility	Expand WWTP	$18,000,000	$25,488,000	$478,000	$34,858,000
Consolidate WWTPs using BRWMUD WWTP as a regional facility	Expand WWTP	$18,000,000	$25,488,000	$478,000	$34,858,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Expand WWTP into the City's only WWTP**	**$42,000,000**	**$59,472,000**	**$1,029,000**	**$79,641,000**

The recommended alternative for the SB-FB WWTP is to continue expansions at the existing plant to develop a large, single regional WWTP at this plant site. While the ultimate capacity of the SB-FB WWTP would be limited to 6.0 MGD using the existing extended aeration process design, it would be more cost-effective to design future expansions around a much more efficient treatment process such as a sequencing batch reactor (SBR) to increase ultimate build-out capacity to more than 20.0 MGD. For example, a 16.0 MGD, four-basin SBR system could be constructed in roughly the same footprint as the required footprint for the proposed, two future extended aeration basins. Discussion of process alternatives for this facility is included in the following section.

Process Alternatives for Regional WWTP Scenarios

As discussed previously, there are currently four different secondary treatment processes in use throughout the various WWTPs in the Study area. The existing treatment processes used are extended aeration, CMAS, contact-stabilization and pure oxygen. Of these four processes, the contact-stabilization process is not designed for removing ammonia, which is now a common permit limit; therefore, it should certainly not be considered for further implementation in any regional WWTP scenario, as any scenario will require ammonia removal as part of its treatment requirements.

Process Alternatives

Potential treatment processes that should be considered for implementation in future regional WWTP improvements are as follows:

- Extended Aeration (EA);
- Conventional Mixed Aerated Sludge (CMAS);
- Pure Oxygen (PO);
- Sequencing Batch Reactor (SBR);
- Modified Ludzack-Ettinger (MLE);
- Biological Nutrient Removal (BNR); and
- Membrane Bio-Reactor (MBR).

The advantages and disadvantages of the various process alternatives are listed in Table 8-24.

Table 8-24
Advantages and Disadvantages of WWTP Process Alternatives

Process	Designed for Ammonia Removal	Designed for Total Nitrogen Removal	Designed for Phosphorus Removal	Requires Clarifiers for Solids Separation	Process Commonly Used for WWTPs Larger than 1.0 MGD	Typical Maximum Organic Loading (lb per 1,000 cf)	Buildout Capacity at SB-FB WWTP Site Based on this Process	Typical Process Capital Cost per Gallon
EA	Yes	No	No	Yes	No	15	6.0 MGD	$3.00
CMAS	Yes	No	No	Yes	Yes	35	12.0 MGD	$4.00
PO	No	No	No	Yes	No	45	10.0 MGD	$6.00
SBR	Yes	Yes	No	No	Yes	35	20.0+ MGD	$2.00
MLE	Yes	Yes	No	Yes	Yes	35	12.0 MGD	$5.00
BNR	Yes	Yes	Yes	Yes	Yes	35	16.0 MGD	$6.00
MBR	Yes	Yes	Yes	No	Yes	50+	20.0+ MGD	$10.00

While processes such as extended aeration and pure oxygen can be constructed for WWTPs with capacities greater than 1.0 MGD, they typically are limited to 1.0 MGD in size due to inherent difficulties in construction or in cost of equipment. With extended aeration as an example, the organic loading allowed by the TCEQ for design is so low that the structure required is usually three times larger than other process alternatives. However, in selecting a recommended process for the improvements in any of the regional WWTP scenarios, it is generally necessary to strike a balance among cost of construction, footprint of the process and complexity of the process. The prioritized goals were first cost of construction and then expandability potential at a given site. In looking at potential improvements in any of the regional WWTP scenarios, the process recommended for implementation is an SBR process.

SBR Process

SBR is an activated sludge process designed to operate in a true batch mode with aeration and sludge settling both occurring in the same basin. The major differences between SBR and CMAS are that the SBR basin carries out the functions of equalization, aeration and sedimentation in a time sequence rather than in the conventional space sequence of CMAS. In addition, an SBR system can be designed with the ability to treat a wide range of influent volumes whereas CMAS is based on a fixed influent flowrate. SBRs produce sludges with good settling properties providing the influent wastewater is admitted into the aeration in a controlled manner.

Controls range from a simplified float and timer based system (older systems) with a programmable logic controller (PLC) to a PC-based supervisory control and data acquisition (SCADA) system (newer systems) with color graphics using either flow proportional aeration or DO-controlled aeration to reduce aeration as necessary to reduce energy consumption and enhance the removal of BOD and nutrients. An appropriately designed SBR process is a unique combination of equipment and software. Working with automated control reduces the number of operators, skill and attention requirements.

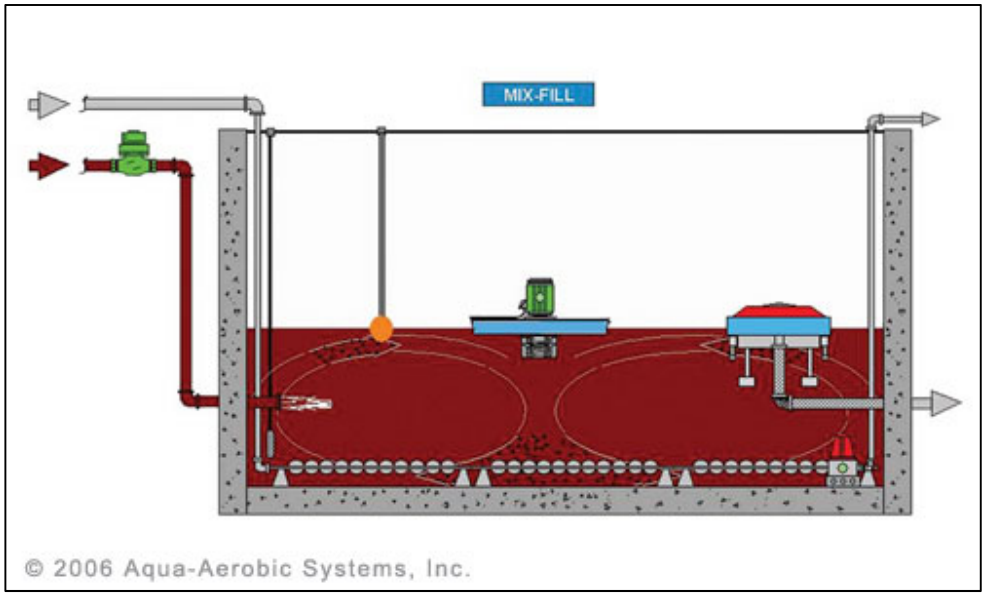
The operating principles of an SBR process are characterized in five discrete cycles:

1. Mix Fill
2. React Fill
3. React
4. Settle
5. Decant / Waste Solids

Following the fifth step in the process, the SBR is ready to start back at Step 1 and begin receiving new influent wastewater flow.

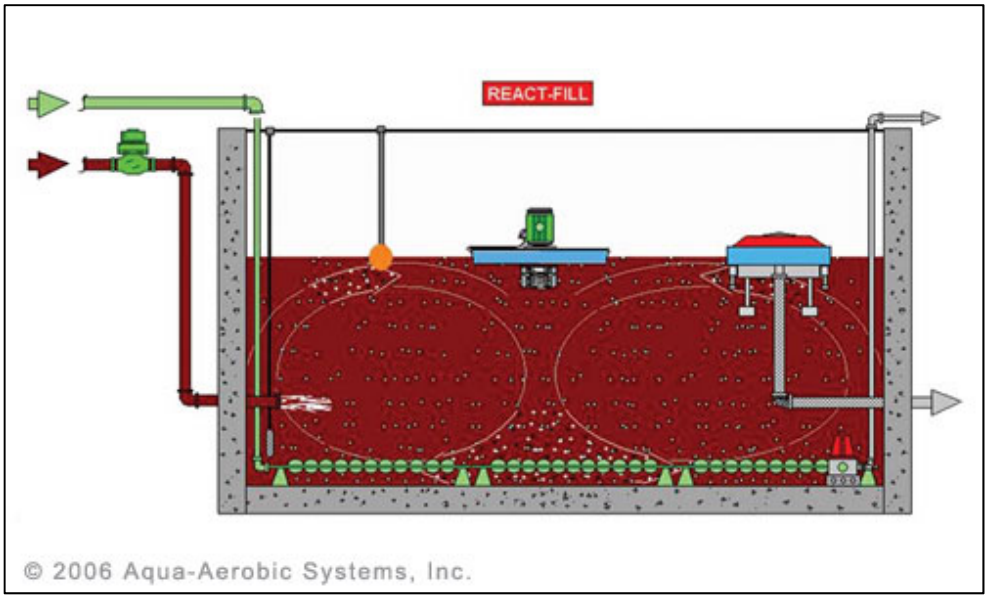
Mix Fill

The influent wastewater is distributed throughout the settled sludge through the influent distribution manifold to provide good contact between the microorganisms and the influent wastewater. The influent can be either pumped in or allowed to flow in by gravity. Most of this step occurs without aeration to create an environment that favors the growth of microorganisms with good settling characteristics. Aeration begins at the end of this period. An example graphic of this cycle is provided. The graphics for each step are based on Aqua Aerobic brand system, though all SBR manufacturers design around the same five basic process periods. Note that in the mix fill diagram, the influent line (brown) is active, showing influent filling. The grey line is the inactive air line to the air diffusers. The vertical line extending into the basin is the float level. The center float is the mixer/aerator and the equipment on the left is the decanter.



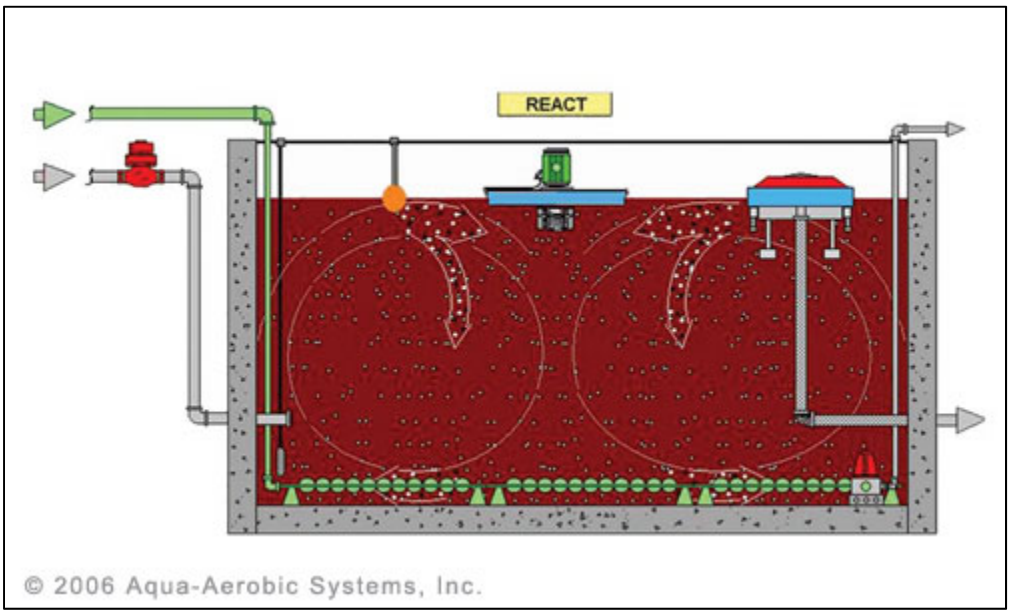
React Fill

The influent wastewater continues to be distributed throughout the settled sludge through the influent distribution manifold to provide good contact between the microorganisms and the influent wastewater. Most of this step occurs with aeration to create an environment that balances energy usage while reducing BOD and ammonia. Aeration begins at the start of this cycle and operates intermittently based on operator input. An example graphic of this cycle is shown as follows. Note that in the react fill diagram, the influent line (brown) is still active, showing influent filling, and the air line (green) is also active, reflecting aeration through the diffusers.



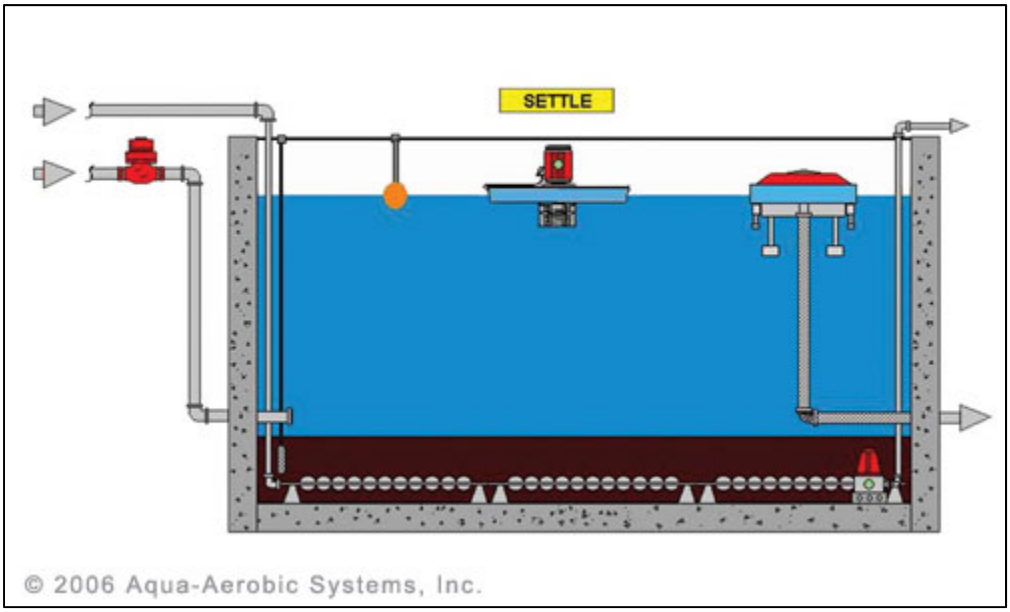
React

During this cycle aeration continues until complete removal of BOD and ammonia is achieved. After the BOD is consumed, the microorganisms enter into a famine stage. During this stage some microorganisms will die because of the lack of food (BOD) and will help to reduce the volume of the settling sludge. The length of the aeration period determines the degree of BOD consumption and ammonia removal. An example graphic of this cycle follows. Note that in the react diagram, only the air line (green) is active, reflecting only aeration in this cycle.



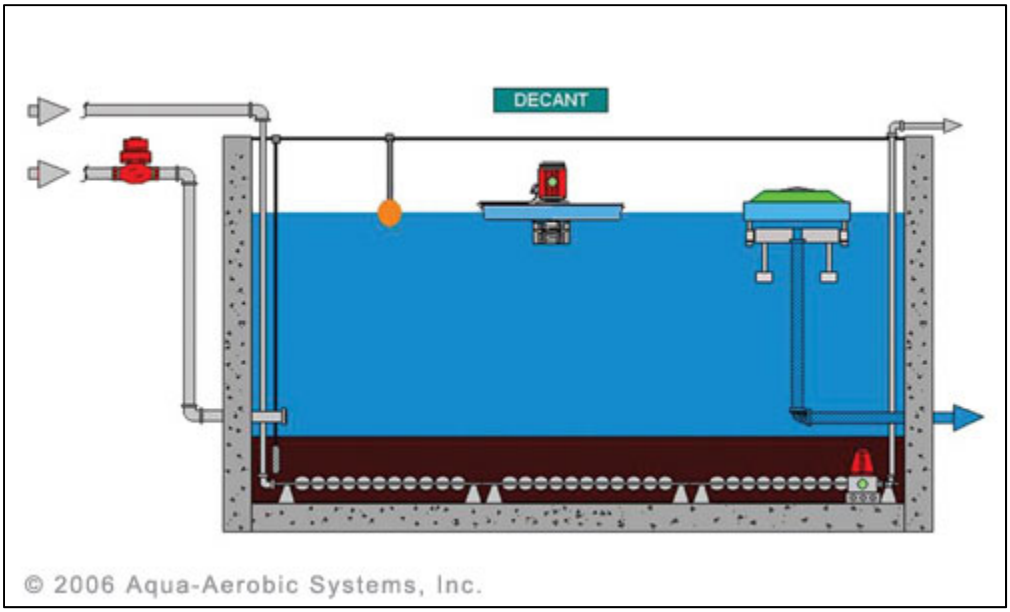
Settle

Aeration is stopped at the settle stage and solids separation takes place, leaving clear, treated effluent above the sludge blanket (basin now operates as a clarifier). During this clarifying period no liquids should enter or leave the tank to avoid turbulence and solids carryover in the effluent. An example graphic of this cycle is included. Note that in the settle diagram, no lines are active, indicating that the system is completely stopped, to allow for settling of sludge.



Decant / Waste Solids

The decant / waste solids period is characterized by the withdrawal of treated effluent from approximately two feet below the surface of the mixed liquor by the floating decanter while preventing solids carryover in the effluent. This removal must be done without disturbing the settled sludge to prevent solids carryover in the effluent. Sludge is then wasted to a nearby sludge storage tank or digester. The frequency of sludge wasting ranges between once each cycle to once every two to three months depending upon system design. An example graphic of this period is shown as follows. Note that in the decant diagram, the decant line (blue)is active, indicating that the system is decanting the top liquid layer as effluent, which goes to either filtration or final disinfection before discharge. Wasting of sludge also occurs in this cycle.



Use of Reclaimed Water

Within the Study area there has been very little use of reclaimed water. Reclaimed water use has typically been limited to the City's use of effluent from the Quail Valley UD WWTP for irrigation of the golf course. The average daily usage is approximately 300,000-400,000 gallons per day (gpd). Therefore, of the average effluent produced each day (6.55 MGD), roughly 94% of the current effluent produced (6.25 MGD) is discharged to waterways ultimately draining to the Brazos River.

As the City begins converting part of the Study area to usage of surface water per the Joint GRP requirements, efficient management of all potential water supply sources is critical to the City. Regardless of whether all the existing WWTPs are selected for consolidation by the City, potential reclaimed water use in each area should be researched thoroughly to determine areas of

drinking water demand reduction via use of reclaimed water for non-potable uses, such as irrigation.

Regional Bed and Banks Permit

Generally about 60% of all water diverted from Texas' rivers and streams or groundwater pumped for municipal purposes enters the state's watercourses as discharges of treated effluent from WWTPs. Once considered a threat to surface water supplies, due in part to actual or perceived water quality concerns, the value of this treated effluent is now clearly recognized. This is evidenced by a much heightened interest in reuse projects to meet current and future increased municipal demands. Further, the concept of reuse is included in nearly every Senate Bill 1 regional plan. Treated wastewater effluent discharged into Texas' rivers also helps meet downstream water needs, including those of the environment and agriculture.[1]

In water rights permitting, reuse is the use of surface water which has already been beneficially used once under a water right, or the use of groundwater which has been used per 30 (TAC § 297.1(44). There are two types of reuse: indirect reuse and direct reuse. Indirect reuse is the reuse of water, usually effluent, which is placed back into the river or stream (referred to as "return flow"). This generally occurs when a WWTP discharges effluent into a stream and either the discharger or another person or entity diverts the effluent further downstream to use again. A bed and banks authorization under the Texas Water Code § 11.042 is required for the use of the watercourse to transport the water for reuse. In contrast, direct reuse occurs when effluent from a WWTP is piped directly to a place where it is used.

Municipalities have increasingly looked to their effluent as an additional water resource and the City is no exception. Currently, under the auspices of the Joint GRP Group with the City as the Sponsor, a regional bed & banks permit is being pursued. The Project will consist primarily of the following tasks:

- Preparation of the Bed and Banks Permit Application(s), which includes data collection, financial development and map preparation;
- Submit initial application to the TCEQ;
- Respond to the TCEQ Requests for Information;
- Prepare and Submit Accounting Plan;

[1]Texas Water Rights and Wastewater Reuse, Prepared by the Reuse Committee of the TWCA

- Coordinate with and support the City in response/negotiations with any permit protestants;

- Work with Staff and outside legal counsel in support of the application process; and

- Work with the TCEQ throughout the process to ensure approval to the best extent possible.

A summary of the WWTPs and their associated effluent discharges included in this project are shown in Table 8-25.

Table 8-25
Potential Bed and Banks Flows

Plant	Source Water	Permit No.	Authorized Discharge (MGD / Acre-ft / year)	2010 Annual Average Discharge (MGD / Acre-ft / year)
SB-FB Regional WWTP	GW / SW	WQ0013873001	6	1.322
			6,721	1,481
Mustang Bayou	GW	WQ0013873002	0.95	0.395
			1,064	442
Palmer Plantation MUD No. 1	GW	WQ0012937001	0.6	0.316
			672	353
Quail Valley UD	GW	WQ0011046001	4	1.309
			4,481	1,467
Sienna Plantation MUD No. 1	GW / SW	WQ0014100001	0.902	0.324
			1,010	363
Totals			**12.452**	**3.666**
			13,948	**4,106**

As the sponsor the City intends to apply for the total permitted discharge of 13,948 acre-feet per year. However, if the City decides to pursue consolidating more WWTPs into the SB-FB WWTP, the City could gain a greater benefit of more flow to apply for in the proposed Bed and Banks permit. For example, if all the existing WWTPs were consolidated into the SB-FB WWTP, the City could apply for the potential total plant flow less reuse demands at Quail Valley UD, of 16.0 MGD, or 17,924 acre-ft per year. In addition, at current City wastewater flows, with approval of the Bed and Banks permit, the City should be able to utilize (less Quail Valley UD reuse flow) up to 6.18 MGD, or 6,923 acre-ft per year.

Currently the City's consultant is assembling the data and calculating the carriage losses. It is anticipated that an application will be submitted in early November 2011.

This Technical Memorandum summarizes the findings of Task IX of the City of Missouri City Regional Water and Wastewater Planning Study (the Study). The focus of Task IX of the Study is the preparation of Wastewater Operation Alternatives for the Study area.

Activities in Task IX included the following:

- ✓ Determine existing operational costs for existing facilities;
- ✓ Determine potential operational scenarios for a single large WWTP as compared to multiple smaller WWTPs;
- ✓ Determine anticipated operational costs for each scenario; and
- ✓ Prepare a technical memorandum summarizing the findings.

Wastewater Operation Alternatives

The goal of this section of the Study is to evaluate potential alternatives of consolidating WWTPs where feasible to increase operational efficiency and cost-effectiveness throughout the Study area's wastewater system. For a city the size of Missouri City, it is normal to only have one or two wastewater treatment facilities. Substantial savings in annual O&M costs (and therefore the cost of service for the City's residents) can typically be attained by consolidating to a smaller number of WWTPs.

There are 11 existing WWTPs within the study area, with an additional regional WWTP planned for the southernmost area of the City. Two of the WWTPs are owned by the City (SB-FB and Mustang Bayou). The remaining wastewater treatment plants are owned by utility districts. Refer to Exhibit 1-6 for a map of the existing WWTP locations.

As with many other utility district WWTPs, the majority of the WWTPs in the Study area consist of package treatment plants. Package plants are typically used for low flows and small service areas, and allow for rapid design and construction. Because package plants are designed for smaller flows than conventional treatment facilities, package plants normally have limited flexibility to handle large hydraulic peak flows through the treatment system. Also, the size of each package plant typically provides very limited buffer capacity resulting in a greater potential for pass-through of untreated wastewater during high flow events. In addition, package plants typically include very little process automation such as dissolved oxygen (DO) metering to quickly monitor DO in the treatment process and variable frequency drives to allow for turndown of pumps and blowers to reduce energy usage at lower flows.

Another disadvantage of package plants is the inherent limitation in operational flexibility when multiple package plants are used to expand treatment capacity versus additional treatment trains in conventional treatment plants. Package plants are normally not well suited for large WWTP demands, such as for flows greater than 1.0 MGD. For example, the Sienna South Regional

Municipal Utility Districts (MUDs)

- Blue Ridge West MUD
- First Colony MUD #9
- Harris County WC & ID Fondren Road
- Fort Bend County MUD #115
- Fort Bend County MUD #129
- Fort Bend County MUD #149
- Fort Bend County MUD #23
- Fort Bend County MUD #24
- Fort Bend County MUD #26
- Fort Bend County MUD #42
- Fort Bend County MUD #46
- Fort Bend County MUD #47
- Fort Bend County MUD #48
- Fort Bend County MUD #49
- Fort Bend County WC & ID #2
- Harris County MUD #122
- Meadowcreek MUD
- Mustang Bayou Utility Service Area
- Palmer Plantation MUD #1
- Palmer Plantation MUD #2
- Quail Valley Utility District
- Sienna Plantation MUD #1
- Sienna Plantation MUD #10
- Sienna Plantation MUD #12
- Sienna Plantation MUD #13
- Sienna Plantation MUD #2
- Sienna Plantation MUD #3
- Sienna Plantation MUD #4
- Sienna Plantation MUD #5
- Sienna Plantation MUD #6
- Sienna Plantation MUD #7
- Sienna Plantation Management District
- Southwest Harris County MUD #1
- Thunderbird Utility District

Map By:
GIS Division
October 2011

Exhibit 1-6
Sanitary Sewer Collection System

Legend

- Waste Water Treatment Plants
- Lift Stations
- Gravity Sanitary Sewer Lines
- City Limits Line
- Force Mains
- ETJ Line

Geographic Coordinate System North American Datum 1983 (NAD83)

0 2,000 4,000 6,000 8,000 Feet

The information on this map is provided and maintained by various agencies, including county departments, municipal governments, state and federal agencies. No guarantee is given as to the accuracy or currency of any of the data. The map is designed to serve as a secondary representation of real property found within this jurisdiction, and is compiled from the recorded deeds, plats, and other public records, which are primary sources for this public information. Users of this map are hereby notified that these primary sources should be consulted for verification of the information presented here. The data layers do not take the place of a legal survey or other primary source documentation. The county and its vendors assume no legal responsibility for the information on this map.

WWTP is currently rated for an average daily flow of 1.2 MGD, though it is based on the operation of 4 simultaneously-operated 0.3 MGD package treatment plants. As a result, the plant operations staff has observed substantially higher than normal daily O&M efforts to keep the plant in operation and consistently meeting permit limits.

In addition, package treatment plants typically have much shorter operating lives than conventional or advanced treatment facilities. Most conventional treatment facilities use concrete structures, which typically have a 40-50 year operating life and equipment is designed for 30-40 years. However, in package plants the anticipated operating life is frequently intended only for 10-20 years, especially when structures are designed using painted carbon steel. Package plants are usually intended to manage short-term needs, with the goal of constructing more permanent facilities in the future as flows increase.

Each WWTP was evaluated in this Study for potential consolidation by being reviewed with respect to rated capacity versus average loading, treatment performance, remaining useful life of structures and equipment, treatment and potential expansion capabilities, potential for reuse and observed level of annual O&M efforts. Based on the evaluation of each WWTP, alternatives have been developed for potential consolidation of WWTPs to a minimum number of operating facilities. A few consolidation alternatives were developed by the various utility district engineering firms which are also incorporated into this Study.

Since the goal of this section is to determine the needs of the entire wastewater system, several additional in-depth analyses were completed for each service area with the goal of developing additional potential consolidation alternatives. In general, there are 3 basic potential alternatives for each WWTP which are rehabilitation and/or replacement of the WWTP structure and equipment; diversion of the entire plant influent flow to a nearby WWTP; or, expand as a new regional WWTP at the existing site. The advantages and disadvantages of each alternative are discussed in general terms in Table 9-1.

Table 9-1 Advantages & Disadvantages of Consolidation Alternatives		
WWTP Alternative	**Advantages**	**Disadvantages**
Rehabilitation/Replacement of existing WWTP	Maintain existing operational requirements; provides a treatment backup in case of any problems at an adjacent WWTP.	Overall O&M is typically lower for one combined WWTP than for separate, smaller plants.
Divert WWTP flow to regional WWTP	Increase in treatment efficiency by combining plant flows or may eliminate treatment requirements in this utility district service area; reduce total O&M cost for a combined facility than separate, smaller plants; provides opportunity to establish a newer, more efficient, regional WWTP in another part of the City.	No longer have a treatment backup in case of any problems at adjacent WWTP; would need to adjust administration requirements for billing for both service areas.
Expand to or Construct new regional WWTP at existing site	Increase in treatment efficiency by combining plant flows; reduces total O&M costs for combined, regional facility rather than operating multiple, separate smaller plants; fewer discharge points increases environmental benefits.	Difficult to obtain buy-in with multiple utility districts; would need to adjust administration requirements for billing for the multiple service areas and address fear of loss of control.

Comparison of O&M Costs for Small WWTPs Versus Regional WWTPs

The goal of this subsection is to review the method of developing O&M costs for new and older WWTPs in this Study, and determining the cost impact of issues such as under- or overloading, type of treatment process, energy use efficiency, solids handling efficiency and level of automation. The intent of developing various O&M costs in this study is to provide the basis for evaluation of each of the existing WWTPs with regard to whether it is more efficient and cost-effective to maintain multiple WWTPs or to consolidate the WWTPs.

In the past EPA developed cost curves for various types of WWTPs which accounted for type of process, whether a facility was a conventional treatment system or a package plant system, and flow loading and method of solids handling. At the time, factors such as energy efficiency and level of automation from control systems had very little impact on the cost curves, as control components such as variable frequency drives were being used in few WWTPs at the time. As a result, the original EPA cost curves for WWTP O&M have been updated and revised over the years to develop more current cost. The O&M cost models used in this Study were based on EPA cost curves with revisions made for newer treatment technologies and improvements in efficiency-enhancing technologies such as variable frequency drives and automated control systems.

WWTPs are typically operated most efficiently at 60-80% of their rated capacities to maximize operation of pumps, blowers and other equipment. Some treatment plants incorporate additional equipment such as variable frequency drives to essentially “turn down” power requirements for equipment to reduce energy usage throughout the plant when operating at lower than optimal flow rates. Most package plants are not designed with this goal in mind, and only operate efficiently when the plant operates close to the permitted flow rate.

In addition to flow underloading, many of the WWTPs also utilize aerobic digestion for onsite sludge storage until such time as a third-party solids handling company can haul the liquid sludge offsite and either use it for beneficial land application or send the liquid sludge to a landfill for ultimate disposal. Aerobic digestion allows for reduction of solids in the sludge by aerobically treating the sludge at a higher rate (5-10 mg/L of dissolved oxygen) than in the normal CMAS process (2 mg/L of dissolved oxygen). Unfortunately, some of the WWTPs in this Study pay for offsite sludge hauling at a cost per gallon, which means that the aerobic digestion provides very little benefit in reduction of hauling cost as opposed to the high energy cost. Impacts of solids handling will also be addressed in the development of O&M costs for the various WWTPs.

Projected annual O&M cost for a brand new, conventional 0.1 MGD facility (operating at 60-80% capacity) is roughly $75,000, while a 1.0 MGD facility (operating at 60-80% capacity) would be roughly $400,000, and a 10.0 MGD facility (operating at 60-80% capacity) would be roughly $1,550,000. Therefore, as the size of the WWTP increases, economies of scale impact the O&M cost (and capital cost), and the O&M cost per 1,000 gallons treated continues to drop with an increasingly larger WWTP. However, as a WWTP deteriorates, the annual cost of operation increases at a lesser or greater rate, depending on the type of treatment process, type of plant (conventional vs. package), level of automation and energy use, and method of solids handling and ultimate disposal.

To review the impacts on the annual O&M cost for a WWTP, several additional cost factors were considered for this analysis. Multipliers for the cost factors were determined based on observations of cost impacts seen at various WWTPs through discussion with operators and engineering experience.

- Cost addition multiplier depending on type of WWTP. Package plant ultimately costs more to operate and maintain than conventional systems; therefore, the conventional plant is the baseline with a 1.0 multiplier and a package plant uses a 1.25 multiplier;

- Cost reduction multiplier to allow for underloading of WWTPs as a cost savings;

- Cost addition multiplier for equipment such as pump and blower systems that are not designed to operate at reduced energy requirements when underloaded. A site-specific multiplier was selected based on the equipment at each facility;

- Cost addition multiplier for age and condition of structure and equipment (e.g. the older a system is, the greater the O&M effort to keep the system operational). The multiplier was calculated using 1 + 0.1 per 5 years of age;

- Cost addition multiplier for onsite aerobic digestion of solids;

- Cost addition multiplier for hauling liquid sludge offsite, as opposed to dewatering onsite and hauling offsite as a dry solids cake; and

- Cost addition multiplier for limited or no automation of plant processes (less automation means greater operator onsite support of plant processes is required).

An example calculation for the SWHCMUD #1 WWTP is shown below.

- Plant Rating: 0.4 MGD;

- O&M Cost for New 0.4 MGD Conventional WWTP: $180,000 per year (this would be the anticipated annual operational cost for a brand new 0.4 MGD conventional WWTP, operated at 60-80% capacity);

- Type of WWTP – Package Plant: 1.25 x $180,000 = $225,000;

- Plant Loading: 0.1 MGD – 0.1/0.4 = 0.25 x $225,000 = $56,250;

- Loss of energy savings on equipment: 1.2 x $56,250 = $67,500;

- Plant Age: 20 years-- 1.4 x $67,500 = $94,500;

- Onsite aerobic digestion of solids: 1.25 x $94,500 = $118,125;

- Hauling liquid sludge offsite: 1.25 x $118,125 = $147,656; and

- Lack of automation of plant processes: 1.2 x $147,656 = $178,000.

While this WWTP is currently operating at only 25% of its rated capacity, cost factors regarding how the system is designed, operated and maintained can have a substantial impact in the O&M cost for each separate facility. Adjusted O&M costs (taking into account the cost factors listed above) have been developed for each WWTP to increase the base O&M cost (developed using updated cost models) which would be anticipated for a new facility operating at full capacity.

As the age of each WWTP increases, the adjusted annual O&M cost will continue to increase unless substantial rehabilitation improvements are completed. Associated O&M costs for each existing facility are listed in Table 9-2.

Table 9-2
Projected O&M Costs at Current Flow Rates

Name	Base O&M Cost (per year)	Multiplier for Type of Plant	Multiplier for Flow Loading	Multiplier for Loss of Energy Savings	Multiplier for Age and Condition	Multiplier for Solids Digestion	Multiplier for 3rd Party Handling of Solids	Multiplier for Level of Automation and SCADA Support	Adjusted O&M Cost (per year)
Blue Ridge West MUD WWTP	$435,000	1.25	0.58	1.1	1.4	1.25	1	1.1	$665,000
Fort Bend County MUD #26 WWTP	$220,000	1.25	0.6	1.2	1.6	1.25	1.25	1.2	$594,000
Harris County MUD #122 WWTP	$130,000	1.25	0.4	1.2	1.4	1.25	1.25	1.2	$205,000
Harris County WC&ID - Fondren Road WWTP	$253,000	1.25	0.33	1.2	1.6	1.25	1.25	1.2	$380,000
Mustang Bayou Regional WWTP	$400,000	1.25	0.4	1.2	1.1	1.25	1.25	1.2	$495,000
Palmer Plantation WWTP	$253,000	1	0.5	1.2	1.6	1.25	1.25	1.2	$456,000
Quail Valley UD WWTP	$780,000	1	0.375	1.75	1.7	1	1	1.2	$1,045,000
Sienna North WWTP	$360,000	1.25	0.33	1.2	1.2	1.25	1.25	1.2	$405,000
Sienna South WWTP	$422,000	1.25	0.92	1	1.4	1.25	1.25	1.2	$1,270,000
Southwest Harris County MUD #1 WWTP	$180,000	1.25	0.25	1.2	1.4	1.25	1.25	1.2	$178,000
SB-FB Regional WWTP	$652,000	1	0.5	1.1	1.1	1	1	1	$395,000

Project O&M Costs for Regional WWTPs

As discussed previously O&M cost projections have been developed for informational purposes only. Since it may or may not be feasible to consolidate the entire City wastewater service area into a single treatment plant, O&M cost projections have been developed for one consolidated, single treatment plant and for several, smaller regional WWTPs in the Study area for comparison.

Projected O&M Costs for a Super Regional WWTP

The existing WWTPs in the City's study area provide an approximate total treatment capacity of 13.75 MGD. While the current flow loading is roughly only 6.55 MGD, or 48%, the flow loading matches fairly closely to the current percent of development within the City limits and ETJ. At build-out, the projected wastewater production will be roughly 16.4 MGD (per wastewater projections from Section 1). Therefore, it would be reasonable to develop costs for a single regional treatment facility based on an assumed capacity of 16.4 MGD to allow for continued future growth. The anticipated annual O&M cost for a brand new, super-regional 16.4 MGD WWTP would be approximately $2,217,000 per year, operating at 60-80% capacity. However, similar to the O&M cost evaluation of the SB-FB WWTP, the super-regional WWTP would not be operated at full flow loading at this time, and so the adjusted O&M cost would be roughly $1,029,000 per year. Also note that this cost does not include the additional O&M costs

for the regional lift stations required to transfer wastewater from the various service areas in the City to this one treatment location, which at full build-out would be approximately $100,000 to $300,000 per year, depending on ultimate pump and pipeline sizing. These costs were developed to compare against total O&M costs for multiple, smaller regional WWTPs discussed as follows.

Projected O&M Costs for Several Regional WWTPs

If the City were to instead develop several sites throughout the study area as smaller regional WWTPs, the cost for new lift stations should be somewhat reduced though it is expected that the total O&M cost for the multiple regional WWTPs would be higher than for a single regional facility. Refer to Table 9-3 for projected O&M costs for multiple regional WWTPs, utilizing both the Fondren Road and Quail Valley UD WWTP sites as regional plant sites. The costs in Table 9-3 assume that the new Sienna South Regional WWTP is not yet in operation (cost to operate existing Sienna South WWTP is much higher than for a new conventional regional WWTP) and that a more permanent, conventional treatment system has not yet been constructed at the Mustang Bayou site (O&M cost would be much lower for a conventional system).

Table 9-3
Projected O&M Costs for Multiple Regional WWTPs - Scenario 1

Name	Base O&M Cost (per year)	Multiplier for Type of Plant	Multiplier for Flow Loading	Multiplier for Loss of Energy Savings	Multiplier for Age and Condition	Multiplier for Solids Digestion	Multiplier for 3rd Party Handling of Solids	Multiplier for Level of Automation and SCADA Support	Adjusted O&M Cost (per year)
New Regional Plant at the Fondren Road WWTP Site	$460,000	1	0.27	1.1	1.1	1	1	1	$149,000
New Regional Plant at the Quail Valley UD WWTP Site	$780,000	1	0.69	1.1	1.1	1	1	1	$649,000
New Regional Plant at the **SB-FB** WWTP Site	$845,000	1	0.47	1.1	1.1	1	1	1	$478,000
Existing Mustang Bayou WWTP Site	$400,000	1.25	0.4	1.2	1.1	1.25	1.25	1.2	$495,000
Sienna South WWTP	$422,000	1.25	0.92	1	1.4	1.25	1.25	1.2	$1,270,000
Total									**$3,041,000**

Since the total projected O&M for multiple regional WWTPs appears to three times higher than the cost to operate one single regional WWTP, it would be more cost-effective to construct a single regional WWTP rather than to maintain several smaller regional WWTPs. However, final recommendation of a WWTP consolidation scenario should be based on the capital cost, annual O&M cost and ultimately the 30-year life cycle costs, which incorporates both capital and O&M costs. Potential life cycle costs for each WWTP have been developed and are discussed below.

Conceptual capital and O&M costs have been developed for each WWTP alternative discussed in TM VII and VIII. Costs have been developed to determine improvements needed for the Study area, which reflect a total required treatment capacity of 16.4 MGD. The total capital costs include the Opinion of Probable Construction Cost (OPCC) plus additional engineering and construction overhead estimates. In some WWTP alternatives several of the costs are similar, such as the cost for consolidation. When considering consolidation of WWTP flow to another offsite facility, the exact same flow, pump station (PS) size and pipeline length and alignment may be used for separate alternatives; therefore, the costs would be the same.

Costs for similar project concepts (same PS and pipeline sizing) will be shown as the same projected cost, regardless of the WWTP being reviewed. Please note that cost factors such as cost for easements and land acquisition, fluctuations in fuel, chemical and power costs, increases in inflation rates and future condition of structures (if consolidations are completed later in the future) have not been incorporated into the costs developed in this section.

Several scenarios were developed to determine anticipated capital and O&M costs for various WWTP consolidation scenarios. The first scenario was developed to determine the 30-year life cycle cost to maintain all the existing WWTPs in operation through 2040, along with construction of a new regional WWTP in the Sienna South area. The second, third and fourth scenarios were developed to evaluate various methods of consolidation with the ultimate goal of reducing the total number of active WWTPs to roughly half the current number of operating WWTPs at this time. During the development of Scenarios 1 through 4, it was determined that as the total number of active WWTPs was reduced, economies of scale for capital and O&M cost resulted in a lower life cycle cost. As a result, a fifth scenario was developed with the concept of utilizing one WWTP site to create a super-regional WWTP that would treat the entire wastewater flows for the Study area even at build-out.

Life cycle costs were developed for each WWTP with regard to the five scenarios discussed above. The goal was to identify which WWTPs were best suited for expansion, rehabilitation or consolidation into another offsite WWTP facility, and how best the recommended alternative for each WWTP fit in with an overall consolidation scenario. In some cases, the recommended alternative for a given WWTP is fairly obvious due to the difference in cost. In some cases, the lowest life cycle cost is not actually the best project, as a higher project cost may ultimately fit in best with the recommended overall consolidation scenario. Life cycle costs per scenario for each WWTP are shown on the following pages.

<u>Blue Ridge West MUD WWTP</u>

Project alternatives have been developed for the Blue Ridge West MUD WWTP, including rehabilitation, expansion or diversion to an offsite facility. Based on the review of the various project scenarios for this facility and the costs in Table 9-4, it is apparent that the most cost-effective alternative is to consolidate flows into an offsite facility, regardless of the ultimate

makeup of final treatment capacity for the Study area. In order to gain maximum benefit from reuse potential, it is recommended that the flows from the three north WWTPs also be collected and transferred to other City WWTPs via the new PS and pipeline proposed for this site. Due to the condition and current flow loading at this facility, it is recommended that this project be completed within the next 5-10 years if possible.

Adjusted O&M costs (taking into account the cost factors listed earlier in this TM) were developed for each WWTP, to modify the anticipated annual O&M cost for each WWTP to account for the improvements proposed in each scenario. Examples on how the adjusted O&M costs (per scenario) were developed for the Blue Ridge West MUD WWTP are shown below. The methodology used to develop adjusted O&M costs are the same for each WWTP.

An example calculation for the Blue Ridge West MUD WWTP is shown below, regarding rehabilitating and/or expanding all WWTPs (corresponding to Scenario 1 discussed later in this section).

- Plant Rating – 1.3 MGD;
- O&M Cost for New 1.3 MGD Conventional WWTP - $435,000 per year (this would be the anticipated cost for a brand new 1.3 MGD conventional WWTP, operated at 60-80% capacity);
- Type of WWTP – Package Plant – 1.25 x $435,000 = $543,750 (some package processes still remain at the site);
- Plant Loading – 0.75 MGD – 0.75/1.3 = 0.58 x $543,750 = $313,702;
- Loss of energy savings on equipment – 1.1 x $313,702 = $345,072 (cost factor decreases to allow for variable frequency drive improvements);
- Plant Age – 5 years or less – 1.1 x $345,072 = $379,579 (following plant improvements;
- Onsite aerobic digestion of solids – 1 x $379,579 = $379,579 (convert digestion to aerated sludge storage to minimize blower and energy use);
- Hauling liquid sludge offsite – 1 x $379,579 = $379,579 (add onsite sludge dewatering to significantly reduce sludge hauling costs); and
- Lack of automation of plant processes – 1.1 x $379,579 = $418,000 (addition of some SCADA improvements, final total rounded up to the nearest 1,000).

Also, an example calculation for the Blue Ridge West MUD WWTP was prepared which corresponds to Scenario 2 and 4 discussed later in this section.

- Plant Rating – 1.8 MGD;
- O&M Cost for New 1.8 MGD Conventional WWTP - $499,000 per year (this would be the anticipated cost for a brand new 1.8 MGD conventional WWTP, operated at 60-80% capacity);
- Type of WWTP – Package Plant – 1.25 x $499,000 = $623,750 (some package processes still remain at the site);
- Plant Loading – 1.25 MGD – 1.25/1.8 = 0.69 x $623,750 = $433,160;
- Loss of energy savings on equipment – 1.1 x $433,160 = $476,476 (cost factor decreases to allow for variable frequency drive improvements);
- Plant Age – 5 years or less – 1.1 x $476,476 = $524,123 (following plant improvements;
- Onsite aerobic digestion of solids – 1 x $524,123 = $524,123 (convert digestion to aerated sludge storage to minimize blower and energy use);
- Hauling liquid sludge offsite – 1 x $524,123 = $524,123 (add onsite sludge dewatering to significantly reduce sludge hauling costs); and
- Lack of automation of plant processes – 1.1 x $524,123 = $577,000 (addition of some SCADA improvements, final total rounded up to the nearest $1,000).

The projected O&M costs for Scenario 3 (using Quail Valley UD as a regional WWTP) and Scenario 5 (using SB-FB WWTP as a regional WWTP) are based solely on the projected energy costs associated with transferring plant flows to the regional plant associated with each scenario. In addition, while Scenario 3 reflects only pumping the Blue Ridge West MUD WWTP flow, Scenario 5 includes also pumping flows from Southwest Harris County MUD #1 WWTP, Harris County WC&ID – Fondren Road WWTP and Harris County MUD #122 WWTP flows.

Table 9-4 Costs for Blue Ridge West MUD WWTP Alternatives					
Scenario	**Impact to WWTP**	**OPCC**	**Total Capital Cost**	**Annual O&M Cost**	**30-Yr Life Cycle Cost**
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$8,775,000	$12,426,000	$418,000	$20,619,000
Consolidate WWTPs based on MUD engineering firm recommendations	Expand WWTP	$9,000,000	$12,744,000	$577,000	$24,054,000
Consolidate WWTPs using QVUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$493,000	$699,000	$10,700	$909,000
Consolidate WWTPs using BRWMUD WWTP as a regional facility	Expand WWTP	$16,500,000	$23,364,000	$577,000	$34,674,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$797,000**	**$1,129,000**	**$32,000**	**$1,757,000**

Fort Bend County MUD #26 WWTP

Project alternatives have been developed for the Fort Bend County MUD #26 WWTP, including rehabilitation or diversion to an offsite facility. Based on the review of the various project scenarios and associated costs as shown in Table 9-5, it is apparent that the most cost-effective alternative is to consolidate flows into an offsite facility. While the cost to divert flow to the Blue Ridge West MUD WWTP is the lowest projected life cycle cost, the cost savings for other offsite WWTP diversions would offset the increased cost shown in bold below. Due to the recent rehabilitation work completed at this facility, it is recommended that this project be completed within the next 10-15 years if possible.

Table 9-5 Costs for Fort Bend County MUD #26 WWTP Alternatives					
Scenario	**Impact to WWTP**	**OPCC**	**Total Capital Cost**	**Annual O&M Cost**	**30-Yr Life Cycle Cost**
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$3,375,000	$4,779,000	$220,000	$9,092,000
Consolidate WWTPs based on MUD engineering firm recommendations	Consolidate WWTP into an offsite facility	$439,000	$622,000	$4,100	$703,000
Consolidate WWTPs using QVUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$1,862,500	$2,638,000	$18,500	$3,001,000
Consolidate WWTPs using BRWMUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$385,000	$546,000	$4,100	$627,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$2,362,500**	**$3,346,000**	**$37,000**	**$4,072,000**

Harris County MUD #122 WWTP

Project alternatives have been developed for the Harris County MUD #122 WWTP, including rehabilitation or diversion to an offsite facility. Based on the review of the various project scenarios for this facility and the costs shown in Table 9-6, it is apparent that the most cost-effective alternative is to consolidate flows into an offsite facility, regardless of the ultimate makeup of final treatment capacity for the Study area. Due to the upcoming potential permit compliance issues (discussed in Section 3) with the Harris County MUD #122 WWTP and the age and condition of the other facilities proposed for consolidation, it is recommended that this project be completed within the next 5 years if possible.

Table 9-6
Cost Estimates for Harris County MUD #122 WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$1,687,500	$2,390,000	$87,000	$4,096,000
Consolidate WWTPs based on MUD engineering firm recommendations	Consolidate WWTP into an offsite facility	$1,480,000	$2,096,000	$89,100	$3,843,000
Consolidate WWTPs using QVUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$443,750	$629,000	$2,100	$671,000
Consolidate WWTPs using BRWMUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$443,750	$629,000	$2,100	$671,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$443,750**	**$629,000**	**$2,100**	**$671,000**

Harris County WC&ID – Fondren Road WWTP

Project alternatives have been developed for the HC-FR WWTP, including rehabilitation, expansion or diversion to an offsite facility. Based on the review of the various project scenarios for this facility and the costs shown in Table 9-7, it is apparent that the most cost-effective alternative is to consolidate flows into an offsite facility, regardless of the ultimate makeup of final treatment capacity for the Study area. In order to gain maximum benefit from reuse potential, it is recommended that the flows from Southwest Harris County MUD #1 WWTP and Harris County MUD #122 WWTP also be collected and transferred to other City WWTPs via the new PS and pipeline proposed for this site. Due to the recent rehabilitation work completed at this facility, it is recommended that this project be completed within the next 10-15 years if possible.

Table 9-7
Costs for Harris County – Fondren Road WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$4,050,000	$5,735,000	$141,000	$8,499,000
Consolidate WWTPs based on MUD engineering firm recommendations	Rehab WWTP	$4,050,000	$5,735,000	$141,000	$8,499,000
Consolidate WWTPs using QVUD WWTP as a regional facility	Expand WWTP	$7,500,000	$10,620,000	$149,000	$13,541,000
Consolidate WWTPs using BRWMUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$1,062,500	$1,505,000	$9,900	$1,700,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$1,062,500**	**$1,505,000**	**$9,900**	**$1,700,000**

Mustang Bayou Regional WWTP

Project alternatives have been developed for the Mustang Bayou WWTP, including rehabilitation, expansion or diversion to an offsite facility. Based on the review of the various project scenarios for this facility and the associated project costs shown in Table 9-8, it is apparent that the most cost-effective alternative is to consolidate flows into an offsite facility, regardless of the ultimate makeup of final treatment capacity for the Study area. Due to the condition and current flow loading at this facility, it is recommended that this project be completed within the next 15-20 years if possible.

Table 9-8
Costs for Mustang Bayou WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Expand WWTP	$8,212,500	$11,629,000	$267,000	$16,863,000
Consolidate WWTPs based on MUD engineering firm recommendations	Expand WWTP	$8,212,500	$11,629,000	$267,000	$16,863,000
Consolidate WWTPs using Quail Valley UD WWTP as a regional facility	Expand WWTP	$8,212,500	$11,629,000	$267,000	$16,863,000
Consolidate WWTPs using Blue Ridge West MUD WWTP as a regional facility	Expand WWTP	$8,212,500	$11,629,000	$267,000	$16,863,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$868,750**	**$1,231,000**	**$19,000**	**$1,604,000**

Palmer Plantation WWTP

The project alternatives developed for the Palmer WWTP, include rehabilitation or diversion to an offsite facility. Based on the review of the various project scenarios for this facility and the project costs as shown in Table 9-9, it is apparent that the most cost-effective alternative is to consolidate flows into an offsite facility. While the cost to divert flow to the SB-FB WWTP with only Palmer Plantation WWTP flow is the lowest projected life cycle cost, the cost savings for other offsite WWTP diversions would offset the increased cost shown in bold below due to transferring shows from other WWTPs also. Due to the condition and current flow loading at this facility, it is recommended that this project be completed within the next 5-10 years if possible.

Table 9-9
Costs for Palmer Plantation WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$4,050,000	$5,735,000	$169,000	$9,048,000
Consolidate WWTPs based on MUD engineering firm recommendations	Consolidate WWTP into an offsite facility	$454,000	$643,000	$5,000	$742,000
Consolidate WWTPs using Quail Valley UD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$454,000	$643,000	$5,000	$742,000
Consolidate WWTPs using Blue Ridge West MUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$454,000	$643,000	$5,000	$742,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$1,108,000**	**$1,569,000**	**$64,000**	**$2,824,000**

Quail Valley UD WWTP

Project alternatives have been developed for the Quail Valley UD WWTP, including rehabilitation, expansion or diversion to an offsite facility. Based on the review of the various project scenarios for this facility and the associated project costs shown in Table 9-10, it is apparent that the most cost-effective alternative is to consolidate flows into an offsite facility, regardless of the ultimate makeup of final treatment capacity for the Study area. However, because non-potable reuse of Quail Valley UD effluent is still a primary goal for the City, the Quail Valley UD WWTP consolidation scenario also includes the construction and operation of a 0.5 MGD reuse PS and pipeline from the SB-FB WWTP back to the Quail Valley UD WWTP for non-potable reclaimed water use. Due to the condition and current flow loading at this facility, it is recommended that this project be completed within the next 5-10 years if possible.

Table 9-10
Costs for Quail Valley UD WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$9,000,000	$12,744,000	$620,000	$24,897,000
Consolidate WWTPs based on MUD engineering firm recommendations	Rehab WWTP	$9,000,000	$12,744,000	$620,000	$24,897,000
Consolidate WWTPs using QVUD WWTP as a regional facility	Expand WWTP	$16,500,000	$23,364,000	$649,000	$36,085,000
Consolidate WWTPs using BRWMUD WWTP as a regional facility	Rehab WWTP	$9,000,000	$12,744,000	$620,000	$24,897,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$1,100,000**	**$1,558,000**	**$23,100**	**$2,011,000**

Sienna Plantation North WWTP

Project alternatives have been developed for the Sienna North WWTP, including rehabilitation or diversion to an offsite facility. Based on the review of the various project scenarios for this facility and the associated project costs as shown in Table 9-11, it is apparent that the most cost-effective alternative is to consolidate flows into an offsite facility, regardless of the ultimate makeup of final treatment capacity for the Study area. While the cost to divert flow to the SB-FB WWTP with only Sienna North WWTP flow is the lowest projected life cycle cost, the cost savings for other offsite WWTP diversions would offset the increased cost shown in bold below due to transferring shows from other WWTPs also. Due to the age and condition of this WWTP and the current flow loading, it is recommended that this project be completed within the next 5-10 years if possible, to prepare for handling and transferring additional offsite wastewater flows.

Table 9-11
Costs for Sienna North WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$6,075,000	$8,603,000	$200,000	$12,524,000
Consolidate WWTPs based on MUD engineering firm recommendations	Rehab WWTP	$6,075,000	$8,603,000	$200,000	$12,524,000
Consolidate WWTPs using QVUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$922,500	$1,307,000	$7,400	$1,453,000
Consolidate WWTPs using BRWMUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$922,500	$1,307,000	$7,400	$1,453,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$2,825,000**	**$4,001,000**	**$50,000**	**$4,982,000**

Sienna Plantation South WWTP

Project alternatives have been developed for the Sienna South WWTP, including rehabilitation or diversion to an offsite facility. Based on the review of the various project scenarios for this facility and the associated project costs as shown in Table 9-12, it is apparent that the most cost-effective alternative is to consolidate flows into an offsite facility, regardless of the ultimate makeup of final treatment capacity for the Study area. While this WWTP service area has previously been intended to be served by a new south regional WWTP, the total capital cost and annual O&M cost for the WWTP, PS and pipeline improvements would be less for consolidating flows from the southern area into a single WWTP facility further north (SB-FB WWTP). Due to the age and condition of this WWTP and the current flow loading, it is recommended that this project be completed within the next 5-10 years if possible.

Table 9-12
Costs for Sienna South WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$8,100,000	$11,470,000	$586,000	$22,956,000
Consolidate WWTPs based on MUD engineering firm recommendations	Consolidate WWTP into an offsite facility	$1,375,000	$1,947,000	$9,900	$2,142,000
Consolidate WWTPs using QVUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$1,375,000	$1,947,000	$9,900	$2,142,000
Consolidate WWTPs using BRWMUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$1,375,000	$1,947,000	$9,900	$2,142,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$3,962,500**	**$5,611,000**	**$43,000**	**$6,454,000**

Southwest Harris County MUD #1 WWTP

Project alternatives have been developed for the Southwest Harris County MUD #1 WWTP, including rehabilitation or diversion to an offsite facility. The projected life cycle costs for each consolidation scenario are included in Table 9-13. Based on the review of the various project scenarios for this facility, it is apparent that the most cost-effective alternative is to consolidate flows into an offsite facility, regardless of the ultimate makeup of final treatment capacity for the Study area. Due to the recent rehabilitation work completed at this facility, it is recommended that this project be completed within the next 10-15 years if possible.

Table 9-13
Cost Estimates for Southwest Harris County MUD #1 WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Rehab WWTP	$2,700,000	$3,824,000	$75,000	$5,295,000
Consolidate WWTPs based on MUD engineering firm recommendations	Rehab WWTP	$2,700,000	$3,824,000	$75,000	$5,295,000
Consolidate WWTPs using Quail Valley UD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$175,000	$248,000	$3,300	$313,000
Consolidate WWTPs using Blue Ridge West MUD WWTP as a regional facility	Consolidate WWTP into an offsite facility	$175,000	$248,000	$3,300	$313,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Consolidate WWTP into an offsite facility**	**$175,000**	**$248,000**	**$3,300**	**$313,000**

SB-FB Regional WWTP

Project alternatives have been developed for the SB-FB WWTP, including expansion for local growth or expansion to incorporate flows from offsite WWTPs. The projected 30-year life cycle costs are shown in Table 9-14. Based on the review of the various project scenarios for this facility, it is apparent that the most cost-effective alternative is to convert this WWTP into a regional treatment facility, and attempt to incorporate as much flow from other WWTPs as possible. While the cost to handle only local wastewater treatment at the SB-FB WWTP is the lowest projected life cycle cost, the cost savings for other offsite WWTP diversions would offset the increased cost shown in bold below. Modular treatment processes are recommended for adoption at the SB-FB WWTP in order to maximize available space at the WWTP site and to allow for additional phased expansions to meet WWTP consolidation goals.

Due to the age and condition of this WWTP and the current flow loading, it is recommended that this project be completed within the next 5-10 years if possible, to prepare for handling and transferring additional offsite wastewater flows. However, the expansion of this facility (if using a modular treatment process) could be completed over multiple phases as needed to incorporate the wastewater flows from the offsite WWTPs and service areas.

Table 9-14
Costs for SB-FB WWTP Alternatives

Scenario	Impact to WWTP	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
Rehab/Expand all WWTPs and include solids improvements	Expand WWTP	$15,000,000	$21,240,000	$395,000	$28,983,000
Consolidate WWTPs based on MUD engineering firm recommendations	Expand WWTP	$17,500,000	$24,780,000	$377,000	$32,170,000
Consolidate WWTPs using QVUD WWTP as a regional facility	Expand WWTP	$18,000,000	$25,488,000	$478,000	$34,858,000
Consolidate WWTPs using BRWMUD WWTP as a regional facility	Expand WWTP	$18,000,000	$25,488,000	$478,000	$34,858,000
Consolidate all WWTPs into a single regional facility at the SB-FB WWTP	**Expand WWTP into the City's only WWTP**	**$42,000,000**	**$59,472,000**	**$1,029,000**	**$79,641,000**

Wastewater Consolidation Project Scenarios

Following the development of life cycle costs for each of the existing and proposed WWTP facilities, combinations of the costs discussed in Tables 9-4 through 9-14 were completed for the five consolidation scenarios discussed on the following pages.

Projected Total Life Cycle Cost to Maintain All WWTPs in Operation

This option considers maintaining all existing WWTPs in operation, along with constructing a new south regional WWTP in the Sienna South area. Since the majority of the existing WWTPs are package plants, extensive rehabilitation effort would be needed to maintain many of these plants in continued operation for the next 30 years. Obviously there are several plants that could be somewhat easily consolidated into nearby facilities, so this cost was developed to determine a baseline of lifecycle cost for the planning area.

Table 9-15
Capital and O&M Costs for WWTP Scenario 1

Item	Description	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
1	Rehab and upgrade Harris County MUD #1 WWTP, including solids improvements	$2,700,000	$3,824,000	$75,000	$5,295,000
2	Rehab and upgrade Fondren Road WWTP, including solids improvements	$4,050,000	$5,735,000	$141,000	$8,499,000
3	Rehab and upgrade Harris County MUD #122 WWTP, including solids improvements	$1,687,500	$2,390,000	$87,000	$4,096,000
4	Rehab and upgrade Blue Ridge West WWTP, including solids improvements	$8,775,000	$12,426,000	$418,000	$20,619,000
5	Rehab and upgrade Fort Bend County MUD #26 WWTP, including structure rehab and equipment replacement	$3,375,000	$4,779,000	$220,000	$9,092,000
6	Rehab and upgrade Quail Valley UD WWTP, including structure rehab and equipment replacement	$9,000,000	$12,744,000	$620,000	$24,897,000
7	Rehab and upgrade Palmer Plantation WWTP, including structure rehab and equipment replacement	$4,050,000	$5,735,000	$169,000	$9,048,000
8	Expand and upgrade SB-FB WWTP, including structure rehab and equipment replacement	$15,000,000	$21,240,000	$395,000	$28,983,000
9	Expand and upgrade Mustang Bayou WWTP, including structure rehab and equipment replacement	$8,212,500	$11,629,000	$267,000	$16,863,000
10	Rehab and upgrade Sienna North WWTP, including structure rehab and equipment replacement	$6,075,000	$8,603,000	$200,000	$12,524,000
11	Rehab and upgrade Sienna South WWTP, including structure rehab and equipment replacement	$8,100,000	$11,470,000	$586,000	$22,956,000
12	Construct new regional WWTP in Sienna South area	$9,200,000	$13,028,000	$297,000	$18,850,000
TOTAL		**$80,225,000**	**$113,603,000**	**$3,475,000**	**$181,722,000**

Notes:
1 - This estimate assumes no offsite collection improvements are required.
2 - This estimate assumes that no other major capital improvements would be necessary during the project life.
3 - This estimate assumes a 30-yr improvement life, at an interest rate of 3%.

Projected Total Life Cycle Cost to Consolidate Utility District Engineer Recommended WWTPs

This option considers consolidating several of the existing WWTPs in operation, along with constructing a new south regional WWTP in the Sienna South area. Since the majority of the existing WWTPs to remain in this scenario are package plants, extensive rehabilitation effort would still be needed. In developing capital costs, consolidated plant costs include new PS and force mains to the regional facilities, and WWTPs intended to remain in this scenario include a budget for rehabilitating and/or upgrading each facility to maintain continued treatment for the next 30 years.

O&M costs for this scenario include projected O&M costs for the regional facilities (accounting for newly added flow) and O&M costs for the consolidated facilities (costs for the new transfer PSs). These O&M costs however do not include the existing collection system O&M. Also, these life cycle costs do not account for any change in inflation in interest or in power cost.

Table 9-16
Capital and O&M Costs for WWTP Scenario 2

Item	Description	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
1	Rehab and upgrade Harris County MUD #1 WWTP, including solids improvements	$2,700,000	$3,824,000	$75,000	$5,295,000
2	Rehab and upgrade Fondren Road WWTP, including solids improvements	$4,050,000	$5,735,000	$141,000	$8,499,000
3	Construct a transfer PS at Harris County MUD #122 WWTP to transfer plant flow to WC&ID #2, includes PS, pipeline and expansion of WC&ID #2 WWTP	$1,480,000	$2,096,000	$89,100	$3,843,000
4	Expand Blue Ridge WWTP to handle Fort Bend County MUD #26 flow, including solids improvements	$9,000,000	$12,744,000	$577,000	$24,054,000
5	Construct a transfer PS at Fort Bend County MUD #26 WWTP to transfer plant flow to Blue Ridge West WWTP, includes PS and pipeline	$439,000	$622,000	$4,100	$703,000
6	Rehab and upgrade Quail Valley UD WWTP, including structure rehab and equipment replacement	$9,000,000	$12,744,000	$620,000	$24,897,000
7	Construct a transfer PS at Palmer Plantation WWTP to transfer plant flow to SB-FB WWTP, includes PS and pipeline	$454,000	$643,000	$5,000	$742,000
8	Expand and upgrade SB-FB WWTP, including structure rehab and equipment replacement	$17,500,000	$24,780,000	$377,000	$32,170,000
9	Expand and upgrade Mustang Bayou WWTP, including structure rehab and equipment replacement	$8,212,500	$11,629,000	$267,000	$16,863,000
10	Rehab and upgrade Sienna North WWTP, including structure rehab and equipment replacement	$6,075,000	$8,603,000	$200,000	$12,524,000
11	Construct new transfer PS at Sienna South WWTP to transfer Sienna South plant flow to the new regional WWTP in Sienna South, includes PS and pipeline	$1,375,000	$1,947,000	$9,900	$2,142,000
12	Construct new regional WWTP in Sienna South area	$14,000,000	$19,824,000	$297,000	$25,646,000
TOTAL		**$74,285,500**	**$105,191,000**	**$2,662,100**	**$157,378,000**

Notes:
1 - This estimate assumes no additional offsite collection improvements are required.
2 - This estimate assumes that no other major capital improvements would be necessary during the project life.
3 - This estimate assumes a 30-yr improvement life, at an interest rate of 3%.

Projected Total Life Cycle Cost to Consolidate WWTPs Using Quail Valley UD WWTP as a Regional WWTP

This option considers consolidating the existing WWTPs down to a maximum of five plants, including constructing a new south regional WWTP in the Sienna South area. In this scenario, the three northernmost WWTPs would be consolidated into a new regional facility, the central service area would be consolidated between the Quail Valley UD WWTP and the SB-FB WWTP, the eastern area would be covered by the Mustang Bayou WWTP and the southern area would be supported by the new south regional WWTP in the Sienna South area. In developing capital costs, consolidated plant costs include new PSs and force mains to the regional facilities, and WWTPs intended to remain in this scenario include a budget for rehabilitating and/or upgrading each facility to maintain continued treatment for the next 30 years.

O&M costs for this scenario include projected O&M costs for the regional facilities (accounting for newly added flow) and O&M costs for the consolidated facilities (costs for the new transfer PSs). These O&M costs however do not include the existing collection system O&M. Also, these life cycle costs do not account for any change in inflation in interest or in power cost.

Table 9-17
Capital and O&M Costs for WWTP Scenario 3

Item	Description	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
1	Construct new transfer PS to transfer Southwest Harris County MUD #1 plant flow to the nearby Fondren Road WWTP, includes PS and pipeline	$175,000	$248,000	$3,300	$313,000
2	Construction of a new regional WWTP at the Fondren Road plant site, includes solids improvements	$7,500,000	$10,620,000	$149,000	$13,541,000
3	Construct new transfer PS to transfer Harris County MUD #122 plant flow to the Fondren Road WWTP, includes PS and pipeline	$443,750	$629,000	$2,100	$671,000
4	Construct new transfer PS to transfer Blue Ridge West WWTP flow to the new Fort Bend County MUD #26 PS, includes PS and pipeline	$493,000	$699,000	$10,700	$909,000
5	Construct new transfer PS to transfer both plant flows to the Quail Valley UD WWTP, includes PS and pipeline	$1,862,500	$2,638,000	$18,500	$3,001,000
6	Expand and upgrade Quail Valley UD WWTP for additional flow	$16,500,000	$23,364,000	$649,000	$36,085,000
7	Construct a transfer PS at Palmer Plantation WWTP to transfer plant flow to SB-FB WWTP, includes PS and pipeline	$454,000	$643,000	$5,000	$742,000
8	Expand and upgrade SB-FB WWTP for growth and to handle Palmer Plantation and Sienna North flow, including structure rehab and equipment replacement	$18,000,000	$25,488,000	$478,000	$34,858,000
9	Expand and upgrade Mustang Bayou WWTP, including solids improvements	$8,212,500	$11,629,000	$267,000	$16,863,000
10	Construct new transfer PS at Sienna North WWTP to transfer Sienna North plant flow to the SB-FB WWTP, includes PS and pipeline	$922,500	$1,307,000	$7,400	$1,453,000

Table 9-17
Capital and O&M Costs for WWTP Scenario 3

Item	Description	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
11	Construct new transfer PS at Sienna South WWTP to transfer Sienna South plant flow to the new regional WWTP in Sienna South, includes PS and pipeline	$1,375,000	$1,947,000	$9,900	$2,142,000
12	Construct new regional WWTP in Sienna South area	$14,000,000	$19,824,000	$297,000	$25,646,000
TOTAL		**$69,938,250**	**$99,036,000**	**$1,896,900**	**$136,224,000**

Notes:
1 - This estimate assumes no additional offsite collection improvements are required.
2 - This estimate assumes that no other major capital improvements would be necessary during the project life.
3 - This estimate assumes a 30-yr improvement life, at an interest rate of 3%.

Projected Total Life Cycle Cost to Consolidate WWTPs Using Blue Ridge West WWTP as a Regional WWTP

This option also considers consolidating the existing WWTPs down to a maximum of five plants, including constructing a new south regional WWTP in the Sienna South area. In this scenario, the three northernmost WWTPs would be consolidated into an expanded Blue Ridge West WWTP, the central service area would be consolidated between the Quail Valley UD WWTP, the Blue Ridge West WWTP and the SB-FB WWTP, the eastern area would still be covered by the Mustang Bayou WWTP and the southern area would still be supported by the new south regional WWTP in the Sienna South area. In developing capital costs, consolidated plant costs include new PSs and force mains to the regional facilities, and WWTPs intended to remain in this scenario include a budget for rehabilitating and/or upgrading each facility to maintain continued treatment for the next 30 years.

O&M costs for this scenario include projected O&M costs for the regional facilities (accounting for newly added flow) and O&M costs for the consolidated facilities (costs for the new transfer PSs). These O&M costs however do not include the existing collection system O&M. Also, these life cycle costs do not account for any change in inflation in interest or in power cost.

Table 9-18
Capital and O&M Costs for WWTP Scenario 4

Item	Description	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
1	Construct new transfer PS to transfer Southwest Harris County MUD #1 plant flow to the nearby Fondren Road WWTP, includes PS and pipeline	$175,000	$248,000	$3,300	$313,000
2	Construction of a new PS at the Fondren Road plant site to transfer all north flows to the Blue Ridge West WWTP, includes PS and pipeline	$1,062,500	$1,505,000	$9,900	$1,700,000
3	Construct new transfer PS to transfer Harris County MUD #122 plant flow to the Fondren Road WWTP, includes PS and pipeline	$443,750	$629,000	$2,100	$671,000
4	Expand Blue Ridge West WWTP for additional flow, including solids improvements	$16,500,000	$23,364,000	$577,000	$34,674,000
5	Construct a transfer PS at Fort Bend County MUD #26 WWTP to transfer plant flow to Blue Ridge West WWTP, includes PS and pipeline	$385,000	$546,000	$4,100	$627,000
6	Rehab and upgrade Quail Valley UD WWTP, including structure rehab and equipment replacement	$9,000,000	$12,744,000	$620,000	$24,897,000
7	Construct a transfer PS at Palmer Plantation WWTP to transfer plant flow to SB-FB WWTP, includes PS and pipeline	$454,000	$643,000	$5,000	$742,000
8	Expand and upgrade SB-FB WWTP for growth and to handle Palmer Plantation and Sienna North flow, including structure rehab and equipment replacement	$18,000,000	$25,488,000	$478,000	$34,858,000
9	Expand and upgrade Mustang Bayou WWTP, including solids improvements	$8,212,500	$11,629,000	$267,000	$16,863,000
10	Construct new transfer PS at Sienna North WWTP to transfer Sienna North plant flow to the SB-FB WWTP, includes PS and pipeline	$922,500	$1,307,000	$7,400	$1,453,000
11	Construct new transfer PS at Sienna South WWTP to transfer Sienna South plant flow to the new regional WWTP in Sienna South, includes PS and pipeline	$1,375,000	$1,947,000	$9,900	$2,142,000
12	Construct new regional WWTP in Sienna South area	$14,000,000	$19,824,000	$297,000	$25,646,000
TOTAL		**$70,530,250**	**$99,874,000**	**$2,280,700**	**$144,586,000**

Notes:
1 - This estimate assumes no additional offsite collection improvements are required.
2 - This estimate assumes that no other major capital improvements would be necessary during the project life.
3 - This estimate assumes a 30-yr improvement life, at an interest rate of 3%.

Projected Total Life Cycle Cost to Consolidate WWTPs into a New Super Regional Facility at the Steep Bank – Flat Bank WWTP

This option considers consolidating all of the existing WWTPs into a super-regional treatment facility, including incorporating flows from the new Sienna South area. In developing capital costs, consolidated plant costs include new PSs and force mains to the regional facilities, and WWTPs intended to remain in this scenario include a budget for expanding and upgrading to maintain continued treatment for the next 30 years.

O&M costs for this scenario include projected O&M costs for the regional facilities (accounting for newly added flow) and O&M costs for the consolidated facilities (costs for the new transfer PSs and pipelines). These O&M costs however do not include the existing collection system O&M. Also, these life cycle costs do not account for any change in inflation in interest or in power cost.

Table 9-19
Capital and O&M Costs for WWTP Scenario 5

Item	Description	OPCC	Total Capital Cost	Annual O&M Cost	30-Yr Life Cycle Cost
1	Construct new transfer PS to transfer Southwest Harris County MUD #1 plant flow to the nearby Fondren Road WWTP, includes PS and pipeline	$175,000	$248,000	$3,300	$313,000
2	Construct new transfer PS to transfer HCMUD #122 plant flow to the Fondren Road WWTP, includes PS and pipeline	$443,750	$629,000	$2,100	$671,000
3	Construction of a new PS at the Fondren Road plant site to transfer all north flows to the Blue Ridge WWTP, includes PS and pipeline	$1,062,500	$1,505,000	$9,900	$1,700,000
4	Construct a new transfer PS at the Blue Ridge West WWTP to transfer north plant flows to the new Fort Bend County MUD #26 WWTP PS, includes PS and pipeline	$797,000	$1,129,000	$32,000	$1,757,000
5	Construct new transfer PS at Fort Bend County MUD #26 WWTP to transfer all northeast plant flows to the new Palmer Plantation WWTP PS, includes PS and pipeline	$2,362,500	$3,346,000	$37,000	$4,072,000
6	Construct new transfer PS at Quail Valley UD WWTP to transfer plant flow to the SB-FB WWTP, includes PS and pipeline for raw wastewater and reuse PS and 6" pipeline to return 0.5 MGD effluent back to Quail Valley UD lake	$1,100,000	$1,558,000	$23,100	$2,011,000
7	Construct new transfer PS at Mustang Bayou WWTP to transfer plant flow to the new Palmer Plantation WWTP PS, includes PS and 10" pipeline	$868,750	$1,231,000	$19,000	$1,604,000
8	Construct a transfer PS at Palmer Plantation WWTP to transfer plant flow to SB-FB WWTP, includes PS and 18" pipeline	$1,108,000	$1,569,000	$64,000	$2,824,000
9	Construct new transfer PS in Sienna South Development to transfer Sienna South flow to new Sienna South WWTP PS, includes PS and 12" pipeline	$1,687,500	$2,390,000	$19,000	$2,763,000
10	Construct new transfer PS at Sienna South WWTP to transfer Sienna South plant flow to the new Sienna North WWTP PS, includes PS and 16" pipeline	$3,962,500	$5,611,000	$43,000	$6,454,000
11	Construct new transfer PS at Sienna North WWTP to transfer all south flows to the SB-FB WWTP, includes PS and 18" pipeline	$2,825,000	$4,001,000	$50,000	$4,982,000
12	Expand and upgrade SB-FB WWTP for growth and to handle remaining plant flows, including structure rehab and equipment replacement	$42,000,000	$59,472,000	$1,029,000	$79,641,000
TOTAL		**$58,392,500**	**$82,689,000**	**$1,331,400**	**$108,792,000**

Notes:
1 - This estimate assumes no offsite collection improvements are required.
2 - This estimate assumes that no other major capital improvements would be necessary during the project life.
3 - This estimate assumes a 30-yr improvement life, at an interest rate of 3%.

Wastewater Improvements Summary

The summary of the five main scenarios reviewed are provided in Table 9-20. Based on the review of the various project scenarios for the existing and proposed WWTPs, it appears that the most cost-effective scenario is to convert the SB-FB WWTP into a super-regional treatment facility, and attempt to incorporate as much flow from the other WWTPs as possible.

Table 9-20
Summary of Capital and O&M Costs for WWTP Scenarios

Scenario Description	WWTPs Online in This Scenario	Projected Total Capital Cost	Projected Annual O&M Cost	Projected 30-Year Life Cycle Cost
Rehab/Expand all existing WWTPs as needed and construct new South Regional WWTP to continue use for 30 years (11 existing WWTPs plus 1 new WWTP)	Southwest Harris County MUD #1, Harris County MUD #122, Harris County MUD-Fondren Road, Blue Ridge West MUD, Fort Bend County MUD #26, Palmer Plantation, Quail Valley UD, SB-FB, Mustang Bayou, Sienna North, Sienna South, New South Regional (Sienna South)	$113,603,000	$3,475,000	$181,722,000
Consolidate WWTPs based on MUD engineering firm recommendations (7 existing WWTPs plus 1 new WWTP)	Southwest Harris County MUD #1, Harris County MUD-Fondren Road, Blue Ridge West MUD, Quail Valley UD, SB-FB, Mustang Bayou, Sienna North, New South Regional (Sienna South)	$105,191,000	$2,662,100	$157,378,000
Consolidate WWTPs to reduce total number of WWTPs using Quail Valley UD as a regional facility (4 existing WWTPs plus 1 new WWTP)	Harris County MUD-Fondren Road, Quail Valley UD, SB-FB, Mustang Bayou, New South Regional (Sienna South)	$99,036,000	$1,896,900	$136,224,000
Consolidate WWTPs to reduce total number of WWTPs using Blue Ridge West MUD as a regional facility (4 existing WWTPs plus 1 new WWTP)	Blue Ridge West MUD, Quail Valley UD, SB-FB, Mustang Bayou, New South Regional (Sienna South)	$99,874,000	$2,280,700	$144,586,000
Consolidate WWTPs to reduce total number of WWTPs using SB-FB as the only regional WWTP facility (1 existing WWTP)	**SB-FB**	**$82,689,000**	**$1,331,400**	**$108,792,000**

This Technical Memorandum summarizes the findings of Task X of the City of Missouri City Regional Water and Wastewater Planning Study (the Study). The focus of Task X of the Study is the preparation of an Implementation Schedule for the Study area.

Activities in Task X included the following:

- ✓ Develop phasing for recommended water distribution projects;
- ✓ Develop phasing for recommended wastewater collection projects;
- ✓ Develop phasing for recommended water treatment projects;
- ✓ Develop phasing for recommended wastewater treatment projects; and
- ✓ Prepare a technical memorandum summarizing the findings.

Water and Wastewater Implementation Schedule

A schedule for the implementation of various water and wastewater consolidation projects that were identified in Section 4 of this Study was prepared. The timing of the implementation for these projects was based on information from the utility districts and the inherent nature of the projects.

For example, some of the projects that re-route influent to a regional WWTP are dependent on when the existing local WWTP becomes too old and/or expensive to maintain, too expensive to rehabilitate, if insufficient space is available for expansion or if additional capacity is needed and the cost for re-routing influent is cheaper than plant expansion. The implementation period matches the projected growth discussed in TM II so the projects are scheduled in 5-year increments.

It should be noted that a number of factors may impact the schedule presented in the flow chart in this Section. These include, but are not limited to, the following influences.

- The projects identified are at a pre-planning level at this point. Preliminary design may delay or accelerate the projects once begun.

- Implementation of the projects is dependent on available funding.

- Utility conflicts, ROW and easement acquisition may delay projects.

- Many of the recommended consolidation projects will involve agreements and contracts between the individual utility districts, including project costs and payment agreements. These negotiated agreements may delay implementation.

- A slow down or acceleration in projected growth will impact the implementation schedule.

- Stricter water or wastewater treatment regulations may accelerate the implementation schedule.

Based on the project data developed in previous TMs and the implementation schedule shown previously, a projected cash draw analysis was developed for the proposed water and wastewater system improvements projects, which are shown in Table 10-1 and 10-2, respectively.

Implementation Schedule

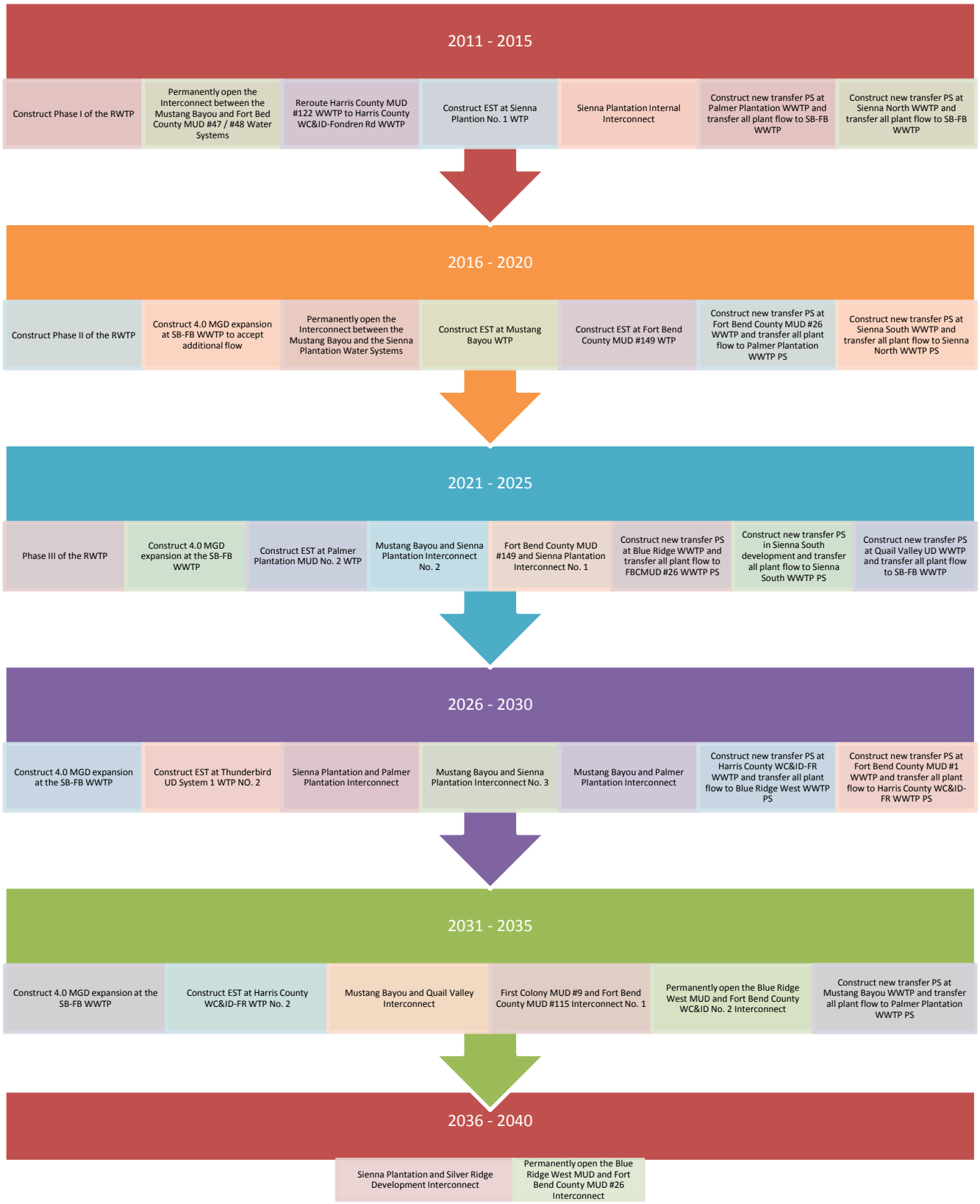


Table 10-1
Projected Cash Draw for Proposed Water Improvements

Year	Project 1	Project 2	Project 3	Project 4	Total Cost for Water Projects
2011-2015	Construct Phase I of the RWTP and Pipeline Improvements	Permanently open the Interconnect between the Mustang Bayou and Fort Bend County MUD #47 / #48 Water Systems	Construct EST at Sienna Plantation No. 1 WTP	Sienna Plantation Internal Interconnect	-
Project Cost [1]	-	-	$4,925,000	$490,000-	**$5,415,000**
2016-2020	Construct Phase II of the RWTP and Pipeline Improvements	Permanently open the Interconnect between the Mustang Bayou and the Sienna Plantation Water Systems	Construct EST at Mustang Bayou WTP	Construct EST at Fort Bend County MUD #149 WTP	-
Project Cost [1]	$61,317,000	-	$2,425,000	$7,934,000	**$71,676,000**
2021-2025	Construct Phase III of the RWTP and Pipeline Improvements	Construct EST at Palmer Plantation MUD No. 2 WTP	Mustang Bayou and Sienna Plantation Interconnect No. 2	Fort Bend County MUD #149 and Sienna Plantation Interconnect No. 1	-
Project Cost [1]	$64,142,000	$5,279,000	$1,135,000	$823,000	**$71,379,000**
2026-2030	Construct EST at Thunderbird UD System 1 WTP NO. 2	Sienna Plantation and Palmer Plantation Interconnect	Mustang Bayou and Sienna Plantation Interconnect No. 3	Mustang Bayou and Palmer Plantation Interconnect	-
Project Cost [1]	$5,929,000	$1,480,000	$1,091,000	$476,000	**$8,976,000**
2031-2035	Construct EST at Harris County WC&ID-Fondren Rd WTP No. 2	Mustang Bayou and Quail Valley Interconnect	First Colony MUD #9 and Fort Bend County MUD #115 Interconnect No. 1	Permanently open the Blue Ridge West MUD and Fort Bend County WC&ID No. 2 Interconnect	-
Project Cost [1]	$3,447,000	$512,000	$1,075,000	-	**$5,034,000**
2036-2040	Sienna Plantation and Silver Ridge Development Interconnect	Permanently open the Blue Ridge West MUD and Fort Bend County MUD #26 Interconnect	-	-	
Project Cost [1]	$300,000	-	-	-	**$300,000**
Total	**$162,780,000**				

Notes:
1 - Please note that these costs are different from the costs discussed in Section 4 (shown in 2011 dollars), as these costs include a 3.5% annual cost escalation factor to account for proposed delay in implementation from the time of this report. This cost is based on the timeline for projects discussed in Section 4 and 7 and assumes that projects will be funded toward the middle of each 5-year implementation period.

Table 10-2
Projected Cash Draw for Proposed Wastewater Improvements

Year	Project - Year 1	Project - Year 2	Project - Year 3	Project - Year 4	Project - Year 5	Total Cost for Wastewater Projects
2011-2015	-	Reroute Harris County MUD #122 WWTP to Harris County WC&ID-Fondren Rd WWTP	Construct new transfer PS at Palmer Plantation WWTP and transfer all plant flow to SB-FB WWTP	Construct new transfer PS at Sienna North WWTP and transfer all plant flow to SB-FB WWTP	-	-
Project Cost [1]	**-**	**$652,000**	**$1,679,000**	**$4,422,000**	**-**	**$6,753,000**
2016-2020	Construct 4.0 MGD expansion at SB-FB WWTP	Construct new transfer PS at Fort Bend County MUD #26 WWTP and transfer all plant flow to Palmer WWTP PS	Construct new transfer PS at Sienna South WWTP and transfer all plant flow to Sienna North WWTP PS	-	-	-
Project Cost [1]	**$17,470,000**	**$4,049,000**	**$6,986,000**	**-**	**-**	**$28,505,000**
2021-2025	Construct new transfer PS at Quail Valley UD WWTP and transfer all plant flow to SB-FB WWTP	Construct 4.0 MGD expansion at SB-FB WWTP	Construct new transfer PS at Blue Ridge West WWTP and transfer all plant flow to Fort Bend County MUD #26 WWTP PS	Construct new transfer PS in Sienna South development and transfer all plant flow to Sienna South WWTP PS	-	-
Project Cost [1]	**$2,104,000**	**$20,593,000**	**$1,604,000**	**$3,478,000**	**-**	**$27,779,000**
2026-2030	Construct new transfer PS at Harris County WC&ID-Fondren Rd WWTP and transfer all plant flow to Blue Ridge West WWTP PS	Construct 4.0 MGD expansion at SB-FB WWTP	Construct new transfer PS at Southwest Harris County MUD #1 WWTP and transfer all plant flow to Harris County WC&ID-Fondren Rd WWTP PS	-	-	-
Project Cost [1]	**$2,296,000**	**$23,195,000**	**$396,000**	**-**	**-**	**$25,887,000**
2031-2035	Construct new transfer PS at Mustang Bayou WWTP and transfer all plant flow to Palmer Plantation WWTP PS	-	-	-	Construct 4.0 MGD expansion at SB-FB WWTP	-
Project Cost [1]	**$2,093,000**	**-**	**-**	**-**	**$27,358,000**	**$29,451,000**
2036-2040	-	-	-	-	-	-
Project Cost [1]	-	-	-	-	-	-
Total	**$118,375,000**					

Notes:
1 - Please note that these costs are different from the costs discussed in Section 4 (shown in 2011 dollars), as these costs include a 3.5% annual cost escalation factor to account for proposed delay in implementation from the time of this report. This cost is based on the timeline for projects discussed in Section 4 and 7.

Technical Memorandum - Task XI – Evaluation of Funding Options and Alternative District Consolidations
City of Missouri City Regional Water & Wastewater Planning Study

---

This Technical Memorandum summarizes the findings of Task XI of the City of Missouri City Regional Water and Wastewater Planning Study (the Study). The focus of Task XI of the Study is the evaluation of funding options and alternative district consolidations for the Study area. Activities in Task XI included the following:

- ✓ Determine potential funding sources;
- ✓ Develop potential alternative district consolidations for regionalization; and
- ✓ Prepare a technical memorandum summarizing the findings.

Funding Alternatives

This Study identified various water projects for interconnects, ESTs, RWTP expansion and water transmission lines. There are 9 interconnect projects totaling $4,795,000. There are 6 ESTs recommended at a total cost $22,302,000. The two expansions require for the RWTP total $77,880,000. Finally, there are 2 transmission line projects for a total cost of $16,540,000. The total cost for the recommended water projects is $121,517,000.

The Study did not identify any stand-alone wastewater collection or conveyance projects that would benefit the Study area; however, the single recommendation to consolidate the existing WWTPs into a super-regional WWTP does include costs for conveyance and pumping to re-route wastewater flows and convey re-use water. The total cost for the super-regional WWTP project is $82,689,000.

The total cost for all of the projects identified in the Study is $204,206,000.

Obviously not all of the funding would be needed at the same time, but with the tightening of the bond market and the fact that the requests for water and wastewater funding are always greater than the funding available, the identification of funding sources is crucial.

The primary source of funding for water and wastewater improvements in Texas has been the TWDB. TWDB financial assistance programs are funded through state-backed bonds, a combination of state bond proceeds and federal grant funds, or limited appropriated funds. Since 1957, the Legislature and voters approved constitutional amendments authorizing the TWDB to issue up to $2.68 billion in Texas Water Development Bonds. To date, the TWDB has sold nearly $1.55 billion of these bonds to finance the construction of water- and wastewater-related projects.

In 1987, the TWDB added the Clean Water State Revolving Fund (CWSRF) to its portfolio of financial assistance programs. Low-interest loans from the CWSRF finance costs associated with the planning, design, construction, expansion or improvement of wastewater treatment facilities, wastewater recycling and reuse facilities, collection systems, stormwater pollution control

projects and nonpoint source pollution control projects. Funded in part by federal grant money, the CWSRF provides loans at interest rates lower than the market can offer to any eligible applicant. The CWSRF offers 20-year loans using either a traditional long-term, fixed-rate or a short-term, variable-rate construction period loan that converts to a long-term, fixed-rate loan on project completion.

With either option, the borrower will receive a net long-term interest rate that is effectively 0.7 percent below the rate the borrower would receive on the open market at the time of closing. This 0.7 percent interest rate reduction equates to a savings of approximately $100,000 per $1 million borrowed during the life of a loan.

The TWDB also administers the Drinking Water State Revolving Fund (DWSRF). Through the DWSRF, the TWDB will make low-interest loans for financing public drinking water systems that facilitate compliance with primary and secondary drinking water regulations or otherwise significantly further the health protection objectives of the federal Safe Drinking Water Act (SDWA), as amended in 1996.

Loans from the DWSRF finance all costs associated with the planning, design and construction of projects to upgrade or replace water supply infrastructure, to correct exceedances of SDWA health standards, to consolidate water supplies and to purchase capacity in water system. Funded in part by federal grant money, the DWSRF provides loans at interest rates lower than the market can offer to any eligible applicant. Initially, the DWSRF offers 20-year loans with a net long-term interest rate that is effectively 1.2 percent below the rate the borrower would receive on the open market at the time of closing. This 1.2 percent interest rate reduction equates to a savings of approximately $165,000 per $1 million borrowed during the life of a loan.[1]

However, the competition for DWSRF and CWSRF is fierce. For example, the TWDB received funding requests for wastewater improvements totaling $1,460,381,105 while only $330,355,000 in funding was available for SFY 2012 CWSRF. Similarly, the SFY 2012 DWSRF received funding requests totaling $705,196,856 while only $70,658,400 of funding available.[2]

The addition of new funding mechanisms, such as the Water Infrastructure Fund, to facilitate state water plan implementation, coupled with declining market conditions, has dramatically increased demand for the Board's financial assistance. With additional water plan funds received in 2007, the Board more than quadrupled the financial commitments it provided from 2006 to 2010. In fiscal year 2010, the Board committed approximately $1.5 billion in loans and grants to

[1] Texas Water Development Web Site
[2] Draft Intended Use Plans, CWSRF and DWSRF

92 different entities across all programs.[3] Table 11-1 shows the various funding programs administered by the TWDB and their general characteristics.

Table 11-1
Texas Water Development Board Funding Programs

Name	Description	Applicants	Availability
DWSRF	Loan and Loan Subsidies (grant for disadvantaged) available for planning, acquisition and construction of water-related infrastructure, including Water Supply and Source. Funding division include disadvantaged, green and Source Water Protection. Interest rate is 130 – 150 basis points below market.	Community Water System Owners and Non-Profits and political subdivisions of the state and private	Annual Priority Rating Process applies to all projects.
CWSRF	Loan and Loan Subsidies (grant for disadvantaged) for planning, acquisition and construction of wastewater treatment, stormwater and nonpoint source pollution control and reclamation/reuse projects. Funding division include disadvantaged, green and Source Water Protection. Interest rate is 130 – 150 basis points below market.	Political subdivisions. Individuals are eligible for nonpoint source projects.	Annual Priority Rating Process applies to all projects.
Rural Water Assistance Fund (RWAF)	Planning, acquisition and construction of water and wastewater related infrastructure. May also be used to obtain service or to finance consolidation/regionalization. Loan only – very limited funds available.	Political Subdivisions and Nonprofit Water Supply Corporations	Open Year Round.
Water Infrastructure Fund (WIF)	Water-related projects that must be recommended in water management strategies in the most recent TWDB approved regional plan or approved State Water Plan. May not be used to maintain a system or develop a retail distribution system. In summary, funding to implement regional water plan components - $998 million funded to date.	Political Subdivisions of the State and Water Supply Corporations.	Multiple invitations annually.
State Participation Program	Construction only of regional water and wastewater construction projects when the local sponsors are unable to assume the debt for optimal sizing of the facility. Deferred Interest loan (State has temporary ownership interest in a facility). State's ownership is purchased by the applicant as the customer base grows.	Political Subdivisions of the State and Water Supply Corporations.	Open year around but limited funds.
Regional Facility Planning Grant Program	Studies and analyses to evaluate and determine the most feasible alternatives to meet regional water supply and wastewater facility needs, estimate the costs associated with implementing feasible regional water supply and wastewater facility alternatives, and identify institutional arrangements to provide regional facilities in Texas. Grant for 50% of Study Cost (75% for disadvantaged) with usual amount of $225,000 per study. Usually $1 million available annually	Political Subdivisions with legal authority to plan, develop, and operate regional facilities and Nonprofit Water Supply Corporations.	Annual Priority Rating Process applies to all projects.
Texas Water Development Fund (DFund)	Planning, acquisition, and construction of water related infrastructure, including water supply, wastewater treatment, stormwater and nonpoint source pollution control, flood control, reservoir construction, storage and acquisition, and agricultural water conservation projects and municipal solid waste facilities. Loan with limited funds – interest rate at market.	Political Subdivisions of the State and Nonprofit Water Supply Corporations.	Open Year-Round
Economically Distressed Areas Program (EDAP)	Grant up to 100%, Loan or combination of both to bring water and wastewater services to economically distressed areas (designated by the TWDB state-wide) where the present water and wastewater are inadequate to meet the minimal needs of the residents. The program includes measures to prevent future substandard development.	Political Subdivisions and Nonprofit Water Supply Corporations.	Open Year-Round

[3] Texas Water Development Board Sunset Advisory Commission Report

While the list above is not all inclusive (there are certain funding programs dedicated solely to specific groups such as regional water planning), it does provide some idea of the breadth and depth of the funding types available for the proposed projects. Each program will have their own unique conditions and these change each legislative session or congressional act. For example, recently the TWDB notified applicants that all CWSRF and DWSRF will have to comply with the Davis-Bacon Act (payroll monitoring/reporting of contracts for regional minimum standards).

Another alternative for financing projects is bond issuance. Utility districts provide developers a vehicle for getting their investment back through the sale of bonds, which are repaid with property taxes. Typically the amount of bond issuance is calculated for build-out and the appropriate bonds are issued as the utility district develops. Since the majority of utility districts are more than 50% developed, the issuance of bonds for new facilities will be limited in the future. However, it should be noted that Sienna MUDs #1, 4, 5, 6, 7 and 13 are currently undeveloped and new bonds to provide infrastructure in these areas will be issued in the future.

While utility districts have the capacity to issue bonds, a municipality such as Missouri City, by its very nature, typically enjoys economic advantages over utility districts in terms of bond issuance costs and interest charges. That advantage is that interest rates are usually much lower for municipal bonds when compared to utility districts or Investor Owned Utilities (IOUs). A prime example of this is the financing for the RWTP. The 28 utility districts agreed to let the City sponsor the Joint GRP and issue bonds for design and construction of the RWTP.

The City backed these bonds with a tax pledge, had the bonds rated and issued the bonds on the open market. The City received a very favorable interest rate when compared to having the utility districts finance the project. In turn the utility districts pay a Groundwater Reduction Fee based on a price per thousand gallons. These revenues are kept in a separate account by the City to pay for administration and operation of the GRP Group and the debt service associated with the RWTP and water transmission lines.

Another alternative that can be used for financing consolidation projects that affect only a few utility districts could be an interlocal agreement between the utility districts to pay for the project in their proportionate shares through a utility fee. Many of the smaller water distribution consolidation projects could be financed by this method. However, for larger regional projects such as the SB-FB WWTP expansion to incorporate the Palmer Plantation influent, having the City sponsor the financing would probably be the most cost-effective method of funding.

Conclusions and Summary

Based on the consolidation projects identified in this Study, the majority of projects that would require significant funding are the water and wastewater projects. As such using the model

established by the RWTP, financing is strongly recommended for the super-regional WWTP. In addition, the TWDB CWSRF Program should be considered based on their subsidized interest rates and the additional points given to projects that result in consolidation of facilities. It should also be noted that this Study, funded in part by the TWDB, improves the chances of a project making the fundable list.

- The conclusions regarding the funding of consolidation or regional projects are listed below.

- Municipalities can typically issue bonds at lower interest rates than utility districts or IOUs.

- Using the Joint GRP financing model for the RWTP is applicable to the larger wastewater consolidation projects.

- The smaller consolidation water distribution projects and interconnects are best financed via interlocal agreements between the affected utility districts.

Consolidation Alternatives

The term "Regionalization" has political connotations that infer a single, regional authority which is not the intent when the term is used in this Study. The direction and goal for this Study has been to identify win-win consolidation opportunities between the participants that benefit the area in a regional manner. Consequently, as we go forward in the discussion of the retroactive regionalization, the term "consolidation" is used interchangeably to convey the identification of "win-win projects" that achieve the objectives of this Study.

Regionalization is a general concept that encourages the orderly planning of water and wastewater facilities and services areas. The goal of regionalization is to limit the number of smaller, less efficient plants by planning larger service areas and larger, more efficient treatment, distribution, storage, pumping and collection facilities. The Study area experienced rapid growth during the past 20 years. This rapid growth was partially enabled by the expanded use of utility districts, which allowed landowners and developers to finance and construct the necessary infrastructure improvements relatively quickly.

As way of background, a utility district is a political subdivision of the State of Texas authorized by the Texas Water Code and TCEQ to provide water, wastewater, drainage and other services within the utility district boundaries. Upon creation of the utility district temporary board members are appointed by the TCEQ as the utility district's interim Board of Directors until an election is held to elect the individual members. Upon election of the Board of Director's the

utility districts creation is confirmed and bonds are authorized and establishment of taxing authority for bond repayment is established.

There are advantages of a utility district which are listed below.

- Utility Districts match those who benefit with those who pay.

- Utility Districts allow desirable land closer to a city to be developed without having to depend on individual lot wells or septic tanks.

Fueled by a strong economy, the utility district process expedited development in the City and the surrounding areas. The proliferation of small water and wastewater treatment plants can be attributed to rapid, uncontrolled growth in the region. Independence among developers, landowners and utility districts, coupled with minimal oversight/assistance from local government and regulatory agencies resulted in a tradeoff of efficiency in water and wastewater service.[4]

Regionalization can occur in two ways. Proactive regionalization occurs prior to development of an area and involves agreements and contracts between political subdivisions, businesses and property owners. This is the preferred method of regionalization as it allows for pre-development planning and proper sizing of treatment facilities and sites, collection, distribution and storage facilities. Obviously the opportunity for proactive regionalization is lost given the establishment of 11 WWTPs, 24 WTPs and almost 30 utility districts in the Study area alone.

Retroactive regionalization, on the other hand, is consolidation of interim/small facilities at a later date. There are inherent disadvantages to relying on a retroactive approach that are listed below.

- Physical barriers (highways, toll roads, drainage facilities) have been established that will prevent or escalate the cost of consolidation.

- Costly diversion infrastructure (pump stations, force mains) may prevent diversion of existing WWTPs or make the diversion process cost-prohibitive.

- Agreements and contracts among political subdivisions are much harder to complete once independent service areas are established.

- Sites ideal or suitable for regional facilities may already be developed.

[4] Domestic Wastewater Regionalization, August 2000, H-GAC

- Determination of an overall rate structure for combined service areas is very difficult to establish once single-service areas and rate schedules have been established. Especially when trying to consolidate an older utility district and a newer utility district that typically has a much higher debt service component.

- There usually is not an economic incentive for consolidation or regionalization after infrastructure is established.

The regionalization of infrastructure was the primary focus of this Study. However, the type of regional authority that could be feasible to implement the regional infrastructure recommendations contained herein was examined. In other words, in addition to just agreement between all parties to implement regional projects, is a single-management authority better for the Study area?

The type of entity to promote and implement regionalization can be in the form of the Joint GRP that was created in response to requirements for reduced groundwater usage or in the form of the creation of a quasi-governmental organization. It should be noted that neither of these vehicles for the creation of regional entities is exclusive; there are a variety of methods and forms of agreements that are available. However, by and large the use of an organization similar to the Joint GRP or a quasi-governmental entity is very common. Since the creation and purpose of the Joint GRP has been discussed in detail in this Study already, a brief discussion of the potential for the establishment of a quasi-governmental entity is provided below.

A quasi-governmental entity is not an agency of government; rather it is a hybrid organization that has been assigned by law some of the legal characteristics of both government and the private sector. It should be noted here that there are numerous types of quasi-government including non-profits, research organizations and utilities. The creation of a quasi-governmental entity separate from City government is not new. One of the most well-known examples is the San Antonio Water System (SAWS).

SAWS was created by the City Council in 1991 to establish a single utility responsible for water, wastewater, storm water, and reuse. This creation involved the consolidation of three City agencies: the City Water Board; the City Wastewater Department; and the Alamo Water Conservation and Reuse District. SAWS is governed by the SAWS Board of Trustees which consists of the Mayor and six members appointed by the City Council.

Of significance and applicability to the current situation between the City and utility districts in the Study area, the consolidation of these agencies required the refinancing of $635 million in water and wastewater bonds. Similar to the concept of regional infrastructure, the creation of a quasi-governmental entity could provide a single, autonomous authority to plan and manage

future water and wastewater improvements while conducting the day-to-day operations of providing water and wastewater services.

While the creation of a single, regional entity sounds appealing, there are a number of factors, not limited to those listed below, that could prevent or severely limit the effectiveness of such an agency.

- In creating a single entity, how do you ensure equal representation among over 30 utility districts in the region?

- Will the creation of a quasi-governmental entity require the dissolution of the utility districts or simply a legal agreement between the entities?

- How can a utility rate structure be developed fairly that accounts for significant differences between the utility districts current rates and debt service?

- Finally what is the incentive to create a quasi-governmental entity versus the local representation and system familiarity offered by the local utility districts?

While the answer for many of the questions listed above would constitute a separate study in and of themselves, an attempt was made to list some of the advantages associated with creating a quasi-governmental entity for the Study area.

- The ability to plan and manage long-term water supply, treatment, distribution, and storage on a regional level through a single authority.

- The ability to manage wastewater collection, treatment, and reuse on a regional level through a single authority.

- The ability to take advantage of the City's favorable bond rating and variety of finance options to implement regional water and wastewater improvements.

- A single rate structure for water and wastewater services throughout the Study area.

As noted above there are a number of pros and cons associated with the creation of a quasi-governmental entity. Given the current conditions this Study does not recommend that a quasi-governmental entity be established to plan and manage the implementation of regional facilities. Perhaps the creation of a regional quasi-governmental entity will be attractive as the utility districts mature and/or the continued operation of the Joint GRP leads to a shift in views regarding regional management and infrastructure.

Consequently, the most feasible alternative to implement a single, regional wastewater treatment and conveyance system is to copy the paradigm established by the Joint GRP - each entity participates but maintains their autonomy via a legal agreement.

Water Treatment & Supply Consolidation

In regard to water treatment and supply, the City and the utility districts have managed to achieve what was unthinkable just a few years ago with the agreement for the new RWTP.

As way of background the FBSD adopted a Regulatory Plan for groundwater reduction for Missouri City and the various utility districts in 2003. The Plan established a policy for the FBSD regarding groundwater regulation. These policies are designed to support the regulation of groundwater withdrawals to control subsidence on a regular basis. The Plan outlines specific permitting procedures and guidelines as well as fees for permits for groundwater withdrawal. Further, the Plan outlines groundwater reduction requirements that permittees are required to reach.

As discussed in previous sections, the City has joined together with other utility districts within the city limits and its ETJ to form a Joint GRP group that identified a plan for which as a whole, the participants will meet the groundwater reduction requirements set forth by the FBSD.

The participants of the Joint GRP group have determined that the most cost-effective means of meeting the requirements set forth by the FBCSD is a complete conversion from groundwater to surface water in a portion of the City's service area, while leaving the remaining service area on ground water supplies. Initial converting entities consist of those utilities located in the southern portion of the City and its ETJ for the initial conversion of groundwater to surface water, required by 2013. As the 60% reduction requirement is approached in 2025, additional entities will be converted to surface water, generally moving northward on the system.

The initial RWTP size is 10 MGD (Phase I), which is anticipated to meet the City's required maximum demand through 2018, at which time the RWTP is intended to be expanded. Exhibit 1-6 identifies the initial converting entities, which will generally consist of Sienna Plantation utility districts. The first phase of the RWTP is currently under construction and is anticipated to be fully operational by the first of the year in 2012.

As the number of customers on the system grows, and thereby the amount of surface water to be supplied increases and as the increased conversion requirements in 2025 are realized, it will become necessary to convert additional entities to surface water. The City anticipates two additional conversion phases. Phase 2 is anticipated to consist of converting Sienna MUD #s 1, 4, 5, 6 and 7, Fort Bend County MUD #s 46, 47, 48, and 149, and the Mustang Bayou Service Area. Phase 3 is anticipated to consist of converting Fort Bend County MUDs #129 and 115.

In regard to water distribution the City's new RWTP has a transmission, pumping and storage component associated with it. Other opportunities for consolidation have also been identified in this Study and are primarily focused on interconnects between the service areas and providers, ESTs and transmission lines. Greater discussion of these opportunities can be found in Section 2 and 4 of this Study.

Wastewater Treatment, Collection & Conveyance

As stated previously the agreement for a regional approach to water treatment, supply and distribution would have been very unlikely without the regulatory driver provided by the FBCSD. The consolidation of any current wastewater facilities will probably require a similar driver in the form of stricter regulatory requirements such as total maximum daily loads (TMDLs) for the affected streams that receive discharge effluent from the WWTPs in the region.

Overall the concept of regionalization or consolidation is adverse to the development attitudes and practices of the Study area. The current system of financing infrastructure improvements allows a developer or group of landowners, to create a utility district and dictate the development process with minimal assistance or directives from local government. Combine this with the fact that past regionalization efforts have offered no financial incentives, then regionalization becomes very difficult to institute.

The Houston-Galveston Area Council (H-GAC) 2000 Domestic Wastewater Regionalization Whitepaper listed some general impediments to wastewater regionalization that are still applicable today for this Study area. These are listed below.

- Regionalization is optional. Currently a regulation does not exist to force regionalization of utilities. Regionalization of infrastructure is encouraged by the regulatory agencies but not required.

- Lack of Financial Incentives. Just as there is not a "stick" to force regionalization, a "carrot" does not exist either to encourage regionalization. For example, if abutting utility districts are better off constructing individual plants from a construction cost perspective, there is no mechanism to bridge the financial gap to make regionalization a viable option.

- Individual Control. While costs are important, control is paramount. Generally speaking the number one problem of regionalization involves the fear of losing autonomy, including concerns about loss of control or power by one group or another and not being able to control their own destiny.

- Occupational Resistance. With the proliferation of utility districts in the Study area and the nature of providing wastewater services, there are numerous professions involved in the industry through the operation and maintenance, billing, engineering, financial and legal services. In addition to resistance to regionalization by a utility district Board due to control reasons, resistance is also encountered from those who work for the utility districts. With a reduced number of plants and plant owners through regionalization or consolidation, there may be the perception that the wastewater industry will turn into a "winner take all" system of engineering, financial, legal and maintenance contracts.

There are 11 WWTPs in the study region varying in size from 0.25 MGD to 4.00 MGD for a total capacity of 13.75 MGD for the Study area. Most importantly 7 of the WWTPs are less than 1.00 MGD. For the most part the common wisdom states that it is inherently difficult to complete consolidation or regionalization of numerous small WWTPs due to the following reasons listed below.

- Usually the costs for diversion of the existing influent flows from a smaller WWTP to a larger WWTP are not cost-effective. By and large it is still cheaper to operate non-regional plants than to bear capital costs required to divert those plants to larger facilities. While there are certainly reductions in treatment costs with a larger plant due to the economy of scale, the up-front diversion/construction costs associated with consolidation usually dissuade municipalities and utility districts from consolidating existing plants. However, it should be noted that this dynamic can change when the smaller plant requires expansion or needs significant rehabilitation due to age or changes in regulatory treatment requirements.

- In addition to costs, there are control issues that compel utility districts to continue to operate small WWTPs. For utility districts, diverting flow to a better-equipped, larger facility may involve relinquishing control of operations to an outside entity (a municipality or other utility district). By having sole control over a WWTP, a utility district can control operation and maintenance expenditures, and ensure that available capacity exists for future growth within the utility district.[5]

Several scenarios were developed to determine anticipated capital and O&M costs for various WWTP consolidation scenarios. The first scenario was developed to determine the 30-year life cycle cost to maintain all the existing WWTPs in operation through 2040, along with construction of a new regional WWTP in the Sienna South area. The second, third and fourth scenarios were developed to evaluate various methods of consolidation with the ultimate goal of

[5] Domestic Wastewater Regionalization, August 2000, H-GAC

reducing the total number of active WWTPs to roughly half the current number of operating WWTPs at this time.

During the development of Scenarios 1 through 4, it was determined that as the total number of active WWTPs was reduced, economies of scale for capital and O&M cost resulted in a lower life cycle cost. As a result, a fifth scenario was developed with the concept of utilizing one WWTP site to create a super-regional WWTP that would treat the entire wastewater flows for the Study area, even at buildout.

The five scenarios include:

1. Rehab/Expand all WWTPs and include solids improvements;

2. Consolidate WWTPs based on utility district engineering firm recommendations;

3. Consolidate WWTPs using Quail Valley UD WWTP as a regional facility;

4. Consolidate WWTPs using Blue Ridge West WWTP as a regional facility; and

5. Consolidate all WWTPs into a single, super-regional facility at the SB-FB WWTP.

Life cycle costs were developed for each WWTP with respect to the alternatives discussed in TM IX and with regard to the five scenarios discussed previously. The goal was to identify which WWTPs were best suited for expansion, rehabilitation or consolidation into another offsite WWTP facility, and how best the recommended alternative for each WWTP fit in with an overall consolidation scenario.

A total of over 60 scenarios were completed to evaluate capital, O&M and life-cycle costs. The result was surprising in that consolidation to a single, super-regional WWTP was the most cost effective scenario despite the costs for re-routing and pumping of flows from other service areas. The various methods of analysis and conclusions are discussed in detail in TM VII, VIII and IX.

The recommended scenario of consolidating all flows to the SB-FB WWTP will have its share of challenges for the reasons discussed previously in this section. However, after exhaustive analyses of costs comparisons it is the most cost effective alternative for the long-term wastewater treatment needs of the Study area.

Conclusions and Summary

The City and the utility districts have successfully implemented the steps to achieve regionalization for water supply and treatment to meet the reduction in groundwater withdrawals.

This living example of cooperation and success can and should be a model for future regionalization or consolidation efforts. There are still opportunities remaining for storage and pumping, especially as the distribution systems become mature and the use of hydro-pneumatic pressure tanks is lessened and elevated storage use is increased.

The recommendation to establish a super-regional WWTP at SB-FB referenced could follow the same model as the RWTP allowing the various utility districts to retain their autonomy. However, the issues of costs to divert the flows, of control and of how costs are apportioned in accordance with utility rates will play a major role in deciding whether or not a regional approach is taken. One thing is certain – 8 of the current WWTPs only have 5-10 years of life remaining. Subtract the time for permitting, design and possible acquisition of land necessary for expansion and a decision will have to be made in the very near future on which direction the small package plants will take.

Appendix C
ANNEXATION ANALYSIS OF SIENNA PLANTATION #2 AND #3

Feasibility Analysis

Annexation of Sienna Municipal Utility Districts 2 and 3 by the City of Missouri City

March 10, 2015

Feasibility Analysis
Annexation of Sienna Municipal Utility Districts 2 and 3

Introduction:
This analysis is an update of the April 2011 analysis prepared by Mueller Management. This analysis follows the same methodology with data updated to the most currently available.

Purpose:
Analyze the financial benefits and impacts of annexation by the City of Missouri City of Sienna Plantation Municipal Utility Districts 2 and 3(the "Districts"). Compare an "annexation scenario" versus a "no annexation scenario" to determine which scenario provides the best financial benefit for the City. This analysis reviews the impacts on both the debt service and general funds of the City. An alternate scenario that allows the Districts to remain in place for limited purposes to reduce the cost impact to the City and residents is also evaluated.

Methodology:
1. Analyze the required debt service tax rate resulting from the combination of the Districts' and the City's existing debt service requirements and assessed valuations.
2. Assuming a constant overall City tax rate of $.57375 (the current rate), calculate the available general fund tax rate and resulting general fund property tax revenues that would be available to the City.
3. Project the "other revenues" generated and the increased costs of service that would be incurred due to the annexation.
4. Identify the net available general fund revenues (new property taxes and other revenues, less new operating expenses) available to City with the "annexation scenario". If the results are neutral or positive, the City is able to cover the costs of annexation; if the results are negative, the annexation will cost the City more than the revenues that will be generated.
5. Analyze a "break even" scenario that that will allow the city to annex the Districts in 2015.

Executive Summary:
The results of this updated analysis are consistent with the original 2011 results. Under a typical annexation scenario of dissolving the Districts and assuming their debt upon annexation, the proposed annexation is not cost-effective at this time. This conclusion is primarily attributable to the high debt load of the Districts and the lack of other revenues (primarily sales tax) to help support the costs of providing services to the Districts.

The proposed annexation is not recommended at this time due to the negative net general fund revenues for costs of service, the outstanding financial obligations for the regional WWTP. Under current conditions, the annexation will not provide a positive financial impact for the City until 2027, which is the same date as predicted in the 2011 analysis.

The analysis should be reviewed periodically to update actual conditions and assumptions.

An alternative method of annexation is explored at the conclusion of the report in which the Districts are annexed, but left in place as "limited districts" so that they can levy a limited tax to subsidize city costs and fund their remaining obligations. This alternative results in a slight initial increase in overall costs for the residents, but allows the City to "break even" on its costs of service and allows residents to have full municipal services.

1. Analyze the required debt service tax rate resulting from the combination of the Districts' and the City's existing debt service requirements and assessed valuations.

In the absence of any special agreements, when a city annexes a MUD, the city must assume all obligations of the district. At this time, the Districts' audits do not indicate outstanding unreimbursed developer obligations, so the existing outstanding debt is the only debt obligation the city would incur. Other outstanding obligations for construction of the regional WWTP are discussed later in the report.

A required debt service tax rate with and without annexation was calculated with the results summarized below:

Table 1

Year	With Annexation: Combined Debt Service Payments	With Annexation: Combined Assessed Valuation	With Annexation: Combined Debt Service Tax Rate	Without Annexation: City Only Debt Service Tax Rate	Increase Over Projected City-Only Debt Service Tax Rate
2016	$ 13,777,844	$ 5,991,847,227	0.2346	0.1731	**0.0615**
2017	$ 13,393,326	$ 6,111,684,172	0.2236	0.1612	**0.0624**
2018	$ 13,372,554	$ 6,233,917,855	0.2189	0.1576	**0.0613**
2019	$ 12,248,074	$ 6,358,596,212	0.1966	0.1317	**0.0648**
2020	$ 12,316,566	$ 6,485,768,137	0.1938	0.1301	**0.0637**
2021	$ 12,315,116	$ 6,615,483,499	0.1900	0.1271	**0.0628**
2022	$ 12,358,615	$ 6,747,793,169	0.1869	0.1246	**0.0623**
2023	$ 12,351,129	$ 6,882,749,033	0.1831	0.1221	**0.0610**
2024	$ 12,313,746	$ 7,020,404,013	0.1790	0.1187	**0.0603**
2025	$ 11,292,703	$ 7,160,812,094	0.1609	0.1039	**0.0571**
2026	$ 11,317,026	$ 7,304,028,336	0.1581	0.1013	**0.0568**
2027	$ 8,413,326	$ 7,450,108,902	0.1152	0.0867	**0.0285**
2028	$ 7,667,844	$ 7,599,111,080	0.1030	0.0724	**0.0306**
2029	$ 5,469,640	$ 7,751,093,302	0.0720	0.0332	**0.0389**
2030	$ 4,741,065	$ 7,906,115,168	0.0612	0.0203	**0.0409**
2031	$ 4,203,938	$ 8,064,237,471	0.0532	0.0121	**0.0411**
2032	$ 3,708,056	$ 8,225,522,221	0.0460	0.0043	**0.0417**
2033	$ 202,313	$ 8,390,032,665	0.0025	0.0031	**-0.0006**

Refer to the Appendix for expanded detail.

Assumptions:
2% annual assessed valuation growth
98% tax collection rate

Discussion:
The effect of annexing the Districts and assuming their outstanding debt results in the need to raise the city's debt service tax rate by roughly $.06 per $100 valuation in comparison to what the City's debt service tax rate would need to be to service its debt only. For reference, the City's current debt service tax rate is $.19337. The SPMUD 2 debt retires in 2026; SPMUD 3 in 2032.

2. Assuming a constant overall City tax rate of $.57375, calculate the available general fund tax rate and resulting general fund property tax revenues that would be available to cover the City's operating costs.

After annexation, the city would levy its general fund property tax on the combined assessed valuation of the city plus the Districts. The available general fund property tax rate would be the total rate less the required debt service rate calculated in section 1. For this analysis, the total City tax rate is assumed to be constant at $.57375.

Table 2

Year	With Annexation: Available General Fund Tax Rate	Without Annexation: Available General Fund Tax Rate	With Annexation: Increase (Decrease) General Fund Property Tax Revenues
2016	0.3391	0.4007	$ 1,071,410
2017	0.3501	0.4126	$ 1,182,092
2018	0.3549	0.4161	$ 1,320,165
2019	0.3772	0.4420	$ 1,444,978
2020	0.3800	0.4437	$ 1,568,503
2021	0.3838	0.4466	$ 1,693,766
2022	0.3869	0.4492	$ 1,794,864
2023	0.3906	0.4516	$ 1,953,262
2024	0.3948	0.4551	$ 2,086,932
2025	0.4128	0.4699	$ 2,563,507
2026	0.4156	0.4724	$ 2,671,140
2027	0.4585	0.4870	$ 4,999,204
2028	0.4708	0.5014	$ 5,157,750
2029	0.5017	0.5406	$ 5,227,098
2030	0.5126	0.5535	$ 5,369,301
2031	0.5206	0.5617	$ 5,589,816
2032	0.5278	0.5695	$ 5,779,094
2033	0.5713	0.5707	$ 9,395,271

Refer to the Appendix for expanded detail.

Discussion:
With the annexation scenario, the City tax base is larger, but the available General Fund tax rate is smaller, resulting in a relatively small increase in General Fund property tax revenues due to the annexation. If the City incurred no additional costs of service due to the annexation, the City would "break even" or better on new general fund property tax revenues. This situation occurs because the debt burden assumed from the Districts absorbs a greater share of the available property tax revenues, leaving less available for general fund purposes.

This calculation is an interim step in the analysis; the additional costs of service and the additional "other" revenues due to the proposed annexation also need to be considered as shown in the next section.

3. Project the "other revenues" generated and the increased costs of service that would be incurred due to the annexation.

With annexation of the Districts, the City would also generate "other revenues" such as franchise fees, fines, permits, etc. The City would also incur additional operating costs for city services such as police, fire, street maintenance, etc. These additional revenues and expenses were extrapolated from current revenues and expenses using appropriate factors such as population, number of homes, or lane-miles depending on the specific item being evaluated. The following figures are annual projections for the first year of the analysis and then they are inflated over time in the projection.

Table 3A

General Fund Revenue Item		With Annexation: Projected Other Revenues
Other Taxes	$	21,500
Licenses & Permits	$	59,000
Fines & Forfeitures	$	162,000
Franchise Fees	$	648,000
Other	$	(352,475)
Total	$	538,025

Table 3B

General Fund Expense Item		With Annexation: Projected Expense
Police	$	1,320,000
Fire	$	1,500,000
Streets	$	389,000
Parks	$	123,976
Other	$	333,000
Total	$	3,665,976

Refer to the Appendix for expanded detail.

Discussion:

Revenues:

Other Taxes consist of sales and beverage taxes, primarily attributable to the Sienna golf clubhouse. There are no other sales tax generating businesses within the annexation area. Licenses & Permits are primarily maintenance-related mechanical, electrical, and plumbing permits; the Districts are essentially built out, so there will not be significant new building permits issued. Fines & Forfeitures consist of fine revenues based on the increased population. The majority of new City revenues due to the annexation are attributable to Franchise Fees. The franchise fees are extrapolated from current City fees using the number of homes in the Districts (total of 3,941) as a percentage in the City (23,897), which translates to a 17% increase. Other Revenues would have an increase in alarm fees, but show an overall decrease due to the elimination of the fire service fee that is currently paid by residents of the Districts

Expenses:

The four major areas of projected cost impact were analyzed. Police expenditures are projected by extrapolating, based on population, the current patrol officer staffing level, plus associated administrative support (64 current patrol officers; an additional 11 would need to be added). Fire costs increase due to the staffing and operations costs of the Sienna fire station. Street maintenance costs increase based on a ratio of lane miles in the Districts in comparison to the current City (21% increase). Parks maintenance costs are assumed to be relatively minor due to the minimal publicly-maintained facilities within

the Districts; a 5% increase in the Parks budget is assumed. Other Expenses are estimated as an additional 10% of costs to cover other miscellaneous or support services provided by the City.

4. Identify the net available general fund revenues available to City with the "annexation scenario".

The Net Available Revenues available to the City with the "annexation" scenario is calculated by adding the available general fund property tax revenues (Table 2) plus the "other" revenues generated due to the annexation (Table 3A), less the increased costs of service due to the annexation (Table 3B).

Table 4

Year	With Annexation: Incremental Available General Fund Property Tax Revenue (Table 2)	With Annexation: Projected Other Revenues (Table 3A)	With Annexation: Projected Expense (Table 3B)	With Annexation: Net Revenues (2+3A+3B)
2016	$ 1,071,410	$ 538,025	$ (3,665,976)	$ (2,056,542)
2017	$ 1,182,092	$ 548,786	$ (3,775,956)	$ (2,045,078)
2018	$ 1,320,165	$ 559,761	$ (3,889,234)	$ (2,009,308)
2019	$ 1,444,978	$ 570,956	$ (4,005,911)	$ (1,989,977)
2020	$ 1,568,503	$ 582,376	$ (4,126,089)	$ (1,975,210)
2021	$ 1,693,766	$ 594,023	$ (4,249,871)	$ (1,962,082)
2022	$ 1,794,864	$ 605,904	$ (4,377,367)	$ (1,976,600)
2023	$ 1,953,262	$ 618,022	$ (4,508,689)	$ (1,937,405)
2024	$ 2,086,932	$ 630,382	$ (4,643,949)	$ (1,926,635)
2025	$ 2,563,507	$ 642,990	$ (4,783,268)	$ (1,576,771)
2026	$ 2,671,140	$ 655,849	$ (4,926,766)	$ (1,599,776)
2027	**$ 4,999,204**	**$ 668,966**	**$ (5,074,569)**	**$ 593,602**
2028	$ 5,157,750	$ 682,346	$ (5,226,806)	$ 613,290
2029	$ 5,227,098	$ 695,993	$ (5,383,610)	$ 539,481
2030	$ 5,369,301	$ 709,913	$ (5,545,118)	$ 534,096
2031	$ 5,589,816	$ 724,111	$ (5,711,472)	$ 602,455
2032	$ 5,779,094	$ 738,593	$ (5,882,816)	$ 634,871
2033	$ 9,395,271	$ 753,365	$ (6,059,300)	$ 4,089,336

Refer to the Appendix for expanded detail.

Assumptions:
Revenues grow by 2% annually and expenses grow by 3% annually.

Discussion:
When all sources of general fund revenues and expenses are accounted for, the net annual cost to the City for the annexation is significant for the foreseeable future. Net revenues do not become positive until 2027, which is the year after the SPMUD 2 debt is retired.

Further, the Districts have an outstanding obligation under previous agreements with the City to fund their pro rata share of a regional wastewater treatment plant. If this facility

is not constructed prior to annexation, the City would assume the obligation to construct. The Districts have established reserve funds for these future expenses, but the reserves are not fully funded. The Districts currently levy a "contract tax" of $.09 that is dedicated to a WWTP reserve fund. The timing of the construction of the regional WWTP is impossible predict because the construction schedules are contingent upon all six affected utility districts having demand for services and funds available.

Conclusion:
Under a typical annexation scenario of dissolving the Districts and assuming their debt upon annexation, the proposed annexation is not cost-effective at time. This conclusion is primarily attributable to:

- The high debt load of the Districts relative to assessed values; and
- The lack of other revenues (primarily a lack of sales tax) to help support the costs of providing services to the Districts.

The Districts' outstanding debt is 81% of the City's outstanding debt ($65,120,000 vs. $80,186,000, respectively), but the City's assessed value is 4.0 times greater than the Districts' ($4,704,436,564 vs. $1,169,923,463, respectively). The debt per capita for the Districts is $5,330, but only $1,142 for the City.

The proposed general purpose annexation is not recommended at this time due to the negative net general fund revenues for costs of service, the outstanding financial obligation for the regional WWTP, and the uncertainty of a construction date for that facility. Under current conditions, the annexation will not provide a positive financial impact for the City until 2027. The analysis should be reviewed periodically to update actual conditions and assumptions.

The following section presents a possible modified scenario under which the annexation could occur in 2015.

5. Analyze a "break even" scenario that that will allow the city to annex the Districts in 2015.

To annex the Districts in 2015 and still allow the City to "break even" on the costs of service, additional sources of revenue would be needed to offset the projected negative net revenues. The most likely method would be to convert the Districts to "limited districts" as authorized in Local Government Code 43.0751. The conversion to limited districts would need to be agreed to by the Districts with the specific terms and conditions subject to negotiation between the City and Districts.

Under this scenario, the Districts would be annexed by the City and the City would provide full municipal services. The City would assume the outstanding debt obligations of the Districts, but the Districts would stay in place for the following "limited purposes":
A. Levy a tax with proceeds paid to the City to offset the City's negative net revenues.
B. Levy a tax to fund the District's outstanding regional WWTP costs.
C. Levy a tax to fund the District's operating expenses.

All three of these levies would be required in order for the City to "break even" on costs of services, to avoid the funding obligation for the regional WWTP from being transferred to the City, and to provide the Districts a source of operating funds until they are completely dissolved.

The following are representative additional provisions that should be negotiated as part of the revised SPA:

- Disposition and control of District fund balances and bond reserve funds should be transferred to the City to help pay down existing debt.
- Use of excess District revenues, if any, to pay down debt.
- The entity that will provide water and sewer utility service.
- Trash collection should follow City policy.
- Term, duration, and termination provisions
- Level of City oversight and control of District operations and financial decisions.

Procedurally, converting the Districts to limited districts and revising the existing Strategic Partnership Agreements (SPAs) would require the concurrence of the Districts, with the specific terms and conditions subject to negotiation between the City and Districts. The conversion to limited districts would be accomplished by amending the current SPAs to provide for the "full purpose annexation conversion date" (i.e. 2015) and the other negotiated terms and conditions. To amend the SPAs, two public hearings each by the Districts and the City are required. Simultaneously, the annexation public hearings would also be conducted. After the hearings are completed and the SPAs are adopted, the annexation becomes effective on the annexation conversion date.

Calculation of the Limited Districts' Tax Levies

A. Tax Rate to Offset City Costs: An equivalent District tax rate was calculated that would generate sufficient revenue to offset the negative net City revenues shown in Table 4. This tax rate is initially $.1759 declining to zero by 2027.
B. Contract Tax Rate: For this analysis, the current contract rate to fund the regional WWTP obligations is assumed to remain constant at $.09. At this rate, sufficient cash would be generated for the MUD 2 and MUD 3 obligations by 2018 and 2021, respectively. *Note:* If the current District general fund reserves are unobligated, it may be possible to negotiate to apply these balances to the costs of the regional WWTP. If this is possible, the contract tax rate may be able to be reduced.
C. Maintenance Tax Rate: A $.05 maintenance tax rate is assumed to cover the Districts' operating continuing operating costs.

At such time that the City cost offset tax rate becomes zero and the regional WWTP obligation is funded, the Districts would be completely dissolved.

The tax rates that would be levied on residents of the Districts are shown below:

Table 5A

Year	City Cost Offset Tax Rate (A)	Contract Tax Rate (B)	O & M Tax Rate (C)	Total District Tax Rate (A+B+C)	District + City Tax Rate
2016	0.1759	0.0900	0.0500	0.3159	0.8896046
2017	0.1714	0.0900	0.0500	0.3114	0.8851955
2018	0.1651	0.0900	0.0500	0.3051	0.8788939
2019	0.1603	0.0900	0.0500	0.3003	0.8740981
2020	0.1560	0.0900	0.0500	0.2960	0.8697875
2021	0.1520	0.0900	0.0500	0.2920	0.8657112
2022	0.1501	0.0900	0.0500	0.2901	0.8638339
2023	0.1442	0.0900	0.0500	0.2842	0.8579733
2024	0.1406	0.0900	0.0500	0.2806	0.8543594
2025	0.1128	0.0900	0.0500	0.2528	0.8265693
2026	0.1122	0.0900	0.0500	0.2522	0.8259709
2027	0.0000	0.0900	0.0500	0.1400	0.71375
2028	0.0000	0.0900	0.0500	0.1400	0.71375
2029	0.0000	0.0900	0.0500	0.1400	0.71375
2030	0.0000	0.0900	0.0500	0.1400	0.71375
2031	0.0000	0.0900	0.0500	0.1400	0.71375
2032	0.0000	0.0900	0.0500	0.1400	0.71375
2033	0.0000	0.0900	0.0500	0.1400	0.71375

Refer to the Appendix for expanded detail.

Discussion:

The projected District tax rate is initially $.3159, declining to $.2522 by 2026 and then dropping to zero in 2027. The combined City and District tax rate would begin at $.8896, which is an increase of $.1796 over the current SPMUDs 2 and 3 rates of $.71.

The combined rate declines over time as the City cost offset tax rate is reduced. Upon dissolution of the Districts, projected as 2027, the residents would pay only the City tax rate.

Cost Impact on Average Home

District residents would pay an additional tax due to the combined tax rates. However, residents would experience decreased costs via the elimination of the current fire operations and sheriff services payments. For this analysis, a post-annexation water/sewer fee was projected by evaluating the District's revised available revenues and expenses and increasing the base rate by the same percentage decrease in net revenues. In this case, that resulted in an average 15% utility rate increase for the two Districts. The first-year monthly bill for 10,000 gallons in this analysis is $75.27 (vs. current average of $65.25). Garbage fees are assumed to be unaffected by the limited purpose annexation.

Table 5B

Year	Annual Homeowner Cost Without Annexation: MUD Tax, Fire Fee, Sheriff Fee, Utility Bill	Annual Homeowner Cost with Annexation & Limited Districts: MUD and City Tax & Utility Bill	Annual Increase (Decrease)	Monthly Increase (Decrease)
2016	$ 2,947	$ 3,347	$ 400	$ 33.32
2017	$ 3,016	$ 3,411	$ 395	$ 32.91
2018	$ 3,087	$ 3,472	$ 384	$ 32.03
2019	$ 3,160	$ 3,538	$ 378	$ 31.46
2020	$ 3,235	$ 3,606	$ 372	$ 30.97
2021	$ 3,311	$ 3,677	$ 366	$ 30.51
2022	$ 3,389	$ 3,756	$ 367	$ 30.57
2023	$ 3,470	$ 3,825	$ 355	$ 29.59
2024	$ 3,552	$ 3,902	$ 350	$ 29.15
2025	$ 3,636	$ 3,903	$ 267	$ 22.21
2026	$ 3,722	$ 3,991	$ 269	$ 22.41
2027	**$ 3,811**	**$ 3,709**	**$ (102)**	**$ (8.46)**
2028	$ 3,901	$ 3,797	$ (105)	$ (8.72)
2029	$ 3,994	$ 3,886	$ (108)	$ (9.00)
2030	$ 4,089	$ 3,978	$ (111)	$ (9.28)
2031	$ 4,187	$ 4,072	$ (115)	$ (9.57)
2032	$ 4,287	$ 4,169	$ (118)	$ (9.86)
2033	$ 4,389	$ 4,267	$ (122)	$ (10.17)

Refer to the Appendix for expanded detail.

Discussion:

District residents would experience an initial cost increase of $400 per year or about $33 per month. This increase over the non-annexation scenario decreases over time until

2026, at which time residents would actually experience decreased costs over the non-annexation scenario.

To implement this scenario, both the City Council and the District MUD Boards would need to agree to modify the existing Strategic Partnership Agreements. In exchange for the nominal increased cost, residents would be receiving full municipal services including police service. The City would assume the Districts' outstanding debt and receive a revenue stream to offset its costs of service. Assuming the District Boards would be willing to negotiate revised SPA's, the ultimate question for the Boards would be: *Will the residents feel that the extra cost would be worth the value of receiving full municipal services?* The primary question for the City would be: *Are the intangible benefits of bringing the Sienna residents into the City substantial enough to justify the assumption of the District debt and just breaking-even on costs of service?*

Appendix:
Expanded Tables with Additional Detail
Current MUD Statistical and Audit Data
City/MUD Comparative Data
Water/Sewer Rate Projection Calculation

Appendix

Expanded Tables with Additional Detail
Current MUD Statistical and Audit Data
City/MUD Comparative Data
Water/Sewer Rate Projection Calculation

Expanded Table 1

	Debt Service Payment Schedules				Assessed Valuations				Required Debt Service Tax Rates		
Year	Sienna MUD 2	Sienna MUD 3	City	With Annexation: Combined Debt Service Payments	Sienna MUD 2	Sienna MUD 3	City	With Annexation: Combined Assessed Valuation	With Annexation: Combined Debt Service Tax Rate	City-Only without Annexation	Increase Over Projected City-Only Debt Service Tax Rate
2016	$ 2,316,450	$ 3,321,891	$ 8,139,503	$ 13,777,844	$ 515,824,630	$ 677,497,302	$ 4,798,525,295	$ 5,991,847,227	0.2346	0.1731	**0.0615**
2017	$ 2,337,725	$ 3,324,129	$ 7,731,473	$ 13,393,326	$ 526,141,123	$ 691,047,248	$ 4,894,495,801	$ 6,111,684,172	0.2236	0.1612	**0.0624**
2018	$ 2,341,525	$ 3,319,135	$ 7,711,894	$ 13,372,554	$ 536,663,945	$ 704,868,193	$ 4,992,385,717	$ 6,233,917,855	0.2189	0.1576	**0.0613**
2019	$ 2,354,325	$ 3,321,138	$ 6,572,611	$ 12,248,074	$ 547,397,224	$ 718,965,557	$ 5,092,233,432	$ 6,358,596,212	0.1966	0.1317	**0.0648**
2020	$ 2,370,025	$ 3,324,323	$ 6,622,218	$ 12,316,566	$ 558,345,168	$ 733,344,868	$ 5,194,078,100	$ 6,485,768,137	0.1938	0.1301	**0.0637**
2021	$ 2,390,125	$ 3,324,216	$ 6,600,775	$ 12,315,116	$ 569,512,072	$ 748,011,765	$ 5,297,959,662	$ 6,615,483,499	0.1900	0.1271	**0.0628**
2022	$ 2,437,725	$ 3,323,681	$ 6,597,209	$ 12,358,615	$ 580,902,313	$ 762,972,001	$ 5,403,918,855	$ 6,747,793,169	0.1869	0.1246	**0.0623**
2023	$ 2,433,750	$ 3,320,383	$ 6,596,996	$ 12,351,129	$ 592,520,360	$ 778,231,441	$ 5,511,997,233	$ 6,882,749,033	0.1831	0.1221	**0.0610**
2024	$ 2,454,075	$ 3,320,536	$ 6,539,136	$ 12,313,746	$ 604,370,767	$ 793,796,069	$ 5,622,237,177	$ 7,020,404,013	0.1790	0.1187	**0.0603**
2025	$ 2,134,575	$ 3,320,691	$ 5,837,437	$ 11,292,703	$ 616,458,182	$ 809,671,991	$ 5,734,681,921	$ 7,160,812,094	0.1609	0.1039	**0.0571**
2026	$ 2,183,025	$ 3,324,984	$ 5,809,018	$ 11,317,026	$ 628,787,346	$ 825,865,431	$ 5,849,375,559	$ 7,304,028,336	0.1581	0.1013	**0.0568**
2027	$ -	$ 3,343,528	$ 5,069,798	$ 8,413,326	$ 641,363,093	$ 842,382,739	$ 5,966,363,070	$ 7,450,108,902	0.1152	0.0867	**0.0285**
2028	$ -	$ 3,351,836	$ 4,316,008	$ 7,667,844	$ 654,190,354	$ 859,230,394	$ 6,085,690,332	$ 7,599,111,080	0.1030	0.0724	**0.0306**
2029	$ -	$ 3,452,680	$ 2,016,960	$ 5,469,640	$ 667,274,162	$ 876,415,002	$ 6,207,404,138	$ 7,751,093,302	0.0720	0.0332	**0.0389**
2030	$ -	$ 3,484,073	$ 1,256,993	$ 4,741,065	$ 680,619,645	$ 893,943,302	$ 6,331,552,221	$ 7,906,115,168	0.0612	0.0203	**0.0409**
2031	$ -	$ 3,440,625	$ 763,313	$ 4,203,938	$ 694,232,038	$ 911,822,168	$ 6,458,183,266	$ 8,064,237,471	0.0532	0.0121	**0.0411**
2032	$ -	$ 3,431,956	$ 276,100	$ 3,708,056	$ 708,116,678	$ 930,058,611	$ 6,587,346,931	$ 8,225,522,221	0.0460	0.0043	**0.0417**
2033	$ -	$ -	$ 202,313	$ 202,313	$ 722,279,012	$ 948,659,784	$ 6,719,093,869	$ 8,390,032,665	0.0025	0.0031	**-0.0006**

MUD debt service schedules from Texas Municipal Reports; City schedules from budget.
Assessed valuations projected from 2015 actual values assuming 2% annual growth.
Tax collection rate: 98%
For Reference: Current Debt Service Tax Rates:

MUD 2	$ 0.52
MUD 3	$ 0.54
City	$ 0.19337

Expanded Table 2

	With Annexation - General Fund Tax Rate & Revenue			Without Annexation-General Fund Tax Rate & Revenue			Difference
Year	With Annexation: Available General Fund Tax Rate	With Annexation: Combined Assessed Valuation	With Annexation: General Fund Revenue with Available GF Tax Rate	Without Annexation: Available General Fund Tax Rate	Without Annexation: City-Only Assessed Valuation	Without Annexation: General Fund Revenue with Available GF Tax Rate	With Annexation: Increase (Decrease) General Fund Property Tax Revenues
2016	0.3391	$ 5,991,847,227	$ 19,912,815	0.4007	$ 4,798,525,295	$ 18,841,405	$ 1,071,410
2017	0.3501	$ 6,111,684,172	$ 20,971,146	0.4126	$ 4,894,495,801	$ 19,789,054	$ 1,182,092
2018	0.3549	$ 6,233,917,855	$ 21,679,207	0.4161	$ 4,992,385,717	$ 20,359,042	$ 1,320,165
2019	0.3772	$ 6,358,596,212	$ 23,504,722	0.4420	$ 5,092,233,432	$ 22,059,744	$ 1,444,978
2020	0.3800	$ 6,485,768,137	$ 24,151,287	0.4437	$ 5,194,078,100	$ 22,582,784	$ 1,568,503
2021	0.3838	$ 6,615,483,499	$ 24,882,094	0.4466	$ 5,297,959,662	$ 23,188,328	$ 1,693,766
2022	0.3869	$ 6,747,793,169	$ 25,582,540	0.4492	$ 5,403,918,855	$ 23,787,676	$ 1,794,864
2023	0.3906	$ 6,882,749,033	$ 26,348,848	0.4516	$ 5,511,997,233	$ 24,395,586	$ 1,953,262
2024	0.3948	$ 7,020,404,013	$ 27,160,230	0.4551	$ 5,622,237,177	$ 25,073,298	$ 2,086,932
2025	0.4128	$ 7,160,812,094	$ 28,970,753	0.4699	$ 5,734,681,921	$ 26,407,246	$ 2,563,507
2026	0.4156	$ 7,304,028,336	$ 29,751,699	0.4724	$ 5,849,375,559	$ 27,080,559	$ 2,671,140
2027	0.4585	$ 7,450,108,902	$ 33,476,774	0.4870	$ 5,966,363,070	$ 28,477,570	$ 4,999,204
2028	0.4708	$ 7,599,111,080	$ 35,060,058	0.5014	$ 6,085,690,332	$ 29,902,307	$ 5,157,750
2029	0.5017	$ 7,751,093,302	$ 38,112,820	0.5406	$ 6,207,404,138	$ 32,885,722	$ 5,227,098
2030	0.5126	$ 7,906,115,168	$ 39,713,044	0.5535	$ 6,331,552,221	$ 34,343,743	$ 5,369,301
2031	0.5206	$ 8,064,237,471	$ 41,139,254	0.5617	$ 6,458,183,266	$ 35,549,437	$ 5,589,816
2032	0.5278	$ 8,225,522,221	$ 42,541,999	0.5695	$ 6,587,346,931	$ 36,762,905	$ 5,779,094
2033	0.5713	$ 8,390,032,665	$ 46,972,744	0.5707	$ 6,719,093,869	$ 37,577,473	$ 9,395,271

Assessed valuations projected from 2015 actual values assuming 2% annual growth.
Tax collection rate: 98%
For Reference: Current City General Fund Tax Rate: $ 0.38038

Expanded Table 3A

Projected "Other" City General Fund Revenues Derived from Sienna MUDs 2 and 3 (excluding property tax)

		FY 2015 City Budget	2016 Revenues from Sienna MUDs 2 & 3	Basis/Comment
310 OTHER TAXES				
0100	City Retail Sales Tax	$ 8,000,000	$ 20,000	Golf club taxable sales (10,000 sf x $200/sf x 1%)
0200	State Beverage Tax	$ 30,000	$ 1,500	Minimal mixed drink sales at golf club
	Total Other Taxes	**$ 8,030,000**	**$ 21,500**	
320 LICENSES & PERMITS				
0100	Zoning Variances		$ -	
0200	Zoning Amendments		$ -	Assume minimal activity
0300	Plat Fees		$ -	Assume minimal activity
0400	Recall Inspection Fees		$ -	Assume minimal activity
0500	General Fire Inspection		$ -	Assume minimal activity
0600	Building Permits		$ -	Assume minimal activity
0700	Change of Occupancy		$ -	Assume minimal activity
0800	Plumbing Permits	$ 100,000	$ 17,000	Prorated on population; rounded to nearest $1,000
0900	Electrical Permits	$ 100,000	$ 17,000	Prorated on population; rounded to nearest $1,000
1000	Air Conditioning Permits	$ 95,000	$ 17,000	Prorated on population; rounded to nearest $1,000
1100	Pool Permits	$ 3,000	$ 1,000	Prorated on population; rounded to nearest $1,000
1200	Sign Permits		$ -	Assume minimal activity
1300	Electrical License		$ -	
1400	Plan Check Fees		$ -	Assume minimal activity
1500	After Hours Inspections		$ -	Assume minimal activity
1600	Liquor License		$ -	Assume no alcohol sales
1700	Solicitors License	$ -	$ -	Prorated on population; rounded to nearest $1,000
1800	Infrastructure Fees		$ -	Assume minimal activity
2000	Lien Reimbursement		$ -	Assume minimal activity
2200	Health Permits	$ 95,000	$ 2,000	Golf club, schools, day care
2300	Housing Code Inspections		$ -	Discontinued
2400	Pub Works After Hrs Inspection		$ -	Assume minimal activity
2500	Sienna Plantation - Prorata	$ 62,000	$ -	Will continue for other Sienna Areas, but no incremental revenue due to annexation
2600	Contractor Registration Fees		$ -	Will not increase due to annexation
2700	Design Review		$ -	Assume minimal activity
2800	Pub Works Plan Review Fee		$ -	Assume minimal activity
2900	Riverstone Inspection Fee		$ -	Not applicable
3000	Housing Rental Registration	$ 60,000	$ 5,000	Prorated on population; rounded to nearest $1,000, but assume rental rate half of current city rate
	Total Licenses & Permits	**$ 515,000**	**$ 59,000**	
330 FINES AND FORFEITURES				
0100	Fines	$ 700,000	$ 122,000	Prorated on population; rounded to nearest $1,000
0300	Warrant Fees	$ 60,000	$ 10,000	Prorated on population; rounded to nearest $1,000
0400	DDC/Insurance	$ 15,000	$ 3,000	Prorated on population; rounded to nearest $1,000
0500	Administrative Fee	$ 32,000	$ 6,000	Prorated on population; rounded to nearest $1,000
0600	Arrest Fees	$ 40,000	$ 7,000	Prorated on population; rounded to nearest $1,000
0700	Cash Over & Under		$ -	
0900	Misc Municipal Court Fees		$ -	
1000	Collection Agency Fees	$ 50,000	$ 9,000	Prorated on population; rounded to nearest $1,000
1100	Judicial Efficiency	$ 4,000	$ 1,000	Prorated on population; rounded to nearest $1,000
1200	Local - No Restriction	$ 25,000	$ 4,000	Prorated on population; rounded to nearest $1,000
1300	Over Payment		$ -	
1500	Motor Carrier Fines		$ -	Assume minimal activity
1600	Overweight Vehicle Fines		$ -	
	Total Fines & Forfeitures	**$ 926,000**	**$ 162,000**	
340 FRANCHISE FEES				
0100	Franchise Fee - Gas	$ 350,000	$ 61,000	Prorated on population; rounded to nearest $1,000
0200	Franchise Fee - Phone	$ 350,000	$ 61,000	Prorated on population; rounded to nearest $1,000
0300	Franchise Fee - Electric	$ 2,000,000	$ 348,000	Prorated on population; rounded to nearest $1,000
0400	Franchise Fee - Cable TV	$ 675,000	$ 117,000	Prorated on population; rounded to nearest $1,000
	Solid Waste	$ 350,000	$ 61,000	Prorated on population; rounded to nearest $1,000
	Total Franchise Fees	**$ 3,725,000**	**$ 648,000**	
350 INTERGOVERNMENTAL REVENUE				
0100	Grants		$ -	No additional Revenue due to annexation
0101	Federal Grants		$ -	No additional Revenue due to annexation
0102	State Grants		$ -	No additional Revenue due to annexation
0103	Miscellaneous Grants		$ -	No additional Revenue due to annexation
0300	Fire Dept. Reimbursement		$ -	No additional Revenue due to annexation
0900	Animal Control Reimb-Stafford		$ -	No additional Revenue due to annexation
1300	Sta-Mo Lease Reimbursement		$ -	No additional Revenue due to annexation
	Total Intergovernmental Revenues	$ -	$ -	

Expanded Table 3A

Projected "Other" City General Fund Revenues Derived from Sienna MUDs 2 and 3 (excluding property tax)

		FY 2015 City Budget		2016 Revenues from Sienna MUDs 2 & 3	Basis/Comment
380	OTHER REVENUE				
0100	Interest Income			$ -	No additional Revenue due to annexation
0200	Cash Over/Under-Cashiers			$ -	
0300	Maps			$ -	
0400	Cash Over/Under-Peard			$ -	
600	Peard Rebate	$ 120,000		$ 12,000	Assume 10% increase
0900	Recreation Leisure Classes			$ -	No additional Revenue due to annexation; Sienna residents already have access to Receation programs
1000	Athletic League Fees			$ -	No additional Revenue due to annexation; Sienna residents already have access to Receation programs
1100	Recreation Center Fees			$ -	No additional Revenue due to annexation; Sienna residents already have access to Receation programs
1200	Special Events			$ -	No additional Revenue due to annexation
1300	Rec - Advertising Fees			$ -	
1400	MCTV Sponsorships			$ -	No additional Revenue due to annexation
1500	Facilities Rental			$ -	No additional Revenue due to annexation; Sienna residents already have access to rent facilities
1501	Security Fees			$ -	
1800	Other/Miscellaneous			$ -	Assume minimal activity
2000	NSF Check Allowance			$ -	Assume minimal activity
2100	Sale of Salvage			$ -	Assume minimal activity
2300	Insurance Reimbursements			$ -	Assume minimal activity
2500	Missouri City History Books			$ -	Assume minimal activity
2600	PM Burglar False Alarm	$ 60,000		$ 10,000	Prorated on population; rounded to nearest $1,000
2700	Unpermitted Burglar Alarms	$ 2,000		$ -	Prorated on population; rounded to nearest $1,000
2800	PM Fire Flase Alarm	$ -		$ -	Prorated on population; rounded to nearest $1,000
2900	Alarm Permit Fees	$ 350,000		$ 98,525	$50/home times number of Sienna 2 and 3 homes times 50%
3000	Unpermitted Fire Alarms			$ -	Assume minimal activity
3200	Pavement Maintenance			$ -	
3300	Recycling			$ -	Assume minimal activity
3400	Solid WasteSubscribers			$ -	
3401	Solid Waste Admin Fee			$ -	
3402	Solid Waste MUD Pmts			$ -	
3403	Collection Fees			$ -	
3600	Miscellaneous - Police			$ -	No additional Revenue due to annexation
3800	Animal License Fees	$ 2,500		$ -	Prorated on population; rounded to nearest $1,000
3900	Donations - Police			$ -	No additional Revenue due to annexation
4000	Donations - Parks			$ -	
4100	Donations - Fire			$ -	No additional Revenue due to annexation
4200	Donations - Economic Development			$ -	
4300	Donation - 50th Anniversary			$ -	No additional Revenue due to annexation
4700	Traffic Control Operation			$ -	
4800	Donations-Urban Forestry			$ -	
5000	Police Dept Miscellaneous			$ -	No additional Revenue due to annexation
6400	Child Safety Fees	$ -		$ -	Prorated on population; rounded to nearest $1,000
7100	Fire Dept Miscellaneous			$ -	No additional Revenue due to annexation
7300	Parks Dept Miscellaneous			$ -	
7400	Recreation Dept Miscellaneous			$ -	
7500	City Secretary Dept Miscellaneous			$ -	
7600	Street Dept Miscellaneous			$ -	Assume minimal activity
7800	Engineering Dept Miscellaneous			$ -	
7900	EMS Billings			$ -	
8000	Fire Seminars			$ -	
8100	Late Fees			$ -	
8200	Pretector Pavers			$ -	
8300	Purchasing Miscellaneous			$ -	No additional Revenue due to annexation
8400	Fire District Pmts	$ 850,000		$ (473,000)	Reduction in payments due to annexation - see separate detail
8500	Disaster Reimbursement			$ -	
8600	GRP Admin Fee Reimb			$ -	
8800	Tower Lease			$ -	
9800	Unapplied Personnel Costs			$ -	
	Total Other Revenue	$ 1,384,500		$ (352,475)	
	Total Revenues	$ 14,580,500		$ 538,025	

Expanded Table 3B

Assume majority of expenses in police, fire, streets/drainage/traffic control, and parks

Police			
Current Patrol Division Staff		64	
Added Patrol staff		**11**	Prorated on population
Average Cost/Officer	$	100,000	
Total Annual Officer Cost	$	1,100,000	
Admin Support Allowance	$	220,000	20%
Total Added Police Cst	**$**	**1,320,000**	

Fire			
Sienna Station Operations	**$**	**1,500,000**	Projection

Streets/Drainage/Traffic Control			
Current Budget	Amount		
Personnel	$	770,169	(2015 Budget)
Cont. Svcs	$	308,963	(2015 Budget)
Other Services	$	755,058	(2015 Budget)
Total Current Street/Drain/Traffic	$	1,834,190	(2015 Budget)
Added Street/Drainage/Traffic Cost	**$**	**389,000**	Prorated on lane miles

Parks			
Current Budget	Amount		
Parks Administration	$	1,598,481	(2015 Budget)
Recreation	$	881,046	(2015 Budget)
Total Current Parks	$	2,479,527	(2015 Budget)
Added Parks & Recreation Cost	$	123,976	5% projected increase

Total Added Expense Estimate			
Total Police, Fire, Street/Drain/Traffic & Parks	$	3,332,976	
Misc. Allowance	$	333,000	10%
Total Estimated Cost Impact	**$**	**3,665,976**	

Data

	Sienna MUDs 2 & 3	City	Sienna % Increase
Homes	3,941	23,897	16.5%
Population	12,217	70,185	17.4%
Lane-Miles	134.77	636	21.2%

Expanded Table 4

Year	**With Annexation:** Incremental Available General Fund Property Tax Revenue (Table 2)	**With Annexation:** Projected Other Revenues (Table 3A)	**With Annexation:** Projected Expense (Table 3B)	**With Annexation:** Net Revenues (2+3A+3B)
2016	$ 1,071,410	$ 538,025	$ (3,665,976)	$ (2,056,542)
2017	$ 1,182,092	$ 548,786	$ (3,775,956)	$ (2,045,078)
2018	$ 1,320,165	$ 559,761	$ (3,889,234)	$ (2,009,308)
2019	$ 1,444,978	$ 570,956	$ (4,005,911)	$ (1,989,977)
2020	$ 1,568,503	$ 582,376	$ (4,126,089)	$ (1,975,210)
2021	$ 1,693,766	$ 594,023	$ (4,249,871)	$ (1,962,082)
2022	$ 1,794,864	$ 605,904	$ (4,377,367)	$ (1,976,600)
2023	$ 1,953,262	$ 618,022	$ (4,508,689)	$ (1,937,405)
2024	$ 2,086,932	$ 630,382	$ (4,643,949)	$ (1,926,635)
2025	$ 2,563,507	$ 642,990	$ (4,783,268)	$ (1,576,771)
2026	$ 2,671,140	$ 655,849	$ (4,926,766)	$ (1,599,776)
2027	$ 4,999,204	$ 668,966	$ (5,074,569)	$ 593,602
2028	$ 5,157,750	$ 682,346	$ (5,226,806)	$ 613,290
2029	$ 5,227,098	$ 695,993	$ (5,383,610)	$ 539,481
2030	$ 5,369,301	$ 709,913	$ (5,545,118)	$ 534,096
2031	$ 5,589,816	$ 724,111	$ (5,711,472)	$ 602,455
2032	$ 5,779,094	$ 738,593	$ (5,882,816)	$ 634,871
2033	$ 9,395,271	$ 753,365	$ (6,059,300)	$ 4,089,336

Equivalent tax increase (decrease) calculated with combined City and MUD valuations.
Tax collection rate: 98%

Expanded Table 5A

Year	City Cost Offset Tax Rate (A)	City Subsidy Revenue	Contract Tax Rate (B)	Contract Revenues (for Regional WWTP)	O & M Tax Rate (C)	MUD O&M Revenues (including fire station costs)	Total District Tax Rate (A+B+C)	District + City Tax Rate
2016	0.1759	$ 2,056,542	0.0900	$ 1,031,872	0.0500	$ 573,262	0.3159	0.88960464
2017	0.1714	$ 2,045,078	0.0900	$ 1,052,510	0.0500	$ 584,728	0.3114	0.88519547
2018	0.1651	$ 2,009,308	0.0900	$ 1,073,560	0.0500	$ 596,422	0.3051	0.8788939
2019	0.1603	$ 1,989,977	0.0900	$ 1,095,031	0.0500	$ 608,351	0.3003	0.87409809
2020	0.1560	$ 1,975,210	0.0900	$ 1,116,932	0.0500	$ 620,518	0.2960	0.8697875
2021	0.1520	$ 1,962,082	0.0900	$ 1,139,271	0.0500	$ 632,928	0.2920	0.86571119
2022	0.1501	$ 1,976,600	0.0900	$ 1,162,056	0.0500	$ 645,587	0.2901	0.86383391
2023	0.1442	$ 1,937,405	0.0900	$ 1,185,297	0.0500	$ 658,498	0.2842	0.85797331
2024	0.1406	$ 1,926,635	0.0900	$ 1,209,003	0.0500	$ 671,668	0.2806	0.85435942
2025	0.1128	$ 1,576,771	0.0900	$ 1,233,183	0.0500	$ 685,102	0.2528	0.82656928
2026	0.1122	$ 1,599,776	0.0900	$ 1,257,847	0.0500	$ 698,804	0.2522	0.82597091
2027	0.0000	$ -	0.0900	$ 1,283,004	0.0500	$ 712,780	0.1400	0.71375
2028	0.0000	$ -	0.0900	$ 1,308,664	0.0500	$ 727,035	0.1400	0.71375
2029	0.0000	$ -	0.0900	$ 1,334,837	0.0500	$ 741,576	0.1400	0.71375
2030	0.0000	$ -	0.0900	$ 1,361,534	0.0500	$ 756,408	0.1400	0.71375
2031	0.0000	$ -	0.0900	$ 1,388,765	0.0500	$ 771,536	0.1400	0.71375
2032	0.0000	$ -	0.0900	$ 1,416,540	0.0500	$ 786,967	0.1400	0.71375
2033	0.0000	$ -	0.0900	$ 1,444,871	0.0500	$ 802,706	0.1400	0.71375

Revenues based on projected assessed valuations of each MUD.
Tax collection rate: 98%

Expanded Table 5B

		Without Annexation					With Annexation & Limited Districts					Difference	
Year	Average Home Value	Taxes @ current Average MUD Tax Rate	Fire Fee @ $10.00/month	Sheriff Service @ $6.50/month	Water and Wastewater Utility Bill	Total Annual Homeowner Cost Without Annexation: MUD Tax, Fire Fee, Sheriff Fee, Utility Bill	Taxes @ Combined City and Limited District Tax Rates	Fire Fee @ $10.00/month	Sheriff Service @ $6.50/month	Water and Wastewater Utility Bill	Total Annual Homeowner Cost with Annexation & Limited Districts: MUD and City Tax & Utility Bill	Annual Increase (Decrease)	Monthly Increase (Decrease)
2016	$ 268,494	$ 1,906	$ 127	$ 83	$ 831	$ 2,947	$ 2,389	$ -	$ -	$ 958	$ 3,347	$ 400	$ 33.32
2017	$ 273,864	$ 1,944	$ 131	$ 85	$ 856	$ 3,016	$ 2,424	$ -	$ -	$ 987	$ 3,411	$ 395	$ 32.91
2018	$ 279,341	$ 1,983	$ 135	$ 88	$ 881	$ 3,087	$ 2,455	$ -	$ -	$ 1,017	$ 3,472	$ 384	$ 32.03
2019	$ 284,928	$ 2,023	$ 139	$ 90	$ 908	$ 3,160	$ 2,491	$ -	$ -	$ 1,047	$ 3,538	$ 378	$ 31.46
2020	$ 290,626	$ 2,063	$ 143	$ 93	$ 935	$ 3,235	$ 2,528	$ -	$ -	$ 1,079	$ 3,606	$ 372	$ 30.97
2021	$ 296,439	$ 2,105	$ 148	$ 96	$ 963	$ 3,311	$ 2,566	$ -	$ -	$ 1,111	$ 3,677	$ 366	$ 30.51
2022	$ 302,368	$ 2,147	$ 152	$ 99	$ 992	$ 3,389	$ 2,612	$ -	$ -	$ 1,144	$ 3,756	$ 367	$ 30.57
2023	$ 308,415	$ 2,190	$ 157	$ 102	$ 1,022	$ 3,470	$ 2,646	$ -	$ -	$ 1,179	$ 3,825	$ 355	$ 29.59
2024	$ 314,583	$ 2,234	$ 161	$ 105	$ 1,052	$ 3,552	$ 2,688	$ -	$ -	$ 1,214	$ 3,902	$ 350	$ 29.15
2025	$ 320,875	$ 2,278	$ 166	$ 108	$ 1,084	$ 3,636	$ 2,652	$ -	$ -	$ 1,250	$ 3,903	$ 267	$ 22.21
2026	$ 327,293	$ 2,324	$ 171	$ 111	$ 1,116	$ 3,722	$ 2,703	$ -	$ -	$ 1,288	$ 3,991	$ 269	$ 22.41
2027	$ 333,838	$ 2,370	$ 176	$ 115	$ 1,150	$ 3,811	$ 2,383	$ -	$ -	$ 1,327	$ 3,709	$ (102)	$ (8.46)
2028	$ 340,515	$ 2,418	$ 182	$ 118	$ 1,184	$ 3,901	$ 2,430	$ -	$ -	$ 1,366	$ 3,797	$ (105)	$ (8.72)
2029	$ 347,326	$ 2,466	$ 187	$ 122	$ 1,220	$ 3,994	$ 2,479	$ -	$ -	$ 1,407	$ 3,886	$ (108)	$ (9.00)
2030	$ 354,272	$ 2,515	$ 193	$ 125	$ 1,256	$ 4,089	$ 2,529	$ -	$ -	$ 1,450	$ 3,978	$ (111)	$ (9.28)
2031	$ 361,358	$ 2,566	$ 198	$ 129	$ 1,294	$ 4,187	$ 2,579	$ -	$ -	$ 1,493	$ 4,072	$ (115)	$ (9.57)
2032	$ 368,585	$ 2,617	$ 204	$ 133	$ 1,333	$ 4,287	$ 2,631	$ -	$ -	$ 1,538	$ 4,169	$ (118)	$ (9.86)
2033	$ 375,956	$ 2,669	$ 210	$ 137	$ 1,373	$ 4,389	$ 2,683	$ -	$ -	$ 1,584	$ 4,267	$ (122)	$ (10.17)

'Without Annexation' taxes based on average District tax rate of $0.71
"With Annexation" taxes based on combined City and Limited District tax rate from Table 4.
Tax collection rate: 98%

Statistical Information

2014 Texas Municipal Report or Audit Information (2/28/14)

	Sienna 2	Sienna 3	Total	
Assessed Valuation	$ 495,794,531	$ 651,189,256	$ 1,146,983,787	
Maintenance Tax	$ 0.10	$ 0.08		
Contract Tax	$ 0.09	$ 0.09		<<< Passed thru to MUD 1 for obligations to MUD 1
Debt Tax	$ 0.52	$ 0.54		
Total Tax	$ 0.71	$ 0.71		
General "Unassigned" Fund Balance	$ 2,951,988	$ 3,626,754	$ 6,578,742	
Debt Service Fund Balance (Restricted)	$ 3,209,404	$ 1,758,605	$ 4,968,009	
Capital Projects Fund Balance (Restricted)	$ -	$ 945,273	$ 945,273	
Outstanding Debt	$ 22,670,000	$ 42,450,000	$ 65,120,000	
Unissued Debt Authority for refunding purposes	$ 16,750,000	$ 28,575,000	$ 45,325,000	
Due to developer *	$ -	$ -	$ -	

Per ABHR. The contract tax can be levied by MUD 2 and 3 for any purpose under their Contract for financing and operation with MUD 1. However, in this case, MUDs 2 and 3 are levying it for their share of the regional wastewater treatment facility and it is being used to save money for that purpose.

Other Statistics

	Sienna 2	Sienna 3	Total	
Acreage	1,056.47	1,228.64	2,285.11	
Wastewater Utility Connections	1,779	2,512	4,291	GRP Report 12/14
Water Utility Connections	1,595	2,346	3,941	GRP Report 12/14
Estimated Population	4,945	7,273	12,217	
Lane Miles	66.31	68.46	134.77	

City & MUD Comparative Data

	Existing City	Sienna MUDs 2 & 3	Increase
Area	19,293	2,285	12%
Homes	23,897	3,941	16%
Population	70,185	12,217	17%
Lane-Miles	636	135	21%
Assessed Valuation	$ 4,704,436,564	$ 1,146,983,787	24%
Outstanding Debt *	$ 80,186,000	$ 65,120,000	81%
Debt per Capita	$ 1,142	$ 5,330	NA
Debt:AV Ratio	1.7%	5.7%	NA

* Texas Municipal Reports

Projected Utility Bill Imapct with Limited District Scenario

Revenues	SPMUD 2 2014 Actual Budget (17 months) 17 months	12 Months	Projected Budget with Limited District	SPMUD 3 2014 Actual Budget (17 months) 17 months	12 Months	Projected Budget with Limited District
Water Service	$ 978,463	$ 690,680	$ 690,680	$1,061,111	$ 749,020	$ 749,020
Sewer Service	$ 1,199,954	$ 847,026	$ 847,026	$1,729,010	$1,220,478	$ 1,220,478
Fire Service	$ 259,622	$ 183,263		$ -	$ -	$ -
Property Taxes	$ 1,697,679	$1,198,362		$2,067,850	$1,459,659	
Penalties and Interest	$ 77,408	$ 54,641		$ 85,846	$ 60,597	
Tap Connections/Inspections	$ 6,943	$ 4,901	$ 4,901	$ 18,864	$ 13,316	$ 13,316
Surface Water	$ 804,068	$ 567,577	$ 567,577	$1,006,248	$ 710,293	$ 710,293
Interest Earnings	$ -	$ -	$ -	$ 124,560	$ 87,925	$ -
Miscellaneous	$ 4,554	$ 3,215	$ 3,215	$ 38,929	$ 27,479	$ 27,479
Investment Earnings	$ 5,764	$ 4,069	$ 4,069	$ 10,770	$ 7,602	$ 7,602
Total Revenues	**$ 5,034,455**	**$3,553,733**	**$ 2,117,468**	**$6,143,188**	**$4,336,368**	**$ 2,728,187**
Expenditures						
Purchased Water	$ 974,400	$ 687,812	$ 687,812	$1,365,312	$ 963,750	$ 963,750
Professional Fees	$ 159,499	$ 112,588	$ 50,000	$ 107,707	$ 76,028	$ 50,000
Contracted Services	$ 728,627	$ 514,325	$ 514,325	$ 678,033	$ 478,612	$ 478,612
Repairs/Maintenance	$ 254,983	$ 179,988	$ 179,988	$ 254,165	$ 179,411	$ 179,411
Utilities	$ 8,152	$ 5,754	$ 5,754	$ -	$ -	$ -
Administrative	$ 65,533	$ 46,259	$ -	$ 94,309	$ 66,571	$ -
Other	$ 21,575	$ 15,229	$ -	$ 82,674	$ 58,358	$ -
Surface Water	$ 877,504	$ 619,415	$ 619,415	$1,100,596	$ 776,891	$ 776,891
Capital Outlay	$ 174,222	$ 122,980	$ 122,980	$ 80,705	$ 56,968	$ 56,968
Intergovernmental/Contractual Obligations (1)	$ 760,916	$ 537,117	$ 225,000	$1,422,142	$1,003,865	$ 500,000
Intergovernmental/Master District Repalcement Fund	$ 104,086	$ 73,472	$ 73,472	$ 127,050	$ 89,682	$ 89,682
Total Expenditures	**$ 4,129,497**	**$2,914,939**	**$ 2,478,746**	**$5,312,693**	**$3,750,136**	**$ 3,095,314**
(1) Projected Budget is less public safety and fire protection contract fees						
Projected Revenue Excess (Defecit)			$ (361,279)			$ (367,126)
Excess (Defecit) Percentage of Total Revenues			-17%			-13%

Apply the revenue excess (defecit) percentage to the average monthly rate to project rate impact.

	2014	Projected	2014	Projected
10,000 Gallon Water Bill/Month	$ 26.10	$ 30.55	$ 18.35	$ 20.82
10,000 Gallon Wastewater Bill/Month	$ 43.24	$ 50.62	$ 42.80	$ 48.56
Total Utility Bill	$ 69.34	$ 81.17	$ 61.15	$ 69.38

Average Projected Monthly Bill	
$ 25.69	Water
$ 49.59	Wastewater
$ 75.27	

Appendix D
Annexation Analysis of Sienna Plantation #10 and #12

Feasibility Analysis

Annexation of Sienna Municipal Utility Districts 10 and 12 by the City of Missouri City

March 31, 2015

Feasibility Analysis
Annexation of Sienna Municipal Utility Districts 10 and 12

Introduction:
This analysis follows the same methodology as the March 10, 2015, Sienna Plantation MUDs 2 and 3 Feasibility Annexation Analysis. This report uses data specific to Sienna Plantation MUDs 10 and 12 with certain assumptions and base data as utilized in the MUDs 2 and 3 Study. A significant assumption in this report is the inclusion of the same fire station operating costs as shown in the Sienna 2 and 3 analysis. This cost is included in both reports since they are each considered on a stand-alone basis; in actual practice, these costs would not be duplicated for the annexation of each set of Districts.

Purpose:
Analyze the financial benefits and impacts of annexation by the City of Missouri City of Sienna Plantation Municipal Utility Districts 10 and 12 (the "Districts"). Compare an "annexation scenario" versus a "no annexation scenario" to determine which scenario provides the best financial benefit for the City. This analysis reviews the impacts on both the debt service and general funds of the City. An alternate scenario that allows the Districts to remain in place for limited purposes to reduce the cost impact to the City and residents is also evaluated.

Methodology:
1. Analyze the required debt service tax rate resulting from the combination of the Districts' and the City's existing debt service requirements and assessed valuations.
2. Assuming a constant overall City tax rate of $.57375 (the current rate), calculate the available general fund tax rate and resulting general fund property tax revenues that would be available to the City.
3. Project the "other revenues" generated and the increased costs of service that would be incurred due to the annexation.
4. Identify the net available general fund revenues (new property taxes and other revenues, less new operating expenses) available to City with the "annexation scenario". If the results are neutral or positive, the City is able to cover the costs of annexation; if the results are negative, the annexation will cost the City more than the revenues that will be generated.
5. Analyze a "break even" scenario that that will allow the city to annex the Districts in 2015.

Executive Summary:
Under a typical annexation scenario of dissolving the Districts and assuming their debt upon annexation, the proposed annexation is not cost-effective at this time. The City would not experience net positive revenue until at least 2038. This conclusion is primarily attributable to the high debt load of the Districts and the lack of other revenues (primarily sales tax) to help support the costs of providing services to the Districts. Additionally, per the most recent audits, the Districts have a combined unreimbursed

balance due to developers of $32,207,170 for which bonds have not yet been issued. When bonds are issued to fund these reimbursements, the final maturities of District bonds will likely be extended and/or the annual debt service payments increased.

The proposed annexation is not recommended at this time due to the negative net general fund revenues for costs of service, the outstanding financial obligations for the regional WWTP, and the outstanding unreimbursed developer obligations. Under current conditions, the annexation will not provide a positive financial impact for the City until at least 2038. The analysis should be reviewed periodically to update actual conditions and assumptions.

An alternative method of annexation is explored at the conclusion of the report in which the Districts are annexed, but left in place as "limited districts" so that they can levy a limited tax to subsidize city costs and fund their remaining obligations. This alternative results in a slight increase in overall costs for the residents, but allows the City to "break even" on its costs of service and allows residents to have full municipal services.

1. Analyze the required debt service tax rate resulting from the combination of the Districts' and the City's existing debt service requirements and assessed valuations.

In the absence of any special agreements, when a city annexes a MUD, the city must assume all obligations of the district. At this time, the Districts' audits do not indicate outstanding unreimbursed developer obligations, so the existing outstanding debt is the only debt obligation the city would incur. Other outstanding obligations for construction of the regional WWTP are discussed later in the report.

A required debt service tax rate with and without annexation was calculated with the results summarized below:

Table 1

Year	With Annexation: Combined Debt Service Payments	With Annexation: Combined Assessed Valuation	With Annexation: Combined Debt Service Tax Rate	Without Annexation: City Only Debt Service Tax Rate	Increase Over Projected City-Only Debt Service Tax Rate
2016	$ 13,347,059	$ 5,615,446,143	0.2425	0.1731	**0.0694**
2017	$ 13,006,733	$ 5,727,755,066	0.2317	0.1612	**0.0705**
2018	$ 13,018,636	$ 5,842,310,168	0.2274	0.1576	**0.0698**
2019	$ 11,928,988	$ 5,959,156,371	0.2043	0.1317	**0.0726**
2020	$ 12,007,053	$ 6,078,339,498	0.2016	0.1301	**0.0715**
2021	$ 12,028,603	$ 6,199,906,288	0.1980	0.1271	**0.0708**
2022	$ 12,057,166	$ 6,323,904,414	0.1946	0.1246	**0.0700**
2023	$ 12,107,136	$ 6,450,382,502	0.1915	0.1221	**0.0694**
2024	$ 12,081,162	$ 6,579,390,152	0.1874	0.1187	**0.0687**
2025	$ 11,419,168	$ 6,710,977,956	0.1736	0.1039	**0.0698**
2026	$ 11,440,684	$ 6,845,197,515	0.1705	0.1013	**0.0692**
2027	$ 10,730,658	$ 6,982,101,465	0.1568	0.0867	**0.0701**
2028	$ 10,028,703	$ 7,121,743,494	0.1437	0.0724	**0.0713**
2029	$ 7,776,675	$ 7,264,178,364	0.1092	0.0332	**0.0761**
2030	$ 6,879,598	$ 7,409,461,931	0.0947	0.0203	**0.0745**
2031	$ 5,363,844	$ 7,557,651,170	0.0724	0.0121	**0.0604**
2032	$ 4,257,234	$ 7,708,804,193	0.0564	0.0043	**0.0521**
2033	$ 4,184,669	$ 7,862,980,277	0.0543	0.0031	**0.0512**
2034	$ 3,415,869	$ 8,020,239,883	0.0435	0.0000	**0.0435**
2035	$ 3,425,563	$ 8,180,644,681	0.0427	0.0000	**0.0427**
2036	$ 3,440,150	$ 8,344,257,574	0.0421	0.0000	**0.0421**
2037	$ 3,449,500	$ 8,511,142,726	0.0414	0.0000	**0.0414**
2038	$ 3,468,425	$ 8,681,365,580	0.0408	0.0000	**0.0408**

Refer to the Appendix for expanded detail.

Assumptions:
2% annual assessed valuation growth; 98% tax collection rate

Discussion:
The effect of annexing the Districts and assuming their outstanding debt results in the need to raise the city's debt service tax rate by roughly $.07 per $100 valuation in

comparison to what the City's debt service tax rate would need to be to service its debt only. For reference, the City's current debt service tax rate is $.19337. The current debt for both SPMUD 10 and 12 retires in 2038, not including future debt which may be issued to satisfy the current unreimbursed developer obligations of $32,207,170.

2. Assuming a constant overall City tax rate of $.57375, calculate the available general fund tax rate and resulting general fund property tax revenues that would be available to cover the City's operating costs.

After annexation, the city would levy its general fund property tax on the combined assessed valuation of the city plus the Districts. The available general fund property tax rate would be the total rate less the required debt service rate calculated in section 1. For this analysis, the total City tax rate is assumed to be constant at $.57375.

Table 2

Year	**With Annexation:** Available General Fund Tax Rate	**Without Annexation:** Available General Fund Tax Rate	**With Annexation:** Increase (Decrease) General Fund Property Tax Revenues
2016	0.3312	0.4007	$ (614,215)
2017	0.3420	0.4126	$ (590,051)
2018	0.3464	0.4161	$ (527,829)
2019	0.3695	0.4420	$ (481,885)
2020	0.3722	0.4437	$ (412,854)
2021	0.3758	0.4466	$ (356,408)
2022	0.3792	0.4492	$ (287,109)
2023	0.3822	0.4516	$ (233,834)
2024	0.3864	0.4551	$ (160,194)
2025	0.4001	0.4699	$ (92,263)
2026	0.4032	0.4724	$ (32,408)
2027	0.4169	0.4870	$ 50,383
2028	0.4301	0.5014	$ 112,773
2029	0.4645	0.5406	$ 182,262
2030	0.4790	0.5535	$ 438,212
2031	0.5013	0.5617	$ 1,581,502
2032	0.5174	0.5695	$ 2,324,539
2033	0.5194	0.5707	$ 2,449,431
2034	0.5303	0.5738	$ 3,144,554
2035	0.5310	0.5738	$ 3,266,069
2036	0.5317	0.5738	$ 3,385,314
2037	0.5324	0.5738	$ 3,512,473
2038	0.5330	0.5738	$ 3,632,788

Refer to the Appendix for expanded detail.

Discussion:

With the annexation scenario, the City tax base is larger, but the available General Fund tax rate is smaller, resulting in an initial decrease in General Fund property tax revenues due to the annexation, followed by increases beginning in 2027. If the City incurred no additional costs of service due to the annexation, the City would "break even" or better on new general fund property tax revenues beginning in 2027. This situation occurs because

the debt burden assumed from the Districts absorbs a greater share of the available property tax revenues, leaving less available for general fund purposes.

This calculation is an interim step in the analysis; the additional costs of service and the additional "other" revenues due to the proposed annexation also need to be considered as shown in the next section.

3. Project the "other revenues" generated and the increased costs of service that would be incurred due to the annexation.

With annexation of the Districts, the City would also generate "other revenues" such as franchise fees, fines, permits, etc. The City would also incur additional operating costs for city services such as police, fire, street maintenance, etc. These additional revenues and expenses were extrapolated from current revenues and expenses using appropriate factors such as population, number of homes, or lane-miles depending on the specific item being evaluated. The following figures are annual projections for the first year of the analysis and then they are inflated over time in the projection.

Table 3A

General Fund Revenue Item		With Annexation: Projected Other Revenues
Other Taxes	$	27,500
Licenses & Permits	$	39,500
Fines & Forfeitures	$	110,000
Franchise Fees	$	443,000
Other	$	(250,825)
Total	$	369,175

Table 3B

General Fund Expense Item		With Annexation: Projected Expense
Police	$	960,000
Fire	$	1,500,000
Streets	$	239,000
Parks	$	123,976
Other	$	282,000
Total	$	3,104,976

Refer to the Appendix for expanded detail.

Discussion:

Revenues:

Other Taxes consist of sales tax, primarily attributable to the businesses near Sienna Parkway @ Sienna Ranch and Sienna Parkway @ Bees Passage. These locations contain an estimated 55,000 square feet; this study assumes 25% of that space will generate sales tax and sales are generated at the rate of $200/square foot. Licenses & Permits are primarily maintenance-related mechanical, electrical, and plumbing permits. Fines & Forfeitures consist of fine revenues based on the increased population. The majority of new City revenues due to the annexation are attributable to Franchise Fees. The franchise fees are extrapolated from current City fees using the number of homes in the Districts (total of 2,687) as a percentage in the City (23,897), which translates to a 12% increase. Other Revenues would have an increase in alarm fees, but show an overall decrease due to the elimination of the fire service fee that is currently paid by residents of the Districts

Expenses:

The four major areas of projected cost impact were analyzed. Police expenditures are projected by extrapolating, based on population, the current patrol officer staffing level, plus associated administrative support (64 current patrol officers; an additional 8 would need to be added). Fire costs increase due to the staffing and operations costs of the Sienna fire station. As noted previously, this analysis assumes the full cost of the projected fire station operational costs (same as in the Sienna 2 and 3 analysis), since

each report is considered on a stand-alone basis; in actual practice, these costs would not be duplicated for the annexation of each set of Districts. Street maintenance costs increase based on a ratio of lane miles in the Districts in comparison to the current City (13% increase). Parks maintenance costs are assumed to be relatively minor due to the minimal publicly-maintained facilities within the Districts; a 5% increase in the Parks budget is assumed. Other Expenses are estimated as an additional 10% of costs to cover other miscellaneous or support services provided by the City.

4. Identify the net available general fund revenues available to City with the "annexation scenario".

The Net Available Revenues available to the City with the "annexation" scenario is calculated by adding the available general fund property tax revenues (Table 2) plus the "other" revenues generated due to the annexation (Table 3A), less the increased costs of service due to the annexation (Table 3B).

Table 4

Year	With Annexation: Incremental Available General Fund Property Tax Revenue (Table 2)	With Annexation: Projected Other Revenues (Table 3A)	With Annexation: Projected Expense (Table 3B)	With Annexation: Net Revenues (2+3A+3B)
2016	$ (614,215)	$ 369,175	$ (3,104,976)	$ (3,350,016)
2017	$ (590,051)	$ 376,559	$ (3,198,126)	$ (3,411,619)
2018	$ (527,829)	$ 384,090	$ (3,294,069)	$ (3,437,808)
2019	$ (481,885)	$ 391,771	$ (3,392,891)	$ (3,483,005)
2020	$ (412,854)	$ 399,607	$ (3,494,678)	$ (3,507,926)
2021	$ (356,408)	$ 407,599	$ (3,599,519)	$ (3,548,328)
2022	$ (287,109)	$ 415,751	$ (3,707,504)	$ (3,578,862)
2023	$ (233,834)	$ 424,066	$ (3,818,729)	$ (3,628,497)
2024	$ (160,194)	$ 432,547	$ (3,933,291)	$ (3,660,938)
2025	$ (92,263)	$ 441,198	$ (4,051,290)	$ (3,702,354)
2026	$ (32,408)	$ 450,022	$ (4,172,829)	$ (3,755,215)
2027	$ 50,383	$ 459,023	$ (4,298,013)	$ (3,788,608)
2028	$ 112,773	$ 468,203	$ (4,426,954)	$ (3,845,978)
2029	$ 182,262	$ 477,567	$ (4,559,762)	$ (3,899,933)
2030	$ 438,212	$ 487,119	$ (4,696,555)	$ (3,771,225)
2031	$ 1,581,502	$ 496,861	$ (4,837,452)	$ (2,759,089)
2032	$ 2,324,539	$ 506,798	$ (4,982,576)	$ (2,151,238)
2033	$ 2,449,431	$ 516,934	$ (5,132,053)	$ (2,165,688)
2034	$ 3,144,554	$ 527,273	$ (5,286,014)	$ (1,614,187)
2035	$ 3,266,069	$ 537,818	$ (5,444,595)	$ (1,640,708)
2036	$ 3,385,314	$ 548,575	$ (5,607,933)	$ (1,674,044)
2037	$ 3,512,473	$ 559,546	$ (5,776,171)	$ (1,704,151)
2038	$ 3,632,788	$ 570,737	$ (5,949,456)	$ (1,745,931)

Refer to the Appendix for expanded detail.

Assumptions:
Revenues grow by 2% annually and expenses grow by 3% annually.

Discussion:
When all sources of general fund revenues and expenses are accounted for, the net annual cost to the City for the annexation is significant for the duration of this analysis. Net revenues do not become positive until at least 2038, which date could be extended after debt is issued to fund the current unreimbursed developer obligations of $32,207,170.

Further, the Districts have an outstanding obligation under previous agreements with the City to fund their pro rata share of a regional wastewater treatment plant. If this facility is not constructed prior to annexation, the City would assume the obligation to construct. The Districts have established reserve funds for these future expenses, but the reserves are not fully funded. The Districts currently levy a "contract tax" of $.09 that is dedicated to a WWTP reserve fund. The timing of the construction of the regional WWTP is impossible predict because the construction schedules are contingent upon all six affected utility districts having demand for services and funds available.

Conclusion:
Under a typical annexation scenario of dissolving the Districts and assuming their debt upon annexation, the proposed annexation is not cost-effective at time. This conclusion is primarily attributable to:

- The high debt load of the Districts relative to assessed values; and
- The lack of other revenues (primarily a lack of sales tax) to help support the costs of providing services to the Districts.

The Districts' outstanding debt is 96% of the City's outstanding debt ($76,690,000 vs. $80,186,000, respectively), but the City's assessed value is 6.0 times greater than the Districts' ($4,704,436,564 vs. $785,198,816, respectively). The debt per capita for the Districts is $5,330, but only $8,957 for the City.

The proposed general purpose annexation is not recommended at this time due to the negative net general fund revenues for costs of service, the outstanding financial obligation for the regional WWTP, current unreimbursed developer obligations, and the uncertainty of a construction date for that facility. Under current conditions, the annexation will not provide a positive financial impact for the City until at least 2038. The analysis should be reviewed periodically to update actual conditions and assumptions.

The following section presents a possible modified scenario under which the annexation could occur in 2015.

5. Analyze a "break even" scenario that that will allow the city to annex the Districts in 2015.

To annex the Districts in 2015 and still allow the City to "break even" on the costs of service, additional sources of revenue would be needed to offset the projected negative net revenues. The most likely method would be to convert the Districts to "limited districts" as authorized in Local Government Code 43.0751. The conversion to limited districts would need to be agreed to by the Districts with the specific terms and conditions subject to negotiation between the City and Districts.

Under this scenario, the Districts would be annexed by the City and the City would provide full municipal services. The City would assume the outstanding debt obligations of the Districts, but the Districts would stay in place for the following "limited purposes":
A. Levy a tax with proceeds paid to the City to offset the City's negative net revenues.
B. Levy a tax to fund the District's outstanding regional WWTP costs.
C. Levy a tax to fund the District's operating expenses.

All three of these levies would be required in order for the City to "break even" on costs of services, to avoid the funding obligation for the regional WWTP from being transferred to the City, and to provide the Districts a source of operating funds until they are completely dissolved.

The following are representative additional provisions that should be negotiated as part of the revised SPA:

- Disposition and control of District fund balances and bond reserve funds should be transferred to the City to help pay down existing debt.
- Use of excess District revenues, if any, to pay down debt.
- The entity that will provide water and sewer utility service.
- Trash collection should follow City policy.
- Term, duration, and termination provisions
- Level of City oversight and control of District operations and financial decisions.

Procedurally, converting the Districts to limited districts and revising the existing Strategic Partnership Agreements (SPAs) would require the concurrence of the Districts, with the specific terms and conditions subject to negotiation between the City and Districts. The conversion to limited districts would be accomplished by amending the current SPAs to provide for the "full purpose annexation conversion date" (i.e. 2015) and the other negotiated terms and conditions. To amend the SPAs, two public hearings each by the Districts and the City are required. Simultaneously, the annexation public hearings would also be conducted. After the hearings are completed and the SPAs are adopted, the annexation becomes effective on the annexation conversion date.

Calculation of the Limited Districts' Tax Levies

A. Tax Rate to Offset City Costs: An equivalent District tax rate was calculated that would generate sufficient revenue to offset the negative net City revenues shown in Table 4. This tax rate is initially $.4184 declining to $.1411 by 2038.
B. Contract Tax Rate: For this analysis, the current contract rate to fund the regional WWTP obligations is assumed to remain constant at $.09. *Note:* If the current District general fund reserves are unobligated, it may be possible to negotiate to apply these balances to the costs of the regional WWTP. If this is possible, the contract tax rate may be able to be reduced.
C. Maintenance Tax Rate: A $.05 maintenance tax rate is assumed to cover the Districts' operating continuing operating costs.

At such time that the City cost offset tax rate becomes zero and the regional WWTP obligation is funded, the Districts would be completely dissolved.

The tax rates that would be levied on residents of the Districts are shown below:

Table 5A

Year	City Cost Offset Tax Rate (A)	Contract Tax Rate (B)	O & M Tax Rate (C)	Total District Tax Rate (A+B+C)	District + City Tax Rate
2016	0.4184	0.0900	0.0500	0.5584	1.1321973
2017	0.4178	0.0900	0.0500	0.5578	1.1315364
2018	0.4127	0.0900	0.0500	0.5527	1.1264888
2019	0.4100	0.0900	0.0500	0.5500	1.1237157
2020	0.4048	0.0900	0.0500	0.5448	1.1185529
2021	0.4014	0.0900	0.0500	0.5414	1.1151865
2022	0.3970	0.0900	0.0500	0.5370	1.1107019
2023	0.3946	0.0900	0.0500	0.5346	1.1083159
2024	0.3903	0.0900	0.0500	0.5303	1.1040378
2025	0.3870	0.0900	0.0500	0.5270	1.1007138
2026	0.3848	0.0900	0.0500	0.5248	1.0985429
2027	0.3806	0.0900	0.0500	0.5206	1.0943525
2028	0.3788	0.0900	0.0500	0.5188	1.0925401
2029	0.3766	0.0900	0.0500	0.5166	1.0903227
2030	0.3570	0.0900	0.0500	0.4970	1.0707547
2031	0.2561	0.0900	0.0500	0.3961	0.9698191
2032	0.1957	0.0900	0.0500	0.3357	0.90949
2033	0.1932	0.0900	0.0500	0.3332	0.906941
2034	0.1412	0.0900	0.0500	0.2812	0.8549208
2035	0.1407	0.0900	0.0500	0.2807	0.8544266
2036	0.1407	0.0900	0.0500	0.2807	0.8544705
2037	0.1404	0.0900	0.0500	0.2804	0.8541925
2038	0.1411	0.0900	0.0500	0.2811	0.8548143

Refer to the Appendix for expanded detail.

Discussion:
The projected District tax rate is initially $.5584, declining to $.2811 by 2038. The combined City and District tax rate would begin at $1.1322, which is an increase of $.1922 over the current SPMUDs 10 and 12 rates of $.94.

The combined rate declines over time as the City cost offset tax rate is reduced. Upon dissolution of the Districts, projected as 2038, the residents would pay only the City tax rate.

Cost Impact on Average Home
District residents would pay an additional tax due to the combined tax rates. However, residents would experience decreased costs via the elimination of the current fire operations and sheriff services payments. For this analysis, a post-annexation water/sewer fee was projected by evaluating the District's revised available revenues and expenses and increasing the base rate by the same percentage decrease in net revenues. In this case, that resulted in an average 2.5% utility rate increase for the two Districts. The first-year monthly bill for 10,000 gallons in this analysis is $69.47 for SPMUD 10 and $97.99 for SPMUD 12 (vs. current $68.82 and $93.84, respectively). Garbage fees are assumed to be unaffected by the limited purpose annexation.

Table 5B

Year	Annual Homeowner Cost Without Annexation: MUD Tax, Fire Fee, Sheriff Fee, Utility Bill	Annual Homeowner Cost with Annexation & Limited Districts: MUD and City Tax & Utility Bill	Annual Increase (Decrease)	Monthly Increase (Decrease)
2016	$ 3,769	$ 4,106	$ 337	$ 28.05
2017	$ 3,857	$ 4,197	$ 340	$ 28.31
2018	$ 3,947	$ 4,278	$ 331	$ 27.54
2019	$ 4,039	$ 4,367	$ 327	$ 27.28
2020	$ 4,134	$ 4,451	$ 317	$ 26.41
2021	$ 4,230	$ 4,542	$ 311	$ 25.94
2022	$ 4,329	$ 4,631	$ 302	$ 25.15
2023	$ 4,431	$ 4,729	$ 298	$ 24.86
2024	$ 4,535	$ 4,823	$ 289	$ 24.06
2025	$ 4,641	$ 4,923	$ 282	$ 23.46
2026	$ 4,750	$ 5,028	$ 278	$ 23.14
2027	$ 4,862	$ 5,129	$ 267	$ 22.24
2028	$ 4,977	$ 5,240	$ 264	$ 21.96
2029	$ 5,094	$ 5,352	$ 259	$ 21.55
2030	$ 5,214	$ 5,406	$ 192	$ 15.98
2031	$ 5,337	$ 5,165	$ (172)	$ (14.32)
2032	$ 5,463	$ 5,063	$ (400)	$ (33.37)
2033	$ 5,593	$ 5,172	$ (421)	$ (35.08)
2034	$ 5,725	$ 5,093	$ (632)	$ (52.65)
2035	$ 5,861	$ 5,211	$ (649)	$ (54.12)
2036	$ 6,000	$ 5,334	$ (665)	$ (55.45)
2037	$ 6,142	$ 5,459	$ (683)	$ (56.92)
2038	$ 6,288	$ 5,591	$ (697)	$ (58.12)

Refer to the Appendix for expanded detail.

Discussion:
District residents would experience an initial cost increase of $337 per year or about $28 per month. This increase over the non-annexation scenario decreases over time until 2031, at which time residents would actually experience decreased costs over the non-annexation scenario.

To implement this scenario, both the City Council and the District MUD Boards would need to agree to modify the existing Strategic Partnership Agreements. In exchange for the nominal increased cost, residents would be receiving full municipal services including police service. The City would assume the Districts' outstanding debt and receive a revenue stream to offset its costs of service. Assuming the District Boards would be willing to negotiate revised SPA's, the ultimate question for the Boards would be: *Will the residents feel that the extra cost would be worth the value of receiving full municipal services?* The primary question for the City would be: *Are the intangible benefits of bringing the Sienna residents into the City substantial enough to justify the assumption of the District debt and just breaking-even on costs of service?*

Appendix:
Expanded Tables with Additional Detail
Current MUD Statistical and Audit Data
City/MUD Comparative Data
Water/Sewer Rate Projection Calculation

Appendix

Expanded Tables with Additional Detail
Current MUD Statistical and Audit Data
City/MUD Comparative Data
Water/Sewer Rate Projection Calculation

Expanded Table 1

	Debt Service Payment Schedules				Assessed Valuations				Required Debt Service Tax Rates		
Year	Sienna MUD 10	Sienna MUD 12	City	With Annexation: Combined Debt Service Payments	Sienna MUD 10	Sienna MUD 12	City	With Annexation: Combined Assessed Valuation	With Annexation: Combined Debt Service Tax Rate	City-Only without Annexation	Increase Over Projected City-Only Debt Service Tax Rate
2016	$ 3,472,715	$ 1,734,841	$ 8,139,503	$ 13,347,059	$ 508,840,245	$ 308,080,603	$ 4,798,525,295	$ 5,615,446,143	0.2425	0.1731	**0.0694**
2017	$ 3,499,446	$ 1,775,814	$ 7,731,473	$ 13,006,733	$ 519,017,050	$ 314,242,215	$ 4,894,495,801	$ 5,727,755,066	0.2317	0.1612	**0.0705**
2018	$ 3,516,911	$ 1,789,830	$ 7,711,894	$ 13,018,636	$ 529,397,391	$ 320,527,060	$ 4,992,385,717	$ 5,842,310,168	0.2274	0.1576	**0.0698**
2019	$ 3,544,694	$ 1,811,683	$ 6,572,611	$ 11,928,988	$ 539,985,339	$ 326,937,601	$ 5,092,233,432	$ 5,959,156,371	0.2043	0.1317	**0.0726**
2020	$ 3,568,309	$ 1,816,526	$ 6,622,218	$ 12,007,053	$ 550,785,045	$ 333,476,353	$ 5,194,078,100	$ 6,078,339,498	0.2016	0.1301	**0.0715**
2021	$ 3,601,574	$ 1,826,255	$ 6,600,775	$ 12,028,603	$ 561,800,746	$ 340,145,880	$ 5,297,959,662	$ 6,199,906,288	0.1980	0.1271	**0.0708**
2022	$ 3,622,874	$ 1,837,084	$ 6,597,209	$ 12,057,166	$ 573,036,761	$ 346,948,798	$ 5,403,918,855	$ 6,323,904,414	0.1946	0.1246	**0.0700**
2023	$ 3,663,001	$ 1,847,139	$ 6,596,996	$ 12,107,136	$ 584,497,496	$ 353,887,773	$ 5,511,997,233	$ 6,450,382,502	0.1915	0.1221	**0.0694**
2024	$ 3,687,371	$ 1,854,655	$ 6,539,136	$ 12,081,162	$ 596,187,446	$ 360,965,529	$ 5,622,237,177	$ 6,579,390,152	0.1874	0.1187	**0.0687**
2025	$ 3,707,778	$ 1,873,954	$ 5,837,437	$ 11,419,168	$ 608,111,195	$ 368,184,840	$ 5,734,681,921	$ 6,710,977,956	0.1736	0.1039	**0.0698**
2026	$ 3,747,156	$ 1,884,510	$ 5,809,018	$ 11,440,684	$ 620,273,419	$ 375,548,536	$ 5,849,375,559	$ 6,845,197,515	0.1705	0.1013	**0.0692**
2027	$ 3,774,539	$ 1,886,321	$ 5,069,798	$ 10,730,658	$ 632,678,888	$ 383,059,507	$ 5,966,363,070	$ 6,982,101,465	0.1568	0.0867	**0.0701**
2028	$ 3,813,314	$ 1,899,381	$ 4,316,008	$ 10,028,703	$ 645,332,465	$ 390,720,697	$ 6,085,690,332	$ 7,121,743,494	0.1437	0.0724	**0.0713**
2029	$ 3,846,309	$ 1,913,406	$ 2,016,960	$ 7,776,675	$ 658,239,115	$ 398,535,111	$ 6,207,404,138	$ 7,264,178,364	0.1092	0.0332	**0.0761**
2030	$ 3,714,243	$ 1,908,363	$ 1,256,993	$ 6,879,598	$ 671,403,897	$ 406,505,813	$ 6,331,552,221	$ 7,409,461,931	0.0947	0.0203	**0.0745**
2031	$ 2,681,613	$ 1,918,919	$ 763,313	$ 5,363,844	$ 684,831,975	$ 414,635,930	$ 6,458,183,266	$ 7,557,651,170	0.0724	0.0121	**0.0604**
2032	$ 2,280,338	$ 1,700,797	$ 276,100	$ 4,257,234	$ 698,528,614	$ 422,928,648	$ 6,587,346,931	$ 7,708,804,193	0.0564	0.0043	**0.0521**
2033	$ 2,282,475	$ 1,699,881	$ 202,313	$ 4,184,669	$ 712,499,187	$ 431,387,221	$ 6,719,093,869	$ 7,862,980,277	0.0543	0.0031	**0.0512**
2034	$ 2,283,700	$ 1,132,169	$ -	$ 3,415,869	$ 726,749,170	$ 440,014,966	$ 6,853,475,747	$ 8,020,239,883	0.0435	0.0000	**0.0435**
2035	$ 2,287,538	$ 1,138,025	$ -	$ 3,425,563	$ 741,284,154	$ 448,815,265	$ 6,990,545,262	$ 8,180,644,681	0.0427	0.0000	**0.0427**
2036	$ 2,298,425	$ 1,141,725	$ -	$ 3,440,150	$ 756,109,837	$ 457,791,570	$ 7,130,356,167	$ 8,344,257,574	0.0421	0.0000	**0.0421**
2037	$ 2,305,975	$ 1,143,525	$ -	$ 3,449,500	$ 771,232,034	$ 466,947,402	$ 7,272,963,290	$ 8,511,142,726	0.0414	0.0000	**0.0414**
2038	$ 2,315,200	$ 1,153,225	$ -	$ 3,468,425	$ 786,656,674	$ 476,286,350	$ 7,418,422,556	$ 8,681,365,580	0.0408	0.0000	**0.0408**

MUD debt service schedules from Texas Municipal Reports; City schedules from budget.
Assessed valuations projected from 2015 actual values assuming 2% annual growth.
Tax collection rate: 98%
For Reference: Current Debt Service Tax Rates:

MUD 2	$ 0.81
MUD 3	$ 0.81
City	$ 0.19337

Expanded Table 2

	With Annexation - General Fund Tax Rate & Revenue			Without Annexation-General Fund Tax Rate & Revenue			Difference
Year	With Annexation: Available General Fund Tax Rate	With Annexation: Combined Assessed Valuation	With Annexation: General Fund Revenue with Available GF Tax Rate	Without Annexation: Available General Fund Tax Rate	Without Annexation: City-Only Assessed Valuation	Without Annexation: General Fund Revenue with Available GF Tax Rate	With Annexation: Increase (Decrease) General Fund Property Tax Revenues
2016	0.3312	$ 5,615,446,143	$ 18,227,191	0.4007	$ 4,798,525,295	$ 18,841,405	$ (614,215)
2017	0.3420	$ 5,727,755,066	$ 19,199,002	0.4126	$ 4,894,495,801	$ 19,789,054	$ (590,051)
2018	0.3464	$ 5,842,310,168	$ 19,831,214	0.4161	$ 4,992,385,717	$ 20,359,042	$ (527,829)
2019	0.3695	$ 5,959,156,371	$ 21,577,859	0.4420	$ 5,092,233,432	$ 22,059,744	$ (481,885)
2020	0.3722	$ 6,078,339,498	$ 22,169,930	0.4437	$ 5,194,078,100	$ 22,582,784	$ (412,854)
2021	0.3758	$ 6,199,906,288	$ 22,831,920	0.4466	$ 5,297,959,662	$ 23,188,328	$ (356,408)
2022	0.3792	$ 6,323,904,414	$ 23,500,567	0.4492	$ 5,403,918,855	$ 23,787,676	$ (287,109)
2023	0.3822	$ 6,450,382,502	$ 24,161,752	0.4516	$ 5,511,997,233	$ 24,395,586	$ (233,834)
2024	0.3864	$ 6,579,390,152	$ 24,913,104	0.4551	$ 5,622,237,177	$ 25,073,298	$ (160,194)
2025	0.4001	$ 6,710,977,956	$ 26,314,983	0.4699	$ 5,734,681,921	$ 26,407,246	$ (92,263)
2026	0.4032	$ 6,845,197,515	$ 27,048,151	0.4724	$ 5,849,375,559	$ 27,080,559	$ (32,408)
2027	0.4169	$ 6,982,101,465	$ 28,527,953	0.4870	$ 5,966,363,070	$ 28,477,570	$ 50,383
2028	0.4301	$ 7,121,743,494	$ 30,015,080	0.5014	$ 6,085,690,332	$ 29,902,307	$ 112,773
2029	0.4645	$ 7,264,178,364	$ 33,067,984	0.5406	$ 6,207,404,138	$ 32,885,722	$ 182,262
2030	0.4790	$ 7,409,461,931	$ 34,781,955	0.5535	$ 6,331,552,221	$ 34,343,743	$ 438,212
2031	0.5013	$ 7,557,651,170	$ 37,130,939	0.5617	$ 6,458,183,266	$ 35,549,437	$ 1,581,502
2032	0.5174	$ 7,708,804,193	$ 39,087,444	0.5695	$ 6,587,346,931	$ 36,762,905	$ 2,324,539
2033	0.5194	$ 7,862,980,277	$ 40,026,904	0.5707	$ 6,719,093,869	$ 37,577,473	$ 2,449,431
2034	0.5303	$ 8,020,239,883	$ 41,679,935	0.5738	$ 6,853,475,747	$ 38,535,381	$ 3,144,554
2035	0.5310	$ 8,180,644,681	$ 42,572,157	0.5738	$ 6,990,545,262	$ 39,306,088	$ 3,266,069
2036	0.5317	$ 8,344,257,574	$ 43,477,524	0.5738	$ 7,130,356,167	$ 40,092,210	$ 3,385,314
2037	0.5324	$ 8,511,142,726	$ 44,406,528	0.5738	$ 7,272,963,290	$ 40,894,054	$ 3,512,473
2038	0.5330	$ 8,681,365,580	$ 45,344,723	0.5738	$ 7,418,422,556	$ 41,711,935	$ 3,632,788

Assessed valuations projected from 2015 actual values assuming 2% annual growth.
Tax collection rate: 98%
For Reference: Current City General Fund Tax Rate: $ 0.38038

Expanded Table 3A

Projected "Other" City General Fund Revenues Derived from Sienna MUDs 2 and 3 (excluding property tax)

		FY 2015 City Budget	2016 Revenues from Sienna MUDs 2 & 3	Basis/Comment
310 OTHER TAXES				
0100	City Retail Sales Tax	$ 8,000,000	$ 27,500	Businesses at Sienna Parkway @ Sienna Ranch and Bees Passage (Est. 55,000 SF x 25% generating sales tax @$200/SF x 1%)
0200	State Beverage Tax	$ 30,000	$ -	Assume minimal activity
	Total Other Taxes	**$ 8,030,000**	**$ 27,500**	
320 LICENSES & PERMITS				
0100	Zoning Variances		$ -	
0200	Zoning Amendments		$ -	Assume minimal activity
0300	Plat Fees		$ -	Assume minimal activity
0400	Recall Inspection Fees		$ -	Assume minimal activity
0500	General Fire Inspection		$ -	Assume minimal activity
0600	Building Permits		$ -	Assume minimal activity
0700	Change of Occupancy		$ -	Assume minimal activity
0800	Plumbing Permits	$ 100,000	$ 12,000	Prorated on population; rounded to nearest $1,000
0900	Electrical Permits	$ 100,000	$ 12,000	Prorated on population; rounded to nearest $1,000
1000	Air Conditioning Permits	$ 95,000	$ 11,000	Prorated on population; rounded to nearest $1,000
1100	Pool Permits	$ 3,000	$ -	Prorated on population; rounded to nearest $1,000
1200	Sign Permits		$ -	Assume minimal activity
1300	Electrical License		$ -	
1400	Plan Check Fees		$ -	Assume minimal activity
1500	After Hours Inspections		$ -	Assume minimal activity
1600	Liquor License		$ -	Assume no alcohol sales
1700	Solicitors License	$ -	$ -	Prorated on population; rounded to nearest $1,000
1800	Infrastructure Fees		$ -	Assume minimal activity
2000	Lien Reimbursement		$ -	Assume minimal activity
2200	Health Permits	$ 95,000	$ 1,000	Businesses at Sienna Parkway @ Sienna Ranch and Bees Passage
2300	Housing Code Inspections		$ -	Discontinued
2400	Pub Works After Hrs Inspection		$ -	Assume minimal activity
2500	Sienna Plantation - Prorata	$ 62,000	$ -	Will continue for other Sienna Areas, but no incremental revenue due to annexation
2600	Contractor Registration Fees		$ -	Will not increase due to annexation
2700	Design Review		$ -	Assume minimal activity
2800	Pub Works Plan Review Fee		$ -	Assume minimal activity
2900	Riverstone Inspection Fee		$ -	Not applicable
3000	Housing Rental Registration	$ 60,000	$ 3,500	Prorated on population; rounded to nearest $1,000, but assume rental rate half of current city rate
	Total Licenses & Permits	**$ 515,000**	**$ 39,500**	
330 FINES AND FORFEITURES				
0100	Fines	$ 700,000	$ 83,000	Prorated on population; rounded to nearest $1,000
0300	Warrant Fees	$ 60,000	$ 7,000	Prorated on population; rounded to nearest $1,000
0400	DDC/Insurance	$ 15,000	$ 2,000	Prorated on population; rounded to nearest $1,000
0500	Administrative Fee	$ 32,000	$ 4,000	Prorated on population; rounded to nearest $1,000
0600	Arrest Fees	$ 40,000	$ 5,000	Prorated on population; rounded to nearest $1,000
0700	Cash Over & Under		$ -	
0900	Misc Municipal Court Fees		$ -	
1000	Collection Agency Fees	$ 50,000	$ 6,000	Prorated on population; rounded to nearest $1,000
1100	Judicial Efficiency	$ 4,000	$ -	Prorated on population; rounded to nearest $1,000
1200	Local - No Restriction	$ 25,000	$ 3,000	Prorated on population; rounded to nearest $1,000
1300	Over Payment		$ -	
1500	Motor Carrier Fines		$ -	Assume minimal activity
1600	Overweight Vehicle Fines		$ -	
	Total Fines & Forfeitures	**$ 926,000**	**$ 110,000**	
340 FRANCHISE FEES				
0100	Franchise Fee - Gas	$ 350,000	$ 42,000	Prorated on population; rounded to nearest $1,000
0200	Franchise Fee - Phone	$ 350,000	$ 42,000	Prorated on population; rounded to nearest $1,000
0300	Franchise Fee - Electric	$ 2,000,000	$ 237,000	Prorated on population; rounded to nearest $1,000
0400	Franchise Fee - Cable TV	$ 675,000	$ 80,000	Prorated on population; rounded to nearest $1,000
	Solid Waste	$ 350,000	$ 42,000	Prorated on population; rounded to nearest $1,000
	Total Franchise Fees	**$ 3,725,000**	**$ 443,000**	
350 INTERGOVERNMENTAL REVENUE				
0100	Grants		$ -	No additional Revenue due to annexation
0101	Federal Grants		$ -	No additional Revenue due to annexation
0102	State Grants		$ -	No additional Revenue due to annexation
0103	Miscellaneous Grants		$ -	No additional Revenue due to annexation
0300	Fire Dept. Reimbursement		$ -	No additional Revenue due to annexation
0900	Animal Control Reimb-Stafford		$ -	No additional Revenue due to annexation
1300	Sta-Mo Lease Reimbursement		$ -	No additional Revenue due to annexation
	Total Intergovernmental Revenues	$ -	$ -	

Expanded Table 3A

Projected "Other" City General Fund Revenues Derived from Sienna MUDs 2 and 3 (excluding property tax)

		FY 2015 City Budget	2016 Revenues from Sienna MUDs 2 & 3	Basis/Comment
380	OTHER REVENUE			
0100	Interest Income		$ -	No additional Revenue due to annexation
0200	Cash Over/Under-Cashiers		$ -	
0300	Maps		$ -	
0400	Cash Over/Under-Pcard		$ -	
600	Pcard Rebate	$ 120,000	$ 6,000	Assume 5% increase
0900	Recreation Leisure Classes		$ -	No additional Revenue due to annexation; Sienna residents already have access to Receation programs
1000	Athletic League Fees		$ -	No additional Revenue due to annexation; Sienna residents already have access to Receation programs
1100	Recreation Center Fees		$ -	No additional Revenue due to annexation; Sienna residents already have access to Receation programs
1200	Special Events		$ -	No additional Revenue due to annexation
1300	Rec - Advertising Fees		$ -	
1400	MCTV Sponsorships		$ -	No additional Revenue due to annexation
1500	Facilities Rental		$ -	No additional Revenue due to annexation; Sienna residents already have access to rent facilities
1501	Security Fees		$ -	
1800	Other/Miscellaneous		$ -	Assume minimal activity
2000	NSF Check Allowance		$ -	Assume minimal activity
2100	Sale of Salvage		$ -	Assume minimal activity
2300	Insurance Reimbursements		$ -	Assume minimal activity
2500	Missouri City History Books		$ -	Assume minimal activity
2600	PM Burglar False Alarm	$ 60,000	$ 7,000	Prorated on population; rounded to nearest $1,000
2700	Unpermitted Burglar Alarms	$ 2,000	$ -	Prorated on population; rounded to nearest $1,000
2800	PM Fire Flase Alarm	$ -	$ -	Prorated on population; rounded to nearest $1,000
2900	Alarm Permit Fees	$ 350,000	$ 67,175	$50/home times number of Sienna 2 and 3 homes times 50%
3000	Unpermitted Fire Alarms		$ -	Assume minimal activity
3200	Pavement Maintenance		$ -	
3300	Recycling		$ -	Assume minimal activity
3400	Solid WasteSubscribers		$ -	
3401	Solid Waste Admin Fee		$ -	
3402	Solid Waste MUD Pmts		$ -	
3403	Collection Fees		$ -	
3600	Miscellaneous - Police		$ -	No additional Revenue due to annexation
3800	Animal License Fees	$ 2,500	$ -	Prorated on population; rounded to nearest $1,000
3900	Donations - Police		$ -	No additional Revenue due to annexation
4000	Donations - Parks		$ -	
4100	Donations - Fire		$ -	No additional Revenue due to annexation
4200	Donations - Economic Development		$ -	
4300	Donation - 50th Anniversary		$ -	No additional Revenue due to annexation
4700	Traffic Control Operation		$ -	
4800	Donations-Urban Forestry		$ -	
5000	Police Dept Miscellaneous		$ -	No additional Revenue due to annexation
6400	Child Safety Fees	$ -	$ -	Prorated on population; rounded to nearest $1,000
7100	Fire Dept Miscellaneous		$ -	No additional Revenue due to annexation
7300	Parks Dept Miscellaneous		$ -	
7400	Recreation Dept Miscellaneous		$ -	
7500	City Secretary Dept Miscellaneous		$ -	
7600	Street Dept Miscellaneous		$ -	Assume minimal activity
7800	Engineering Dept Miscellaneous		$ -	
7900	EMS Billings		$ -	
8000	Fire Seminars		$ -	
8100	Late Fees		$ -	
8200	Protector Pavers		$ -	
8300	Purchasing Miscellaneous		$ -	No additional Revenue due to annexation
8400	Fire District Pmts	$ 850,000	$ (331,000)	Reduction in payments due to annexation - see separate detail
8500	Disaster Reimbursement		$ -	
8600	GRP Admin Fee Reimb		$ -	
8800	Tower Lease		$ -	
9800	Unapplied Personnel Costs		$ -	
	Total Other Revenue	$ 1,384,500	$ (250,825)	
	Total Revenues	$ 14,580,500	$ 369,175	

Expanded Table 3B

Assume majority of expenses in police, fire, streets/drainage/traffic control, and parks

Police			
Current Patrol Division Staff		64	
Added Patrol staff		8	Prorated on population
Average Cost/Officer	$	100,000	
Total Annual Officer Cost	$	800,000	
Admin Support Allowance	$	160,000	20%
Total Added Police Cst	**$**	**960,000**	

Fire			
Sienna Station Operations	**$**	**1,500,000**	Cost included with SPMUDs 2&3

Streets/Drainage/Traffic Control			
Current Budget	Amount		
Personnel	$	770,169	(2015 Budget)
Cont. Svcs	$	308,963	(2015 Budget)
Other Services	$	755,058	(2015 Budget)
Total Current Street/Drain/Traffic	$	1,834,190	(2015 Budget)
Added Street/Drainage/Traffic Cost	**$**	**239,000**	Prorated on lane miles

Parks			
Current Budget	Amount		
Parks Administration	$	1,598,481	(2015 Budget)
Recreation	$	881,046	(2015 Budget)
Total Current Parks	$	2,479,527	(2015 Budget)
Added Parks & Recreation Cost	$	123,976	5% projected increase

Total Added Expense Estimate			
Total Police, Fire, Street/Drain/Traffic & Parks	$	2,822,976	
Misc. Allowance	$	282,000	10%
Total Estimated Cost Impact	$	3,104,976	

Data

	Sienna MUDs 10 & 12	City	Sienna % Increase
Homes	2,762	23,897	11.6%
Population	8,330	70,185	11.9%
Lane-Miles	82.88	636	13.0%

Expanded Table 4

Year	**With Annexation:** Incremental Available General Fund Property Tax Revenue (Table 2)	**With Annexation:** Projected Other Revenues (Table 3A)	**With Annexation:** Projected Expense (Table 3B)	**With Annexation:** Net Revenues (2+3A+3B)
2016	$ (614,215)	$ 369,175	$ (3,104,976)	$ (3,350,016)
2017	$ (590,051)	$ 376,559	$ (3,198,126)	$ (3,411,619)
2018	$ (527,829)	$ 384,090	$ (3,294,069)	$ (3,437,808)
2019	$ (481,885)	$ 391,771	$ (3,392,891)	$ (3,483,005)
2020	$ (412,854)	$ 399,607	$ (3,494,678)	$ (3,507,926)
2021	$ (356,408)	$ 407,599	$ (3,599,519)	$ (3,548,328)
2022	$ (287,109)	$ 415,751	$ (3,707,504)	$ (3,578,862)
2023	$ (233,834)	$ 424,066	$ (3,818,729)	$ (3,628,497)
2024	$ (160,194)	$ 432,547	$ (3,933,291)	$ (3,660,938)
2025	$ (92,263)	$ 441,198	$ (4,051,290)	$ (3,702,354)
2026	$ (32,408)	$ 450,022	$ (4,172,829)	$ (3,755,215)
2027	$ 50,383	$ 459,023	$ (4,298,013)	$ (3,788,608)
2028	$ 112,773	$ 468,203	$ (4,426,954)	$ (3,845,978)
2029	$ 182,262	$ 477,567	$ (4,559,762)	$ (3,899,933)
2030	$ 438,212	$ 487,119	$ (4,696,555)	$ (3,771,225)
2031	$ 1,581,502	$ 496,861	$ (4,837,452)	$ (2,759,089)
2032	$ 2,324,539	$ 506,798	$ (4,982,576)	$ (2,151,238)
2033	$ 2,449,431	$ 516,934	$ (5,132,053)	$ (2,165,688)
2034	$ 3,144,554	$ 527,273	$ (5,286,014)	$ (1,614,187)
2035	$ 3,266,069	$ 537,818	$ (5,444,595)	$ (1,640,708)
2036	$ 3,385,314	$ 548,575	$ (5,607,933)	$ (1,674,044)
2037	$ 3,512,473	$ 559,546	$ (5,776,171)	$ (1,704,151)
2038	$ 3,632,788	$ 570,737	$ (5,949,456)	$ (1,745,931)

Equivalent tax increase (decrease) calculated with combined City and MUD valuations.
Tax collection rate: 98%

Expanded Table 5A

Year	City Cost Offset Tax Rate (A)	City Subsidy Revenue	Contract Tax Rate (B)	Contract Revenues (for Regional WWTP)	O & M Tax Rate (C)	MUD O&M Revenues (including fire station costs)	Total District Tax Rate (A+B+C)	District + City Tax Rate
2016	0.4184	$ 3,350,016	0.0900	$ 539,108	0.0500	$ 392,442	0.5584	1.13219734
2017	0.4178	$ 3,411,619	0.0900	$ 549,890	0.0500	$ 400,291	0.5578	1.13153635
2018	0.4127	$ 3,437,808	0.0900	$ 560,888	0.0500	$ 408,297	0.5527	1.12648876
2019	0.4100	$ 3,483,005	0.0900	$ 572,106	0.0500	$ 416,463	0.5500	1.12371574
2020	0.4048	$ 3,507,926	0.0900	$ 583,548	0.0500	$ 424,792	0.5448	1.11855291
2021	0.4014	$ 3,548,328	0.0900	$ 595,219	0.0500	$ 433,288	0.5414	1.11518648
2022	0.3970	$ 3,578,862	0.0900	$ 607,123	0.0500	$ 441,954	0.5370	1.11070186
2023	0.3946	$ 3,628,497	0.0900	$ 619,266	0.0500	$ 450,793	0.5346	1.10831592
2024	0.3903	$ 3,660,938	0.0900	$ 631,651	0.0500	$ 459,809	0.5303	1.10403779
2025	0.3870	$ 3,702,354	0.0900	$ 644,284	0.0500	$ 469,005	0.5270	1.10071383
2026	0.3848	$ 3,755,215	0.0900	$ 657,170	0.0500	$ 478,385	0.5248	1.09854285
2027	0.3806	$ 3,788,608	0.0900	$ 670,313	0.0500	$ 487,953	0.5206	1.09435255
2028	0.3788	$ 3,845,978	0.0900	$ 683,719	0.0500	$ 497,712	0.5188	1.09254013
2029	0.3766	$ 3,899,933	0.0900	$ 697,394	0.0500	$ 507,666	0.5166	1.09032272
2030	0.3570	$ 3,771,225	0.0900	$ 711,342	0.0500	$ 517,819	0.4970	1.07075473
2031	0.2561	$ 2,759,089	0.0900	$ 725,569	0.0500	$ 528,176	0.3961	0.96981905
2032	0.1957	$ 2,151,238	0.0900	$ 740,080	0.0500	$ 538,739	0.3357	0.90949003
2033	0.1932	$ 2,165,688	0.0900	$ 754,881	0.0500	$ 549,514	0.3332	0.90694098
2034	0.1412	$ 1,614,187	0.0900	$ 769,979	0.0500	$ 560,504	0.2812	0.85492077
2035	0.1407	$ 1,640,708	0.0900	$ 785,379	0.0500	$ 571,714	0.2807	0.8544266
2036	0.1407	$ 1,674,044	0.0900	$ 801,086	0.0500	$ 583,149	0.2807	0.85447049
2037	0.1404	$ 1,704,151	0.0900	$ 817,108	0.0500	$ 594,812	0.2804	0.85419246
2038	0.1411	$ 1,745,931	0.0900	$ 833,450	0.0500	$ 606,708	0.2811	0.85481433

Revenues based on projected assessed valuations of each MUD.
Tax collection rate: 98%

Expanded Table 5B

		Without Annexation					With Annexation & Limited Districts					Difference	
Year	Average Home Value	Taxes @ current Average MUD Tax Rate	Fire Fee @ $10.00/month	Sheriff Service @ $6.50/month	Water and Wastewater Utility Bill	Total Annual Homeowner Cost Without Annexation: MUD Tax, Fire Fee, Sheriff Fee, Utility Bill	Taxes @ Combined City and Limited District Tax Rates	Fire Fee @ $10.00/month	Sheriff Service @ $6.50/month	Water and Wastewater Utility Bill	Total Annual Homeowner Cost with Annexation & Limited Districts: MUD and City Tax & Utility Bill	Annual Increase (Decrease)	Monthly Increase (Decrease)
2016	$ 268,494	$ 2,524	$ 127	$ 83	$ 1,035	$ 3,769	$ 3,040	$ -	$ -	$ 1,066	$ 4,106	$ 337	$ 28.05
2017	$ 273,864	$ 2,574	$ 131	$ 85	$ 1,066	$ 3,857	$ 3,099	$ -	$ -	$ 1,098	$ 4,197	$ 340	$ 28.31
2018	$ 279,341	$ 2,626	$ 135	$ 88	$ 1,098	$ 3,947	$ 3,147	$ -	$ -	$ 1,131	$ 4,278	$ 331	$ 27.54
2019	$ 284,928	$ 2,678	$ 139	$ 90	$ 1,131	$ 4,039	$ 3,202	$ -	$ -	$ 1,165	$ 4,367	$ 327	$ 27.28
2020	$ 290,626	$ 2,732	$ 143	$ 93	$ 1,165	$ 4,134	$ 3,251	$ -	$ -	$ 1,200	$ 4,451	$ 317	$ 26.41
2021	$ 296,439	$ 2,787	$ 148	$ 96	$ 1,200	$ 4,230	$ 3,306	$ -	$ -	$ 1,236	$ 4,542	$ 311	$ 25.94
2022	$ 302,368	$ 2,842	$ 152	$ 99	$ 1,236	$ 4,329	$ 3,358	$ -	$ -	$ 1,273	$ 4,631	$ 302	$ 25.15
2023	$ 308,415	$ 2,899	$ 157	$ 102	$ 1,273	$ 4,431	$ 3,418	$ -	$ -	$ 1,311	$ 4,729	$ 298	$ 24.86
2024	$ 314,583	$ 2,957	$ 161	$ 105	$ 1,312	$ 4,535	$ 3,473	$ -	$ -	$ 1,350	$ 4,823	$ 289	$ 24.06
2025	$ 320,875	$ 3,016	$ 166	$ 108	$ 1,351	$ 4,641	$ 3,532	$ -	$ -	$ 1,391	$ 4,923	$ 282	$ 23.46
2026	$ 327,293	$ 3,077	$ 171	$ 111	$ 1,391	$ 4,750	$ 3,595	$ -	$ -	$ 1,433	$ 5,028	$ 278	$ 23.14
2027	$ 333,838	$ 3,138	$ 176	$ 115	$ 1,433	$ 4,862	$ 3,653	$ -	$ -	$ 1,476	$ 5,129	$ 267	$ 22.24
2028	$ 340,515	$ 3,201	$ 182	$ 118	$ 1,476	$ 4,977	$ 3,720	$ -	$ -	$ 1,520	$ 5,240	$ 264	$ 21.96
2029	$ 347,326	$ 3,265	$ 187	$ 122	$ 1,521	$ 5,094	$ 3,787	$ -	$ -	$ 1,565	$ 5,352	$ 259	$ 21.55
2030	$ 354,272	$ 3,330	$ 193	$ 125	$ 1,566	$ 5,214	$ 3,793	$ -	$ -	$ 1,612	$ 5,406	$ 192	$ 15.98
2031	$ 361,358	$ 3,397	$ 198	$ 129	$ 1,613	$ 5,337	$ 3,505	$ -	$ -	$ 1,661	$ 5,165	$ (172)	$ (14.32)
2032	$ 368,585	$ 3,465	$ 204	$ 133	$ 1,662	$ 5,463	$ 3,352	$ -	$ -	$ 1,711	$ 5,063	$ (400)	$ (33.37)
2033	$ 375,956	$ 3,534	$ 210	$ 137	$ 1,711	$ 5,593	$ 3,410	$ -	$ -	$ 1,762	$ 5,172	$ (421)	$ (35.08)
2034	$ 383,475	$ 3,605	$ 217	$ 141	$ 1,763	$ 5,725	$ 3,278	$ -	$ -	$ 1,815	$ 5,093	$ (632)	$ (52.65)
2035	$ 391,145	$ 3,677	$ 223	$ 145	$ 1,816	$ 5,861	$ 3,342	$ -	$ -	$ 1,869	$ 5,211	$ (649)	$ (54.12)
2036	$ 398,968	$ 3,750	$ 230	$ 149	$ 1,870	$ 6,000	$ 3,409	$ -	$ -	$ 1,925	$ 5,334	$ (665)	$ (55.45)
2037	$ 406,947	$ 3,825	$ 237	$ 154	$ 1,926	$ 6,142	$ 3,476	$ -	$ -	$ 1,983	$ 5,459	$ (683)	$ (56.92)
2038	$ 415,086	$ 3,902	$ 244	$ 159	$ 1,984	$ 6,288	$ 3,548	$ -	$ -	$ 2,043	$ 5,591	$ (697)	$ (58.12)

'Without Annexation' taxes based on average District tax rate of $0.94
"With Annexation" taxes based on combined City and Limited District tax rate from Table 4.
Tax collection rate: 98%

Statistical Information

2014 Texas Municipal Report or Audit Information (7/31/14)

	Sienna 10	Sienna 12	Total	
Assessed Valuation	$ 489,081,358	$ 296,117,458	$ 785,198,816	
Maintenance Tax	$ 0.05	$ 0.08		
Contract Tax	$ 0.08	$ 0.05		<<< Passed thru to MUD 1 for obligations to MUD 1
Debt Tax	$ 0.81	$ 0.81		
Total Tax	$ 0.94	$ 0.94		
General "Unassigned" Fund Balance	$ 1,677,975	$ 914,817	$ 2,592,792	
Debt Service Fund Balance (Restricted)	$ 2,707,032	$ 1,862,725	$ 4,569,757	
Capital Projects Fund Balance (Restricted)	$ 470,638	$ 52,780	$ 523,418	
Outstanding Debt	$ 50,930,000	$ 25,760,000	$ 76,690,000	
Unissued Debt Authority (GO and Refunding)	$ 150,050,000	$ 88,655,000	$ 238,705,000	
Due to developer	$ 7,794,277	$ 24,412,893	$ 32,207,170	

Other Statistics

	Sienna 10	Sienna 12	Total	
Acreage	943.81	1,085.47	2,029.28	
Wastewater Utility Connections	1,895	792	2,687	Audit
Water Utility Connections	1,907	855	2,762	GRP Report 12/14
Estimated Population	5,912	2,651	8,562	
Lane Miles	46.62433	36.25416	82.88	

City & MUD Comparative Data

	Existing City	Sienna MUDs 10 & 12	Increase
Area	19,293	2,029	11%
Homes	23,897	2,687	11%
Population	70,185	8,562	12%
Lane-Miles	636	83	13%
Assessed Valuation	$ 4,704,436,564	$ 785,198,816	17%
Outstanding Debt *	$ 80,186,000	$ 76,690,000	96%
Debt per Capita	$ 1,142	$ 8,957	NA
Debt:AV Ratio	1.7%	9.8%	NA

* Texas Municipal Reports

Projected Utility Bill Imapct with Limited District Scenario

Revenues	SPMUD 10 2014 Actual Budget 12 Months	Projected Budget with Limited District	SPMUD 12 2014 Actual Budge 12 Months	Projected Budget with Limited District
Water Service	$ 771,102	$ 771,102	$ 355,940	$ 355,940
Sewer Service	$1,148,542	$ 1,148,542	$ 314,243	$ 314,243
Fire Service	$ 226,357		$ 63,851	
Property Taxes	$ 555,111		$ 190,224	
Penalties and Interest	$ 51,140		$ 13,460	
Tap Connections/Inspections	$ 68,637	$ 30,000	$ 606,864	$ 300,000
Surface Water	$ 589,890	$ 589,890	$ 431,581	$ 431,581
Interest Earnings	$ -	$ -		$ -
Miscellaneous	$ 13,406	$ 13,406	$ 25,914	$ 25,914
Investment Earnings	$ 708	$ 708	$ 767	$ 767
Total Revenues	**$3,424,893**	**$ 2,553,648**	**$2,002,844**	**$ 1,428,445**
Expenditures				
Purchased Water	$ 764,480	$ 764,480	$ 269,604	$ 269,604
Professional Fees	$ 84,777	$ 50,000	$ 121,081	$ 50,000
Contracted Services (1)	$ 639,665	$ 283,220	$ 566,518	$ 439,800
Repairs/Maintenance	$ 266,701	$ 266,701	$ 135,656	$ 135,656
Utilities	$ 5,692	$ 5,692	$ 1,652	$ 1,652
Administrative	$ 78,007	$ -	$ 55,156	$ -
Other	$ 29,824	$ -	$ 28,190	$ -
Surface Water	$ 605,185	$ 605,185	$ 441,136	$ 441,136
Capital Outlay	$ -	$ -		$ -
Intergovernmental/Contractual Obligations	$ 534,385	$ 534,385	$ 105,678	$ 105,678
Intergovernmental/Master District Repalcement Fund	$ 68,263	$ 68,263	$ 48,095	$ 48,095
Total Expenditures	**$3,076,979**	**$ 2,577,926**	**$1,772,766**	**$ 1,491,621**
(1) Projected Budget is less public safety and fire protection contract fees				
Projected Revenue Excess (Defecit)		$ (24,278)		$ (63,176)
Excess (Defecit) Percentage of Total Revenues		-1%		-4%

Apply the revenue excess (defecit) percentage to the average monthly rate to project rate impact.

	2014	Projected	2014	Projected
10,000 Gallon Water Bill/Month	$ 23.60	$ 23.82	$ 47.90	$ 50.02
10,000 Gallon Wastewater Bill/Month	$ 45.22	$ 45.65	$ 45.94	$ 47.97
Total Utility Bill	$ 68.82	$ 69.47	$ 93.84	$ 97.99

Average Projected Monthly Bill	
$ 36.92	Water
$ 46.81	Wastewater
$ 83.73	

Appendix E
Annexation Analysis of Fort Bend County #23 and #24

Feasibility Analysis

Annexation of Fort Bend County Municipal Utility Districts 23 and 24 by the City of Missouri City

April 20, 2015

Feasibility Analysis
Annexation of Fort Bend County Municipal Utility Districts 23 and 24

Introduction:
This analysis follows the same methodology as the March 10, 2015, Sienna Plantation MUDs 2 and 3 Feasibility Annexation Analysis. This report uses data specific to Fort Bend County MUDs (FBCMUD) 23 and 24 with certain relevant assumptions and base data as utilized in the previous analysis.

Purpose:
Analyze the financial benefits and impacts of annexation by the City of Missouri City of FBCMUDs 23 and 24 (the "Districts"). Compare an "annexation scenario" versus a "no annexation scenario" to determine which scenario provides the best financial benefit for the City. This analysis reviews the impacts on both the debt service and general funds of the City. An alternate scenario that allows the Districts to remain in place for limited purposes to reduce the cost impact to the City is also evaluated.

Methodology:
1. Analyze the required debt service tax rate resulting from the combination of the Districts' and the City's existing debt service requirements and assessed valuations.
2. Assuming a constant overall City tax rate of $.57375 (the current rate), calculate the available general fund tax rate and resulting general fund property tax revenues that would be available to the City.
3. Project the "other revenues" generated and the increased costs of service that would be incurred due to the annexation.
4. Identify the net available general fund revenues (new property taxes and other revenues, less new operating expenses) available to City with the "annexation scenario". If the results are neutral or positive, the City is able to cover the costs of annexation; if the results are negative, the annexation will cost the City more than the revenues that will be generated.
5. Analyze a "break even" scenario that that will allow the city to annex the Districts in 2015.

Special Considerations Pertinent to FBCMUDs 23 and 24
While this analysis follows the same methodology as utilized in similar studies of other MUDs, FBCMUDs 23 and 24 have specific unique characteristics that will make annexation more complex. The following factors will require additional research prior to any annexation decisions regarding these Districts can be made:

FBCMUD 23 is mostly within the City of Houston ETJ and only partially within the City of Missouri City ETJ. On December 19, 2011, FBCMUD 23 entered into a 50-year strategic partnership agreement (SPA) with the City of Houston. The City of Houston collects its sales tax within a portion of the district and pays 50% to FBMUD 23. Any annexation of this district by the City of Missouri City would require consent of the City

of Houston and FBMUD 23 to amend/rescind that existing SPA. The City of Houston would also have to agree to release the district from its ETJ. This report does not address the political, procedural, and technical obstacles that would have to be overcome to secure these approvals by the City of Houston and FBCMUD 23.

FBCMUD 24 is fully within the City of Houston ETJ. Any annexation of this district by the City of Missouri City would require consent of the City of Houston to release the district from its ETJ. This report does not address the political, procedural, and technical obstacles that would have to be overcome to secure this approval by the City of Houston.

FBCMUD 23 holds legal title to regional water supply and wastewater treatment facilities and operates such facilities on behalf of itself and FBCMUD 24. The water distribution system is operated as an integrated system. An annexation of only FBMUD 23 would require system modifications and/or ownership/operating agreements. This report does not address the political, procedural, and technical obstacles that would have to be overcome to secure these approvals from FBMUD 23 and FBMUD 24.

Neither FBCMUD 23 nor 24 are fully developed. FBCMUD 24, in particular, is in the early stages of development. It currently has over $5.5 million in outstanding unreimbursed developer obligations, which would transfer to the City upon annexation. Additionally, FBCMUD 24 has an unissued bond capacity of over $78 million (plus unissued refunding bond capacity) indicating significant future development financing potential that would have to be accommodated by the City upon annexation. This report does not address the implications of additional debt that may be incurred by the City due to the potential future debt obligations of the Districts.

Executive Summary:

Under a typical annexation scenario of dissolving the Districts and assuming their debt upon annexation, the proposed annexation is not cost-effective at this time. In fact, during the entire term of this analysis, concluding in 2038, annexation of the Districts never produces net positive revenues for the City. This conclusion is primarily attributable to the high debt load and high debt per capita of the Districts, the low average home value, and the lack of other revenues (primarily sales tax) to help support the costs of providing services to the Districts.

The proposed annexation is not recommended at this time due to the negative net general fund revenues for costs of service the large unreimbursed developed advances, and the high potential future debt obligations of the Districts. Further, annexation consideration is not recommended due to the location of the Districts primarily within the Houston ETJ and the presence of an existing SPA between Houston and FBCMUD 23. It is unlikely that these conditions will be materially altered in the near term, therefore, any near term updates to this analysis are not recommended.

An alternative method of annexation is explored at the conclusion of the report in which the Districts are annexed, but left in place as "limited districts" so that they can levy a

limited tax to subsidize city costs and fund their existing obligations. This alternative results in a combined City and District tax rate of $1.28, which exceeds the current FBCMUD rate of $1.05 and is slightly less than the FBCMUD 24 rate of $1.36. The cost impact to the average resident under this scenario would be greater than the status quo through at least 2035. Also, as described above, the city of Houston and the Districts themselves would have to consent to these annexations, which is unlikely based on past City of Houston practices.

Neither a traditional or limited district annexation appears to be feasible. A traditional annexation does not generate net positive revenues for the City. A limited district annexation would impose higher costs on residents for at least the next 20 years. Either scenario would require the consent of the City of Houston and would need to account for substantial unreimbursed and potential future reimbursement obligations that would transfer to the City of Missouri City.

1. Analyze the required debt service tax rate resulting from the combination of the Districts' and the City's existing debt service requirements and assessed valuations.

In the absence of any special agreements, when a city annexes a MUD, the city must assume all obligations of the district. In addition to outstanding debt, the Districts have nearly $7.8 million in additional unreimbursed developer advances and the potential for additional future bond issues as development is still occurring within the Districts. This analysis only includes existing debt obligations. Future debt issues will exacerbate the negative consequences of this annexation.

A required debt service tax rate with and without annexation was calculated with the results summarized below:

Table 1

Year	With Annexation: Combined Debt Service Payments	With Annexation: Combined Assessed Valuation	With Annexation: Combined Debt Service Tax Rate	Without Annexation: City Only Debt Service Tax Rate	Increase Over Projected City-Only Debt Service Tax Rate
2016	$ 12,453,408	$ 5,371,340,177	0.2366	0.1731	**0.0635**
2017	$ 12,092,946	$ 5,478,766,981	0.2252	0.1612	**0.0640**
2018	$ 12,071,087	$ 5,588,342,320	0.2204	0.1576	**0.0628**
2019	$ 10,924,241	$ 5,700,109,167	0.1956	0.1317	**0.0639**
2020	$ 10,970,778	$ 5,814,111,350	0.1925	0.1301	**0.0624**
2021	$ 10,952,010	$ 5,930,393,577	0.1884	0.1271	**0.0613**
2022	$ 10,967,929	$ 6,049,001,449	0.1850	0.1246	**0.0604**
2023	$ 10,981,038	$ 6,169,981,478	0.1816	0.1221	**0.0595**
2024	$ 10,908,826	$ 6,293,381,107	0.1769	0.1187	**0.0582**
2025	$ 10,204,677	$ 6,419,248,729	0.1622	0.1039	**0.0583**
2026	$ 10,162,574	$ 6,547,633,704	0.1584	0.1013	**0.0570**
2027	$ 9,423,894	$ 6,678,586,378	0.1440	0.0867	**0.0573**
2028	$ 8,710,727	$ 6,812,158,106	0.1305	0.0724	**0.0581**
2029	$ 6,408,384	$ 6,948,401,268	0.0941	0.0332	**0.0610**
2030	$ 4,134,473	$ 7,087,369,293	0.0595	0.0203	**0.0393**
2031	$ 5,270,086	$ 7,229,116,679	0.0744	0.0121	**0.0623**
2032	$ 4,773,610	$ 7,373,699,013	0.0661	0.0043	**0.0618**
2033	$ 4,788,534	$ 7,521,172,993	0.0650	0.0031	**0.0619**
2034	$ 4,586,686	$ 7,671,596,453	0.0610	0.0000	**0.0610**
2035	$ 4,573,840	$ 7,825,028,382	0.0596	0.0000	**0.0596**
2036	$ 2,352,369	$ 7,981,528,949	0.0301	0.0000	**0.0301**
2037	$ 2,377,938	$ 8,141,159,528	0.0298	0.0000	**0.0298**
2038	$ 366,750	$ 8,303,982,719	0.0045	0.0000	**0.0045**

Refer to the Appendix for expanded detail.

Assumptions:
2% annual assessed valuation growth
98% tax collection rate

Table 1 Discussion:
The effect of annexing the Districts and assuming their outstanding debt results in the need to raise the city's debt service tax rate by roughly $.06 per $100 valuation in comparison to what the City's debt service tax rate would need to be to service its debt only. This situation persists until at least 2035.

For reference, the City's current debt service tax rate is $.19337. The existing FBCMUD 23 debt retires in 2038; FBCMUD 24 in 2040. Future MUD debt issues could extend these maturities and/or increase the required debt tax rate.

2. Assuming a constant overall City tax rate of $.57375, calculate the available general fund tax rate and resulting general fund property tax revenues that would be available to cover the City's operating costs.

After annexation, the city would levy its general fund property tax on the combined assessed valuation of the city plus the Districts. The available general fund property tax rate would be the total rate less the required debt service rate calculated in section 1. For this analysis, the total City tax rate is assumed to be constant at $.57375.

Table 2

Year	**With Annexation:** Available General Fund Tax Rate	**Without Annexation:** Available General Fund Tax Rate	**With Annexation:** Increase (Decrease) General Fund Property Tax Revenues
2016	0.3372	0.4007	$ (1,093,110)
2017	0.3485	0.4126	$ (1,076,263)
2018	0.3533	0.4161	$ (1,008,278)
2019	0.3782	0.4420	$ (933,697)
2020	0.3812	0.4437	$ (862,268)
2021	0.3853	0.4466	$ (795,217)
2022	0.3887	0.4492	$ (743,582)
2023	0.3921	0.4516	$ (684,360)
2024	0.3969	0.4551	$ (596,015)
2025	0.4115	0.4699	$ (518,092)
2026	0.4154	0.4724	$ (427,425)
2027	0.4298	0.4870	$ (349,443)
2028	0.4433	0.5014	$ (309,972)
2029	0.4796	0.5406	$ (224,982)
2030	0.5142	0.5535	$ 1,372,290
2031	0.4994	0.5617	$ (172,008)
2032	0.5077	0.5695	$ (76,049)
2033	0.5088	0.5707	$ (76,331)
2034	0.5127	0.5738	$ 13,402
2035	0.5141	0.5738	$ 118,250
2036	0.5437	0.5738	$ 2,433,563
2037	0.5439	0.5738	$ 2,503,713
2038	0.5692	0.5738	$ 4,612,533

Refer to the Appendix for expanded detail.

Discussion:

With the annexation scenario, the District's dent burden is relatively high and their assessed values are relatively low, resulting in a net decrease of general fund tax rate capacity and revenues. This situation persists until at least 2033 with a one-year anomaly in 2030 when the FBCMUD 23 debt service has a one-year dip. This calculation is an interim step in the analysis. The additional costs of service and the additional "other" revenues due to the proposed annexation also need to be considered as shown in the next section; however, general fund revenues to the City are generally negative even before accounting for the additional costs of service.

3. Project the "other revenues" generated and the increased costs of service that would be incurred due to the annexation.

With annexation of the Districts, the City would also generate "other revenues" such as franchise fees, fines, permits, etc. The City would also incur additional operating costs for city services such as police, fire, street maintenance, etc. These additional revenues and expenses were extrapolated from current revenues and expenses using appropriate factors such as population, number of homes, or lane-miles depending on the specific item being evaluated. The following figures are annual projections for the first year of the analysis and then they are inflated over time in the projection.

Table 3A

General Fund Revenue Item		With Annexation: Projected Other Revenues
Other Taxes	$	70,000
Licenses & Permits	$	73,000
Fines & Forfeitures	$	188,000
Franchise Fees	$	757,000
Other	$	139,070
Total	$	1,227,070

Table 3B

General Fund Expense Item		With Annexation: Projected Expense
Police	$	1,560,000
Fire	$	1,889,096
Streets	$	270,000
Parks	$	123,976
Other	$	345,000
Total	$	4,188,073

Refer to the Appendix for expanded detail.

Discussion:

Revenues:

Other Taxes consist of sales taxes attributable to the businesses near Teal Run Boulevard and SH 6. These businesses contain an estimated 70,000 square feet; this study assumes 50% of that space will generate sales tax and sales are generated at the rate of $200/square foot. Licenses & Permits are primarily maintenance-related mechanical, electrical, and plumbing permits. Fines & Forfeitures consist of fine revenues based on the increased population. The majority of new City revenues due to the annexation are attributable to Franchise Fees. The franchise fees are extrapolated from current City fees using the number of homes in the Districts (total of 4,607) as a percentage in the City (23,897), which translates to a 19% increase. Other Revenues primarily consist of parks and recreation participation fees and an increase in alarm fees.

Expenses:

The four major areas of projected cost impact were analyzed. Police expenditures are projected by extrapolating, based on population, the current patrol officer staffing level, plus associated administrative support (64 current patrol officers; an additional 13 would need to be added). Fire costs are based on the City staff assessment that an additional fire station will be needed to service this area (since it is not in the City's ETJ, it has not previously been accounted for in the City's facility planning). The projected fire station costs are based on the Sienna fire station construction costs (amortized over 20 years); the staffing and operations costs are projected on the same basis as in the Sienna MUDs 2 &

3 annexation analysis. Street maintenance costs increase based on a ratio of lane miles in the Districts in comparison to the current City (15% increase). The actual lane miles for FBCMUDs 23 and 24 were not available through the City's GIS; therefore, the lane miles were estimated based on an average "lane miles per acre" calculated from other districts being analyzed concurrently with this study. Parks maintenance costs are assumed to be relatively minor due to the minimal publicly-maintained facilities within the Districts; a 5% increase in the Parks budget is assumed. Other Expenses are estimated as an additional 10% of costs to cover other miscellaneous or support services provided by the City.

4. Identify the net available general fund revenues available to City with the "annexation scenario".

The Net Available Revenues available to the City with the "annexation" scenario is calculated by adding the available general fund property tax revenues (Table 2) plus the "other" revenues generated due to the annexation (Table 3A), less the increased costs of service due to the annexation (Table 3B).

Table 4

Year	With Annexation: Incremental Available General Fund Property Tax Revenue (Table 2)	With Annexation: Projected Other Revenues (Table 3A)	With Annexation: Projected Expense (Table 3B)	With Annexation: Net Revenues (2+3A+3B)
2016	$ (1,093,110)	$ 1,227,070	$ (3,798,976)	$ (3,665,016)
2017	$ (1,076,263)	$ 1,251,611	$ (3,912,946)	$ (3,737,597)
2018	$ (1,008,278)	$ 1,276,644	$ (4,030,334)	$ (3,761,968)
2019	$ (933,697)	$ 1,302,177	$ (4,151,244)	$ (3,782,764)
2020	$ (862,268)	$ 1,328,220	$ (4,275,781)	$ (3,809,829)
2021	$ (795,217)	$ 1,354,784	$ (4,404,055)	$ (3,844,488)
2022	$ (743,582)	$ 1,381,880	$ (4,536,176)	$ (3,897,878)
2023	$ (684,360)	$ 1,409,518	$ (4,672,262)	$ (3,947,104)
2024	$ (596,015)	$ 1,437,708	$ (4,812,430)	$ (3,970,737)
2025	$ (518,092)	$ 1,466,462	$ (4,956,802)	$ (4,008,432)
2026	$ (427,425)	$ 1,495,791	$ (5,105,507)	$ (4,037,140)
2027	$ (349,443)	$ 1,525,707	$ (5,258,672)	$ (4,082,407)
2028	$ (309,972)	$ 1,556,221	$ (5,416,432)	$ (4,170,183)
2029	$ (224,982)	$ 1,587,346	$ (5,578,925)	$ (4,216,561)
2030	$ 1,372,290	$ 1,619,093	$ (5,746,293)	$ (2,754,909)
2031	$ (172,008)	$ 1,651,475	$ (5,918,681)	$ (4,439,215)
2032	$ (76,049)	$ 1,684,504	$ (6,096,242)	$ (4,487,786)
2033	$ (76,331)	$ 1,718,194	$ (6,279,129)	$ (4,637,266)
2034	$ 13,402	$ 1,752,558	$ (6,467,503)	$ (4,701,543)
2035	$ 118,250	$ 1,787,609	$ (6,661,528)	$ (4,755,669)
2036	$ 2,433,563	$ 1,823,361	$ (6,861,374)	$ (2,604,449)
2037	$ 2,503,713	$ 1,859,829	$ (7,067,215)	$ (2,703,673)
2038	$ 4,612,533	$ 1,897,025	$ (7,279,232)	$ (769,673)

Refer to the Appendix for expanded detail.

Assumptions:
Revenues grow by 2% annually and expenses grow by 3% annually.

Discussion:
When all sources of general fund revenues and expenses are accounted for, the net annual cost to the City for the annexation is significant (generally $3.5 - $4.5 million per year) for the entire duration of this analysis. Further, the Districts have outstanding unreimbursed obligations of approximately $7,786,000 and continuing development that will incur additional reimbursement obligations.

Conclusion:
Under a typical annexation scenario of dissolving the Districts and assuming their debt upon annexation, the proposed annexation is not cost-effective at time. This conclusion is primarily attributable to:

- The high debt load of the Districts relative to assessed values;
- The low average home value of the Districts ($117,801) in comparison to the City's average home value ($150,295);
- The lack of other revenues (primarily a lack of sales tax) to help support the costs of providing services to the Districts;
- The cost of providing services, primarily police and fire services, to the Districts; and
- The high potential for future additional reimbursement obligations to serve continuing development within the Districts.

The Districts' outstanding debt is 79% of the City's outstanding debt ($63,425,000 vs. $80,186,000, respectively), but the City's assessed value is 8.5 times greater than the Districts' ($4,704,436,564 vs. $550,571,782, respectively). The debt per capita for the Districts is $4,507, but only $1,142 for the City.

The proposed general purpose annexation is not recommended at this time due to the negative net general fund revenues for costs of service and the existing and potential outstanding reimbursement obligations of the Districts. Additionally, the procedural difficulties of attempting to annex properties within the City of Houston ETJ that are subject to an existing strategic partnership agreement should not be discounted. It is unlikely that these conditions will be materially altered in the near term, therefore, any near term updates to this analysis are not recommended.

The following section explores the limited district annexation scenario.

5. Analyze a "break even" scenario that that will allow the city to annex the Districts in 2015.

To annex the Districts in 2015 and still allow the City to "break even" on the costs of service, additional sources of revenue would be needed to offset the projected negative net revenues. The most likely method would be to convert the Districts to "limited districts" as authorized in Local Government Code 43.0751. The conversion to limited districts would need to be agreed to by the City of Houston and the Districts with the specific terms and conditions subject to negotiation between the parties.

Under this scenario, the Districts would be annexed by the City and the City would provide full municipal services. The City would assume the outstanding debt obligations of the Districts, but the Districts would stay in place for the following "limited purposes":
A. Levy a tax with proceeds paid to the City to offset the City's negative net revenues.
B. Levy a tax to fund the District's operating expenses.

Both of these levies would be required in order for the City to "break even" on costs of services and to provide the Districts a source of operating funds until they are completely dissolved. This analysis does not account for the Districts' existing and future reimbursement obligations, which can not be predicted with adequate certainty.

Pursuing this limited district scenario would require the consent of the City of Houston and each of the Districts as the property is primarily within the City of Houston ETJ, and Houston and FBCMUD 23 have an existing strategic partnership agreement in place. The political and technical challenges of gaining these consents should not be underestimated. Neither a full analysis of these challenges or any discussions of these negotiations with the City of Houston or the Districts was included in the scope of this analysis.

Calculation of the Limited Districts' Tax Levies

A. Tax Rate to Offset City Costs: An equivalent District tax rate was calculated that would generate sufficient revenue to offset the negative net City revenues shown in Table 4. This tax rate is initially $.6529 and stays above $.58 through at least 2035.
B. Contract Tax Rate: These Districts do not have a contract tax rate for master district facilities.
C. Maintenance Tax Rate: A $.05 maintenance tax rate is assumed to cover the Districts' operating continuing operating costs.

At such time that the City cost offset tax rate becomes zero the Districts could be completely dissolved; however, that situation does not occur during the study period concluding in 2038.

The tax rates that would be levied on residents of the Districts are shown below:

Table 5A

Year	City Cost Offset Tax Rate (A)	Contract Tax Rate (B)	O & M Tax Rate (C)	Total District Tax Rate (A+B+C)	District + City Tax Rate
2016	0.6529	0.0000	0.0500	0.7029	1.2766333
2017	0.6528	0.0000	0.0500	0.7028	1.2765076
2018	0.6441	0.0000	0.0500	0.6941	1.2678813
2019	0.6350	0.0000	0.0500	0.6850	1.2587422
2020	0.6270	0.0000	0.0500	0.6770	1.2507456
2021	0.6203	0.0000	0.0500	0.6703	1.2440435
2022	0.6166	0.0000	0.0500	0.6666	1.2403263
2023	0.6121	0.0000	0.0500	0.6621	1.2358707
2024	0.6037	0.0000	0.0500	0.6537	1.2274614
2025	0.5975	0.0000	0.0500	0.6475	1.2212427
2026	0.5900	0.0000	0.0500	0.6400	1.2137225
2027	0.5849	0.0000	0.0500	0.6349	1.2086398
2028	0.5858	0.0000	0.0500	0.6358	1.2095005
2029	0.5807	0.0000	0.0500	0.6307	1.2044018
2030	0.3719	0.0000	0.0500	0.4219	0.9956829
2031	0.5876	0.0000	0.0500	0.6376	1.2113248
2032	0.5824	0.0000	0.0500	0.6324	1.2061067
2033	0.5900	0.0000	0.0500	0.6400	1.2137047
2034	0.5864	0.0000	0.0500	0.6364	1.210154
2035	0.5815	0.0000	0.0500	0.6315	1.2052744
2036	0.3122	0.0000	0.0500	0.3622	0.9359782
2037	0.3178	0.0000	0.0500	0.3678	0.9415181
2038	0.0887	0.0000	0.0500	0.1387	0.7124374

Refer to the Appendix for expanded detail.

Discussion:
The projected District tax rate is initially $.6529 and stays above $.58 through 2035. The combined City and District tax rate would begin at $1.28, which is an increase of $.23 over the current FBCMUD 23 rate of $1.05 and a decrease of $.08 from the current FBCMUD 24 rate of $1.36. However, as previously stated, this analysis does not incorporate the future debt requirements of the Districts from existing and future reimbursement obligations.

The City subsidy rate would need to stay in place throughout the entire duration of the study period. The City would not reach a point of positive net revenues without being supplemented by the subsidy tax rate.

Cost Impact on Average Home
District residents would pay an additional tax due to the combined tax rates. FBCMUD 23 residents would experience a slight tax rate increase; FBCMUD 24 residents would experience a slight tax rate decrease. The Districts would no longer need to separately contract for security services. The average utility bill would need to increase to

compensate for the loss of property tax subsidy that normally occurs in MUD utility rates. For this analysis, a post-annexation water/sewer fee was projected by evaluating the Districts' revised available revenues and expenses and increasing the base rate by the same percentage decrease in net revenues. In this case, that resulted in a 12% utility rate increase for FBCMUD 23 and a 38% increase for FBCMUD 24. The first-year monthly combined average bill for 10,000 gallons in this analysis is $63.62 (vs. current typical of $53.80 and $48.81 for FBCMUD 23 and 24, respectively). Garbage fees are assumed to be unaffected by the limited purpose annexation.

Table 5B

Year	Annual Homeowner Cost Without Annexation: MUD Tax & Utility Bill	Annual Homeowner Cost with Annexation & Limited Districts: MUD and City Tax & Utility Bill	Annual Increase (Decrease)	Monthly Increase (Decrease)
2016	$ 2,130	$ 2,375	$ 245	$ 20.38
2017	$ 2,179	$ 2,430	$ 251	$ 20.91
2018	$ 2,229	$ 2,476	$ 247	$ 20.54
2019	$ 2,281	$ 2,522	$ 241	$ 20.10
2020	$ 2,334	$ 2,571	$ 237	$ 19.76
2021	$ 2,388	$ 2,622	$ 235	$ 19.55
2022	$ 2,443	$ 2,679	$ 236	$ 19.66
2023	$ 2,500	$ 2,736	$ 236	$ 19.69
2024	$ 2,558	$ 2,789	$ 231	$ 19.24
2025	$ 2,617	$ 2,846	$ 228	$ 19.03
2026	$ 2,678	$ 2,902	$ 224	$ 18.64
2027	$ 2,740	$ 2,963	$ 223	$ 18.55
2028	$ 2,804	$ 3,035	$ 231	$ 19.21
2029	$ 2,870	$ 3,099	$ 229	$ 19.11
2030	$ 2,937	$ 2,835	$ (101)	$ (8.45)
2031	$ 3,005	$ 3,260	$ 255	$ 21.22
2032	$ 3,076	$ 3,329	$ 253	$ 21.12
2033	$ 3,148	$ 3,422	$ 274	$ 22.84
2034	$ 3,221	$ 3,497	$ 276	$ 22.99
2035	$ 3,297	$ 3,572	$ 275	$ 22.95
2036	$ 3,374	$ 3,167	$ (207)	$ (17.23)
2037	$ 3,453	$ 3,256	$ (198)	$ (16.48)
2038	$ 3,535	$ 2,902	$ (633)	$ (52.74)

Refer to the Appendix for expanded detail.

Discussion:

District residents would experience an initial cost increase of $245 per year or about $20 per month. This increase over the non-annexation scenario holds relatively constant over time until 2036, at which time residents would begin to experience decreased costs over the non-annexation scenario. To implement this scenario, Missouri City, Houston, and the District MUD Boards would need to agree to release the Districts from the Houston ETJ and to modify the existing Houston SPA with FBCMUD 23.

Appendix

Expanded Tables with Additional Detail
Current MUD Statistical and Audit Data
City/MUD Comparative Data
Water/Sewer Rate Projection Calculation

Expanded Table 1

	Debt Service Payment Schedules				Assessed Valuations				Required Debt Service Tax Rates		
Year	Fort Bend County MUD 23	Fort Bend County MUD 24	City	With Annexation: Combined Debt Service Payments	Fort Bend County MUD 23	Fort Bend County MUD 24	City	With Annexation: Combined Assessed Valuation	With Annexation: Combined Debt Service Tax Rate	City-Only without Annexation	Increase Over Projected City-Only Debt Service Tax Rate
2016	$ 3,956,061	$ 357,844	$ 8,139,503	$ 12,453,408	$ 509,752,784	$ 63,062,098	$ 4,798,525,295	$ 5,371,340,177	0.2366	0.1731	**0.0635**
2017	$ 3,984,211	$ 377,263	$ 7,731,473	$ 12,092,946	$ 519,947,840	$ 64,323,340	$ 4,894,495,801	$ 5,478,766,981	0.2252	0.1612	**0.0640**
2018	$ 3,983,011	$ 376,181	$ 7,711,894	$ 12,071,087	$ 530,346,796	$ 65,609,807	$ 4,992,385,717	$ 5,588,342,320	0.2204	0.1576	**0.0628**
2019	$ 3,975,686	$ 375,944	$ 6,572,611	$ 10,924,241	$ 540,953,732	$ 66,922,003	$ 5,092,233,432	$ 5,700,109,167	0.1956	0.1317	**0.0639**
2020	$ 3,973,049	$ 375,511	$ 6,622,218	$ 10,970,778	$ 551,772,807	$ 68,260,443	$ 5,194,078,100	$ 5,814,111,350	0.1925	0.1301	**0.0624**
2021	$ 3,971,549	$ 379,686	$ 6,600,775	$ 10,952,010	$ 562,808,263	$ 69,625,652	$ 5,297,959,662	$ 5,930,393,577	0.1884	0.1271	**0.0613**
2022	$ 3,992,349	$ 378,371	$ 6,597,209	$ 10,967,929	$ 574,064,428	$ 71,018,165	$ 5,403,918,855	$ 6,049,001,449	0.1850	0.1246	**0.0604**
2023	$ 4,002,293	$ 381,749	$ 6,596,996	$ 10,981,038	$ 585,545,717	$ 72,438,528	$ 5,511,997,233	$ 6,169,981,478	0.1816	0.1221	**0.0595**
2024	$ 3,990,305	$ 379,385	$ 6,539,136	$ 10,908,826	$ 597,256,631	$ 73,887,299	$ 5,622,237,177	$ 6,293,381,107	0.1769	0.1187	**0.0582**
2025	$ 3,985,543	$ 381,698	$ 5,837,437	$ 10,204,677	$ 609,201,764	$ 75,365,045	$ 5,734,681,921	$ 6,419,248,729	0.1622	0.1039	**0.0583**
2026	$ 3,975,038	$ 378,519	$ 5,809,018	$ 10,162,574	$ 621,385,799	$ 76,872,346	$ 5,849,375,559	$ 6,547,633,704	0.1584	0.1013	**0.0570**
2027	$ 3,974,290	$ 379,806	$ 5,069,798	$ 9,423,894	$ 633,813,515	$ 78,409,793	$ 5,966,363,070	$ 6,678,586,378	0.1440	0.0867	**0.0573**
2028	$ 4,019,100	$ 375,619	$ 4,316,008	$ 8,710,727	$ 646,489,785	$ 79,977,988	$ 6,085,690,332	$ 6,812,158,106	0.1305	0.0724	**0.0581**
2029	$ 4,015,293	$ 376,131	$ 2,016,960	$ 6,408,384	$ 659,419,581	$ 81,577,548	$ 6,207,404,138	$ 6,948,401,268	0.0941	0.0332	**0.0610**
2030	$ 2,476,580	$ 400,900	$ 1,256,993	$ 4,134,473	$ 672,607,973	$ 83,209,099	$ 6,331,552,221	$ 7,087,369,293	0.0595	0.0203	**0.0393**
2031	$ 4,102,530	$ 404,244	$ 763,313	$ 5,270,086	$ 686,060,132	$ 84,873,281	$ 6,458,183,266	$ 7,229,116,679	0.0744	0.0121	**0.0623**
2032	$ 4,095,785	$ 401,725	$ 276,100	$ 4,773,610	$ 699,781,335	$ 86,570,747	$ 6,587,346,931	$ 7,373,699,013	0.0661	0.0043	**0.0618**
2033	$ 4,187,503	$ 398,719	$ 202,313	$ 4,788,534	$ 713,776,962	$ 88,302,162	$ 6,719,093,869	$ 7,521,172,993	0.0650	0.0031	**0.0619**
2034	$ 4,191,843	$ 394,844	$ -	$ 4,586,686	$ 728,052,501	$ 90,068,205	$ 6,853,475,747	$ 7,671,596,453	0.0610	0.0000	**0.0610**
2035	$ 4,178,371	$ 395,469	$ -	$ 4,573,840	$ 742,613,551	$ 91,869,569	$ 6,990,545,262	$ 7,825,028,382	0.0596	0.0000	**0.0596**
2036	$ 2,007,025	$ 345,344	$ -	$ 2,352,369	$ 757,465,822	$ 93,706,960	$ 7,130,356,167	$ 7,981,528,949	0.0301	0.0000	**0.0301**
2037	$ 2,021,250	$ 356,688	$ -	$ 2,377,938	$ 772,615,138	$ 95,581,100	$ 7,272,963,290	$ 8,141,159,528	0.0298	0.0000	**0.0298**
2038	$ -	$ 366,750	$ -	$ 366,750	$ 788,067,441	$ 97,492,722	$ 7,418,422,556	$ 8,303,982,719	0.0045	0.0000	**0.0045**

MUD debt service schedules from Texas Municipal Reports; City schedules from budget.
Assessed valuations projected from 2015 actual values assuming 2% annual growth.
Tax collection rate: 98%
For Reference: Current Debt Service Tax Rates:

MUD 23	$ 0.80
MUD 24	$ 0.70
City	$ 0.19337

Expanded Table 2

	With Annexation - General Fund Tax Rate & Revenue			Without Annexation-General Fund Tax Rate & Revenue			Difference
Year	With Annexation: Available General Fund Tax Rate	With Annexation: Combined Assessed Valuation	With Annexation: General Fund Revenue with Available GF Tax Rate	Without Annexation: Available General Fund Tax Rate	Without Annexation: City-Only Assessed Valuation	Without Annexation: General Fund Revenue with Available GF Tax Rate	With Annexation: Increase (Decrease) General Fund Property Tax Revenues
2016	0.3372	$ 5,371,340,177	$ 17,748,295	0.4007	$ 4,798,525,295	$ 18,841,405	$ (1,093,110)
2017	0.3485	$ 5,478,766,981	$ 18,712,791	0.4126	$ 4,894,495,801	$ 19,789,054	$ (1,076,263)
2018	0.3533	$ 5,588,342,320	$ 19,350,765	0.4161	$ 4,992,385,717	$ 20,359,042	$ (1,008,278)
2019	0.3782	$ 5,700,109,167	$ 21,126,047	0.4420	$ 5,092,233,432	$ 22,059,744	$ (933,697)
2020	0.3812	$ 5,814,111,350	$ 21,720,516	0.4437	$ 5,194,078,100	$ 22,582,784	$ (862,268)
2021	0.3853	$ 5,930,393,577	$ 22,393,111	0.4466	$ 5,297,959,662	$ 23,188,328	$ (795,217)
2022	0.3887	$ 6,049,001,449	$ 23,044,094	0.4492	$ 5,403,918,855	$ 23,787,676	$ (743,582)
2023	0.3921	$ 6,169,981,478	$ 23,711,226	0.4516	$ 5,511,997,233	$ 24,395,586	$ (684,360)
2024	0.3969	$ 6,293,381,107	$ 24,477,283	0.4551	$ 5,622,237,177	$ 25,073,298	$ (596,015)
2025	0.4115	$ 6,419,248,729	$ 25,889,154	0.4699	$ 5,734,681,921	$ 26,407,246	$ (518,092)
2026	0.4154	$ 6,547,633,704	$ 26,653,134	0.4724	$ 5,849,375,559	$ 27,080,559	$ (427,425)
2027	0.4298	$ 6,678,586,378	$ 28,128,127	0.4870	$ 5,966,363,070	$ 28,477,570	$ (349,443)
2028	0.4433	$ 6,812,158,106	$ 29,592,335	0.5014	$ 6,085,690,332	$ 29,902,307	$ (309,972)
2029	0.4796	$ 6,948,401,268	$ 32,660,739	0.5406	$ 6,207,404,138	$ 32,885,722	$ (224,982)
2030	0.5142	$ 7,087,369,293	$ 35,716,033	0.5535	$ 6,331,552,221	$ 34,343,743	$ 1,372,290
2031	0.4994	$ 7,229,116,679	$ 35,377,430	0.5617	$ 6,458,183,266	$ 35,549,437	$ (172,008)
2032	0.5077	$ 7,373,699,013	$ 36,686,856	0.5695	$ 6,587,346,931	$ 36,762,905	$ (76,049)
2033	0.5088	$ 7,521,172,993	$ 37,501,142	0.5707	$ 6,719,093,869	$ 37,577,473	$ (76,331)
2034	0.5127	$ 7,671,596,453	$ 38,548,783	0.5738	$ 6,853,475,747	$ 38,535,381	$ 13,402
2035	0.5141	$ 7,825,028,382	$ 39,424,338	0.5738	$ 6,990,545,262	$ 39,306,088	$ 118,250
2036	0.5437	$ 7,981,528,949	$ 42,525,773	0.5738	$ 7,130,356,167	$ 40,092,210	$ 2,433,563
2037	0.5439	$ 8,141,159,528	$ 43,397,767	0.5738	$ 7,272,963,290	$ 40,894,054	$ 2,503,713
2038	0.5692	$ 8,303,982,719	$ 46,324,469	0.5738	$ 7,418,422,556	$ 41,711,935	$ 4,612,533

Assessed valuations projected from 2015 actual values assuming 2% annual growth.
Tax collection rate: 98%
For Reference: Current City General Fund Tax Rate: $ 0.38038

Expanded Table 3A

Projected "Other" City General Fund Revenues Derived from FBCMUDs 23 and 34 (excluding property tax)

		FY 2015 City Budget	2016 Revenues from Sienna MUDs 23 & 34	Basis/Comment
310 OTHER TAXES				
0100	City Retail Sales Tax	$ 8,000,000	$ 70,000	Businesses at Teal Run/SH 6 (Est. 70,000 SF x 50% generating sales tax @$200/SF x 1%)
0200	State Beverage Tax	$ 30,000	$ -	Assume minimal activity
	Total Other Taxes	**$ 8,030,000**	$ 70,000	
320 LICENSES & PERMITS				
0100	Zoning Variances		$ -	
0200	Zoning Amendments		$ -	Assume minimal activity
0300	Plat Fees		$ -	Assume minimal activity
0400	Recall Inspection Fees		$ -	Assume minimal activity
0500	General Fire Inspection		$ -	Assume minimal activity
0600	Building Permits		$ -	Assume minimal activity
0700	Change of Occupancy		$ -	Assume minimal activity
0800	Plumbing Permits	$ 100,000	$ 20,000	Prorated on population; rounded to nearest $1,000
0900	Electrical Permits	$ 100,000	$ 20,000	Prorated on population; rounded to nearest $1,000
1000	Air Conditioning Permits	$ 95,000	$ 19,000	Prorated on population; rounded to nearest $1,000
1100	Pool Permits	$ 3,000	$ 1,000	Prorated on population; rounded to nearest $1,000
1200	Sign Permits		$ -	Assume minimal activity
1300	Electrical License		$ -	
1400	Plan Check Fees		$ -	Assume minimal activity
1500	After Hours Inspections		$ -	Assume minimal activity
1600	Liquor License		$ -	Assume no alcohol sales
1700	Solicitors License	$ -	$ -	Prorated on population; rounded to nearest $1,000
1800	Infrastructure Fees		$ -	Assume minimal activity
2000	Lien Reimbursement		$ -	Assume minimal activity
2200	Health Permits	$ 95,000	$ 1,000	Businesses at Teal Run/SH 6
2300	Housing Code Inspections		$ -	Discontinued
2400	Pub Works After Hrs Inspection		$ -	Assume minimal activity
2500	Sienna Plantation - Prorata	$ 62,000	$ -	Not applicable
2600	Contractor Registration Fees		$ -	Will not increase due to annexation
2700	Design Review		$ -	Assume minimal activity
2800	Pub Works Plan Review Fee		$ -	Assume minimal activity
2900	Riverstone Inspection Fee		$ -	Not applicable
3000	Housing Rental Registration	$ 60,000	$ 12,000	Prorated on population; rounded to nearest $1,000
	Total Licenses & Permits	**$ 515,000**	$ 73,000	
330 FINES AND FORFEITURES				
0100	Fines	$ 700,000	$ 142,000	Prorated on population; rounded to nearest $1,000
0300	Warrant Fees	$ 60,000	$ 12,000	Prorated on population; rounded to nearest $1,000
0400	DDC/Insurance	$ 15,000	$ 3,000	Prorated on population; rounded to nearest $1,000
0500	Administrative Fee	$ 32,000	$ 7,000	Prorated on population; rounded to nearest $1,000
0600	Arrest Fees	$ 40,000	$ 8,000	Prorated on population; rounded to nearest $1,000
0700	Cash/Over & Under		$ -	
0900	Misc Municipal Court Fees		$ -	
1000	Collection Agency Fees	$ 50,000	$ 10,000	Prorated on population; rounded to nearest $1,000
1100	Judicial Efficiency	$ 4,000	$ 1,000	Prorated on population; rounded to nearest $1,000
1200	Local - No Restriction	$ 25,000	$ 5,000	Prorated on population; rounded to nearest $1,000
1300	Over Payment		$ -	
1500	Motor Carrier Fines		$ -	Assume minimal activity
1600	Overweight Vehicle Fines		$ -	
	Total Fines & Forfeitures	**$ 926,000**	$ 188,000	
340 FRANCHISE FEES				
0100	Franchise Fee - Gas	$ 350,000	$ 71,000	Prorated on population; rounded to nearest $1,000
0200	Franchise Fee - Phone	$ 350,000	$ 71,000	Prorated on population; rounded to nearest $1,000
0300	Franchise Fee - Electric	$ 2,000,000	$ 407,000	Prorated on population; rounded to nearest $1,000
0400	Franchise Fee - Cable TV	$ 675,000	$ 137,000	Prorated on population; rounded to nearest $1,000
	Solid Waste	$ 350,000	$ 71,000	Prorated on population; rounded to nearest $1,000
	Total Franchise Fees	**$ 3,725,000**	$ 757,000	
350 INTERGOVERNMENTAL REVENUE				
0100	Grants		$ -	No additional Revenue due to annexation
0101	Federal Grants		$ -	No additional Revenue due to annexation
0102	State Grants		$ -	No additional Revenue due to annexation
0103	Miscellaneous Grants		$ -	No additional Revenue due to annexation
0300	Fire Dept. Reimbursement		$ -	No additional Revenue due to annexation
0900	Animal Control Reimb-Stafford		$ -	No additional Revenue due to annexation
1300	Sta-Mo Lease Reimbursement		$ -	No additional Revenue due to annexation
	Total Intergovernmental Revenues	$ -	$ -	

Expanded Table 3A

Projected "Other" City General Fund Revenues Derived from FBCMUDs 23 and 34 (excluding property tax)

		FY 2015 City Budget	2016 Revenues from Sienna MUDs 23 & 34	Basis/Comment
380	OTHER REVENUE			
0100	Interest Income		$ -	No additional Revenue due to annexation
0200	Cash Over/Under-Cashiers		$ -	
0300	Maps		$ -	
0400	Cash Over/Under-Pcard		$ -	
600	Pcard Rebate	$ 120,000	$ 12,000	Assume 10% increase
0900	Recreation Leisure Classes	$ 90,000	$ 18,000	Prorated on population; rounded to nearest $1,000
1000	Athletic League Fees	$ 15,000	$ 3,000	Prorated on population; rounded to nearest $1,000
1100	Recreation Center Fees	$ 150,000	$ 31,000	Prorated on population; rounded to nearest $1,000
1200	Special Events	$ 8,000	$ 2,000	Prorated on population; rounded to nearest $1,000
1300	Rec - Advertising Fees		$ -	
1400	MCTV Sponsorships		$ -	No additional Revenue due to annexation
1500	Facilities Rental	$ 70,000	$ 14,000	Prorated on population; rounded to nearest $1,000
1501	Security Fees		$ -	
1800	Other/Miscellaneous		$ -	Assume minimal activity
2000	NSF Check Allowance		$ -	Assume minimal activity
2100	Sale of Salvage		$ -	Assume minimal activity
2300	Insurance Reimbursements		$ -	Assume minimal activity
2500	Missouri City History Books		$ -	Assume minimal activity
2600	PM Burglar False Alarm	$ 60,000	$ 12,000	Prorated on population; rounded to nearest $1,000
2700	Unpermitted Burglar Alarms	$ 2,000	$ -	Prorated on population; rounded to nearest $1,000
2800	PM Fire Flase Alarm	$ -	$ -	Prorated on population; rounded to nearest $1,000
2900	Alarm Permit Fees	$ 350,000	$ 46,070	$50/home times number of homes times 20%
3000	Unpermitted Fire Alarms		$ -	Assume minimal activity
3200	Pavement Maintenance		$ -	
3300	Recycling		$ -	Assume minimal activity
3400	Solid WasteSubscribers		$ -	
3401	Solid Waste Admin Fee		$ -	
3402	Solid Waste MUD Pmts		$ -	
3403	Collection Fees		$ -	
3600	Miscellaneous - Police		$ -	No additional Revenue due to annexation
3800	Animal License Fees	$ 2,500	$ 1,000	Prorated on population; rounded to nearest $1,000
3900	Donations - Police		$ -	No additional Revenue due to annexation
4000	Donations - Parks		$ -	
4100	Donations - Fire		$ -	No additional Revenue due to annexation
4200	Donations - Economic Development		$ -	
4300	Donation - 50th Anniversary		$ -	No additional Revenue due to annexation
4700	Traffic Control Operation		$ -	
4800	Donations-Urban Forestry		$ -	
5000	Police Dept Miscellaneous		$ -	No additional Revenue due to annexation
6400	Child Safety Fees	$ -	$ -	Prorated on population; rounded to nearest $1,000
7100	Fire Dept Miscellaneous		$ -	No additional Revenue due to annexation
7300	Parks Dept Miscellaneous		$ -	
7400	Recreation Dept Miscellaneous		$ -	
7500	City Secretary Dept Miscellaneous		$ -	
7600	Street Dept Miscellaneous		$ -	Assume minimal activity
7800	Engineering Dept Miscellaneous		$ -	
7900	EMS Billings		$ -	
8000	Fire Seminars		$ -	
8100	Late Fees		$ -	
8200	Protector Pavers		$ -	
8300	Purchasing Miscellaneous		$ -	No additional Revenue due to annexation
8400	Fire District Pmts	$ 850,000	$ -	Not applicable
8500	Disaster Reimbursement		$ -	
8600	GRP Admin Fee Reimb		$ -	
8800	Tower Lease		$ -	
9800	Unapplied Personnel Costs		$ -	
	Total Other Revenue	$ 1,717,500	$ 139,070	
	Total Revenues	$ 14,913,500	$ 1,227,070	

Expanded Table 3B

Assume majority of expenses in police, fire, streets/drainage/traffic control, and parks

Police			
Current Patrol Division Staff		64	
Added Patrol staff		**13**	Prorated on population
Average Cost/Officer	$	100,000	
Total Annual Officer Cost	$	1,300,000	
Admin Support Allowance	$	260,000	20%
Total Added Police Cst	**$**	**1,560,000**	

Fire			
Station Construction Cost Amorization	$	389,096	See detail at right
Station Operations	$	1,500,000	Projection
Total Fire Costs	**$**	**1,889,096**	

Streets/Drainage/Traffic Control			
Current Budget	Amount		
Personnel	$	770,169	(2015 Budget)
Cont. Svcs	$	308,963	(2015 Budget)
Other Services	$	755,058	(2015 Budget)
Total Current Street/Drain/Traffic	$	1,834,190	(2015 Budget)
Added Street/Drainage/Traffic Cost	**$**	**270,000**	Prorated on lane miles

Parks			
Current Budget	Amount		
Parks Administration	$	1,598,481	(2015 Budget)
Recreation	$	881,046	(2015 Budget)
Total Current Parks	$	2,479,527	(2015 Budget)
Added Parks & Recreation Cost	$	123,976	5% projected increase

Total Added Expense Estimate			
Total Police, Fire, Street/Drain/Traffic & Parks	$	3,453,976	
Misc. Allowance	$	345,000	10%
Total Estimated Cost Impact	**$**	**3,798,976**	

Data

	MUDs 23 & 24	City	% Increase
Homes	4,607	23,897	19.3%
Population	14,282	70,185	20.3%
Lane-Miles	93.48	636	14.7%

Fire Station Constrcution Cost		
Land (1.5 ac)	$	100,000
Building	$	2,950,000
Equipment	$	700,000
Professional Fees (15%)	$	547,500
Contingency (10%)	$	365,000
Costs of Issuance (4%)	$	186,500
Total	$	4,849,000
Amorization		
Term		20
Interest Rate		5%
Annual Debt Cost		**389,096**

Expanded Table 4

Year	**With Annexation:** Incremental Available General Fund Property Tax Revenue (Table 2)	**With Annexation:** Projected Other Revenues (Table 3A)	**With Annexation:** Projected Expense (Table 3B)	**With Annexation:** Net Revenues (2+3A+3B)
2016	$ (1,093,110)	$ 1,227,070	$ (3,798,976)	$ (3,665,016)
2017	$ (1,076,263)	$ 1,251,611	$ (3,912,946)	$ (3,737,597)
2018	$ (1,008,278)	$ 1,276,644	$ (4,030,334)	$ (3,761,968)
2019	$ (933,697)	$ 1,302,177	$ (4,151,244)	$ (3,782,764)
2020	$ (862,268)	$ 1,328,220	$ (4,275,781)	$ (3,809,829)
2021	$ (795,217)	$ 1,354,784	$ (4,404,055)	$ (3,844,488)
2022	$ (743,582)	$ 1,381,880	$ (4,536,176)	$ (3,897,878)
2023	$ (684,360)	$ 1,409,518	$ (4,672,262)	$ (3,947,104)
2024	$ (596,015)	$ 1,437,708	$ (4,812,430)	$ (3,970,737)
2025	$ (518,092)	$ 1,466,462	$ (4,956,802)	$ (4,008,432)
2026	$ (427,425)	$ 1,495,791	$ (5,105,507)	$ (4,037,140)
2027	$ (349,443)	$ 1,525,707	$ (5,258,672)	$ (4,082,407)
2028	$ (309,972)	$ 1,556,221	$ (5,416,432)	$ (4,170,183)
2029	$ (224,982)	$ 1,587,346	$ (5,578,925)	$ (4,216,561)
2030	$ 1,372,290	$ 1,619,093	$ (5,746,293)	$ (2,754,909)
2031	$ (172,008)	$ 1,651,475	$ (5,918,681)	$ (4,439,215)
2032	$ (76,049)	$ 1,684,504	$ (6,096,242)	$ (4,487,786)
2033	$ (76,331)	$ 1,718,194	$ (6,279,129)	$ (4,637,266)
2034	$ 13,402	$ 1,752,558	$ (6,467,503)	$ (4,701,543)
2035	$ 118,250	$ 1,787,609	$ (6,661,528)	$ (4,755,669)
2036	$ 2,433,563	$ 1,823,361	$ (6,861,374)	$ (2,604,449)
2037	$ 2,503,713	$ 1,859,829	$ (7,067,215)	$ (2,703,673)
2038	$ 4,612,533	$ 1,897,025	$ (7,279,232)	$ (769,673)

Equivalent tax increase (decrease) calculated with combined City and MUD valuations.
Tax collection rate: 98%

Expanded Table 5A

Year	City Cost Offset Tax Rate (A)	City Subsidy Revenue	Contract Tax Rate (B)	Contract Revenues (for Regional WWTP)	O & M Tax Rate (C)	MUD O&M Revenues	Total District Tax Rate (A+B+C)	District + City Tax Rate
2016	0.6529	$ 3,665,016	0.0000	$ -	0.0500	$ 275,176	0.7029	1.2766333
2017	0.6528	$ 3,737,597	0.0000	$ -	0.0500	$ 280,679	0.7028	1.27650763
2018	0.6441	$ 3,761,968	0.0000	$ -	0.0500	$ 286,293	0.6941	1.26788125
2019	0.6350	$ 3,782,764	0.0000	$ -	0.0500	$ 292,019	0.6850	1.2587422
2020	0.6270	$ 3,809,829	0.0000	$ -	0.0500	$ 297,859	0.6770	1.25074557
2021	0.6203	$ 3,844,488	0.0000	$ -	0.0500	$ 303,816	0.6703	1.2440435
2022	0.6166	$ 3,897,878	0.0000	$ -	0.0500	$ 309,893	0.6666	1.24032635
2023	0.6121	$ 3,947,104	0.0000	$ -	0.0500	$ 316,090	0.6621	1.23587066
2024	0.6037	$ 3,970,737	0.0000	$ -	0.0500	$ 322,412	0.6537	1.2274614
2025	0.5975	$ 4,008,432	0.0000	$ -	0.0500	$ 328,861	0.6475	1.22124273
2026	0.5900	$ 4,037,140	0.0000	$ -	0.0500	$ 335,438	0.6400	1.21372249
2027	0.5849	$ 4,082,407	0.0000	$ -	0.0500	$ 342,146	0.6349	1.2086398
2028	0.5858	$ 4,170,183	0.0000	$ -	0.0500	$ 348,989	0.6358	1.20950045
2029	0.5807	$ 4,216,561	0.0000	$ -	0.0500	$ 355,969	0.6307	1.20440183
2030	0.3719	$ 2,754,909	0.0000	$ -	0.0500	$ 363,089	0.4219	0.99568285
2031	0.5876	$ 4,439,215	0.0000	$ -	0.0500	$ 370,350	0.6376	1.21132485
2032	0.5824	$ 4,487,786	0.0000	$ -	0.0500	$ 377,757	0.6324	1.20610669
2033	0.5900	$ 4,637,266	0.0000	$ -	0.0500	$ 385,313	0.6400	1.21370473
2034	0.5864	$ 4,701,543	0.0000	$ -	0.0500	$ 393,019	0.6364	1.21015402
2035	0.5815	$ 4,755,669	0.0000	$ -	0.0500	$ 400,879	0.6315	1.20527443
2036	0.3122	$ 2,604,449	0.0000	$ -	0.0500	$ 408,897	0.3622	0.93597819
2037	0.3178	$ 2,703,673	0.0000	$ -	0.0500	$ 417,075	0.3678	0.94151808
2038	0.0887	$ 769,673	0.0000	$ -	0.0500	$ 425,416	0.1387	0.71243742

Revenues based on projected assessed valuations of each MUD.
Tax collection rate: 98%

Expanded Table 5B

		Without Annexation			With Annexation & Limited Districts			Difference	
Year	Average Home Value	Taxes @ current Average MUD Tax Rate	Water and Wastewater Utility Bill	Total Annual Homeowner Cost Without Annexation: MUD Tax & Utility Bill	Taxes @ Combined City and Limited District Tax Rates	Water and Wastewater Utility Bill	Total Annual Homeowner Cost with Annexation & Limited Districts: MUD and City Tax & Utility Bill	Annual Increase (Decrease)	Monthly Increase (Decrease)
2016	$ 122,560	$ 1,477	$ 653	$ 2,130	$ 1,565	$ 810	$ 2,375	$ 245	$ 20.38
2017	$ 125,011	$ 1,506	$ 673	$ 2,179	$ 1,596	$ 834	$ 2,430	$ 251	$ 20.91
2018	$ 127,512	$ 1,537	$ 693	$ 2,229	$ 1,617	$ 859	$ 2,476	$ 247	$ 20.54
2019	$ 130,062	$ 1,567	$ 714	$ 2,281	$ 1,637	$ 885	$ 2,522	$ 241	$ 20.10
2020	$ 132,663	$ 1,599	$ 735	$ 2,334	$ 1,659	$ 912	$ 2,571	$ 237	$ 19.76
2021	$ 135,316	$ 1,631	$ 757	$ 2,388	$ 1,683	$ 939	$ 2,622	$ 235	$ 19.55
2022	$ 138,023	$ 1,663	$ 780	$ 2,443	$ 1,712	$ 967	$ 2,679	$ 236	$ 19.66
2023	$ 140,783	$ 1,696	$ 803	$ 2,500	$ 1,740	$ 996	$ 2,736	$ 236	$ 19.69
2024	$ 143,599	$ 1,730	$ 827	$ 2,558	$ 1,763	$ 1,026	$ 2,789	$ 231	$ 19.24
2025	$ 146,471	$ 1,765	$ 852	$ 2,617	$ 1,789	$ 1,057	$ 2,846	$ 228	$ 19.03
2026	$ 149,400	$ 1,800	$ 878	$ 2,678	$ 1,813	$ 1,088	$ 2,902	$ 224	$ 18.64
2027	$ 152,388	$ 1,836	$ 904	$ 2,740	$ 1,842	$ 1,121	$ 2,963	$ 223	$ 18.55
2028	$ 155,436	$ 1,873	$ 931	$ 2,804	$ 1,880	$ 1,155	$ 3,035	$ 231	$ 19.21
2029	$ 158,545	$ 1,910	$ 959	$ 2,870	$ 1,910	$ 1,189	$ 3,099	$ 229	$ 19.11
2030	$ 161,716	$ 1,949	$ 988	$ 2,937	$ 1,610	$ 1,225	$ 2,835	$ (101)	$ (8.45)
2031	$ 164,950	$ 1,988	$ 1,018	$ 3,005	$ 1,998	$ 1,262	$ 3,260	$ 255	$ 21.22
2032	$ 168,249	$ 2,027	$ 1,048	$ 3,076	$ 2,029	$ 1,300	$ 3,329	$ 253	$ 21.12
2033	$ 171,614	$ 2,068	$ 1,080	$ 3,148	$ 2,083	$ 1,339	$ 3,422	$ 274	$ 22.84
2034	$ 175,046	$ 2,109	$ 1,112	$ 3,221	$ 2,118	$ 1,379	$ 3,497	$ 276	$ 22.99
2035	$ 178,547	$ 2,151	$ 1,145	$ 3,297	$ 2,152	$ 1,420	$ 3,572	$ 275	$ 22.95
2036	$ 182,118	$ 2,195	$ 1,180	$ 3,374	$ 1,705	$ 1,463	$ 3,167	$ (207)	$ (17.23)
2037	$ 185,760	$ 2,238	$ 1,215	$ 3,453	$ 1,749	$ 1,507	$ 3,256	$ (198)	$ (16.48)
2038	$ 189,476	$ 2,283	$ 1,252	$ 3,535	$ 1,350	$ 1,552	$ 2,902	$ (633)	$ (52.74)

'Without Annexation' taxes based on average District tax rate of $1.205
"With Annexation" taxes based on combined City and Limited District tax rate from Table 4.
Tax collection rate: 98%

Statistical Information

2014 Texas Municipal Report or Audit Information (12/31/13)

	FBCMUD 23	FBCMUD 24	Total
Assessed Valuation	$ 489,958,462	$ 60,613,320	$ 550,571,782
Maintenance Tax	$ 0.25	$ 0.66	
Contract Tax	$ -	$ -	
Debt Tax	$ 0.80	$ 0.70	
Total Tax	$ 1.05	$ 1.36	
General "Unassigned" Fund Balance	$ 3,210,579	$ 782,640	$ 3,993,219
Debt Service Fund Balance (Restricted)	$ 4,095,256	$ 355,431	$ 4,450,687
Capital Projects Fund Balance (Restricted)	$ 1,047,807	$ 12,101	$ 1,059,908
Outstanding Debt	$ 57,765,000	$ 5,660,000	$ 63,425,000
Unissued Debt Authority	$ 24,270,000	$ 73,870,000	$ 98,140,000
Unissued Debt Authority for refunding purposes	$ 10,110,000	$ 47,100,000	$ 57,210,000
Unissued Debt Authority for parks purposes	$ 6,800,000	$ 4,450,000	$ 11,250,000
Due to developer *	$ 2,274,866	$ 5,511,314	$ 7,786,180
		$ 78,320,000	

Other Statistics

	FBCMUD 23	FBCMUD 24	Total	
Acreage	1,303.00	254.63	1,557.63	
Wastewater Utility Connections	4,126	414	4,540	2014 Break-Even analysis data
Water Utility Connections	4,182	425	4,607	Audits
Estimated Population	12,791	1,283	14,074	
Lane Miles	78.18	15.3	93.48	Estimate-prorated on lane-miles/acre average of other city distircts

City & MUD Comparative Data

	Existing City	FBCMUDs 23 & 24	Increase
Area	19,293	1,558	8%
Homes	23,897	4,607	19%
Population	70,185	14,074	20%
Lane-Miles	636	93	15%
Assessed Valuation	$ 4,704,436,564	$ 550,571,782	12%
Outstanding Debt *	$ 80,186,000	$ 63,425,000	79%
Debt per Capita	$ 1,142	$ 4,507	NA
Debt:AV Ratio	1.7%	11.5%	NA

* Texas Municipal Reports

Projected Utility Bill Imapct with Limited District Scenario

Revenues	FBCMUD 23 12 Months (Year ended 12/31/13)	FBCMUD 23 Projected Budget with Limited District	FBCMUD 24 12 Months (Year ended 12/31/13)	FBCMUD 24 Projected Budget with Limited District
Water Service	$ 881,590	$ 881,590	$ 107,098	$ 107,098
Sewer Service	$ 934,050	$ 934,050	$ 113,664	$ 113,664
Fire Service				
Property Taxes	$1,184,459		$ 302,123	
Penalties and Interest	$ 102,022	$ 102,022	$ 11,199	$ 11,199
Tap Connections/Inspections	$ 89,100	$ 89,100	$ 82,609	$ 82,609
Surface Water	$ 583,909	$ 583,909	$ 55,980	$ 55,980
Sales Taxes	$ 38,770	$ -		$ -
Miscellaneous	$ 129,341	$ 129,341	$ 7,956	$ 7,956
Investment Earnings	$ 10,623	$ 10,623	$ 2,193	$ 2,193
Total Revenues	**$3,953,864**	**$ 2,730,635**	**$ 682,822**	**$ 380,699**
Expenditures				
Purchased Water	$ 812,606	$ 812,606	$ 63,496	$ 63,496
Professional Fees	$ 112,726	$ 50,000	$ 61,495	$ 50,000
Contracted Services	$1,280,809	$ 803,288	$ 167,163	$ 131,945
Repairs/Maintenance	$ 616,463	$ 616,463	$ 45,184	$ 45,184
Utilities	$ 23,471	$ 23,471	$ -	
Administrative		$ -	$ 14,632	$ 14,632
Other	$ 213,071	$ 183,999	$ 7,526	$ 7,526
Surface Water	$ 525,140	$ 525,140	$ 50,758	$ 50,758
Capital Outlay	$ 33,663	$ 33,663	$ 160,386	$ 160,386
Intergovernmental/Contractual Obligations (1)				
Interest		$ -	$ 8,019	
Total Expenditures	**$3,617,949**	**$ 3,048,630**	**$ 578,659**	**$ 523,927**
Projected Revenue Excess (Defecit)		$ (317,995)		$ (143,228)
Excess (Defecit) Percentage of Total Revenues		-12%		-38%

Apply the revenue excess (defecit) percentage to the average monthly rate to project rate impact.

	2014	Projected	2014	Projected
10,000 Gallon Water Bill/Month	$ 34.80	$ 38.85	$ 25.25	$ 34.75
10,000 Gallon Wastewater Bill/Month	$ 19.00	$ 21.21	$ 23.56	$ 32.42
Total Utility Bill	$ 53.80	$ 60.07	$ 48.81	$ 67.17

Average Projected Monthly Bill	
$ 36.80	Water
$ 26.82	Wastewater
$ 63.62	

Appendix F
2018 Regional Water & Wastewater Planning Study by eHT

missouri CITY
TEXAS
the show me city

2018 REGIONAL WATER & WASTEWATER PLANNING STUDY UPDATE

Prepared by:

Enprotec / Hibbs & Todd

402 Cedar I Abilene, TX 79601
(325) 698-5560 tel I (325) 690-3240 fax
www.e-ht.com
PE Firm Registration No. 1151
PG Firm Registraion No. 50103
RPLS Firm Registration Nos. 10011900 & 10007300

Enprotec / Hibbs & Todd

Missouri City Texas
the show me city

2018 REGIONAL WATER & WASTEWATER PLANNING STUDY UPDATE

This document is released for the purpose of interim review only under the authority of Jordan S. Hibbs, P.E. #115729 on January 7, 2019.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

EXECUTIVE SUMMARY

SECTION 1: INTRODUCTION AND BACKGROUND
- 1.1 Project Scope
- 1.2 Participants and Study Area
- 1.3 Existing Water Treatment Facilities
- 1.4 Existing Wastewater Treatment Facilities
- 1.5 Water and Wastewater Capital Improvement Plans

SECTION 2: STUDY AREA STATISTICS
- 2.1 Current and Projected Connections
- 2.2 Current and Projected Population
- 2.3 Current and Projected Water Demand
- 2.4 Current and Projected Wastewater Production
- 2.5 Levee Infrastructure

SECTION 3: WATER TREATMENT AND DISTRIBUTION ALTERNATIVES

SECTION 4: WASTEWATER COLLECTION AND TREATMENT ALTERANTIVES
- 4.1 Option 1 – Retain Existing WWTPs
- 4.2 Option 2 – Consolidation to Five Treatment Facilities
- 4.3 Option 3 – Consolidation to Four Treatment Facilities
- 4.4 Option 4 – Consolidation to Three Treatment Facilities
- 4.5 Option 5 – New Sienna South and Steep Bank / Flat Bank Regional Master WWTPs

SECTION 5: RECOMMENDED CONSOLIDATION PROJECTS AND COSTS
- 5.1 Wastewater Consolidation

SECTION 6: IMPLEMENTATION PLAN

SECTION 7: CONCLUSIONS AND RECOMMENDATIONS

APPENDICES
- Appendix A Study Area Map
- Appendix B New Sienna Plantation Water Treatment Plant No. 3
- Appendix C Levee Map
- Appendix D Wastewater Consolidation Option 2 – Five Regional WWTPs
- Appendix E Wastewater Consolidation Option 3 – Four Regional WWTPs
- Appendix F Wastewater Consolidation Option 4 – Three Regional WWTPs
- Appendix G Wastewater Consolidation Option 5 – Two Master Regional WWTPs

ACKNOWLEDGEMENTS

The 2018 Regional Water and Wastewater Planning Study Update (Study) was prepared for the City of Missouri City (COMC [City]) to explore changes across the region since 2011. Although the 2011 Planning Study provided a strong foundation for the 2018 update, completing the Study would not have been successful without continued support from the City, as well as the 31 Municipal Utility District (MUD) participants providing water and wastewater services across the region. Enprotec / Hibbs & Todd, Inc. (eHT) would like to recognize and thank those who made contributions to the update efforts.

In particular, eHT would like to acknowledge the ongoing contribution and support from Mr. Scott Elmer, P.E. (COMC Assistant City Manager), Mr. Daniel McGraw (COMC Utility Manager), Ms. Karen Kennard and Mr. Phillip Gildan (Greenberg Traurig, LLP), Mr. David Yanke (NewGen Strategies & Solutions), and the MUDs. Also, eHT would like to thank Ms. Sharon Heisler with the City's Geographical Information System (GIS) Department for providing an updated map of the study area.

EXECUTIVE SUMMARY

The primary objectives of the 2018 Regional Water and Wastewater Planning Study Update (Study) were to highlight changes to the water and wastewater landscape since 2011, re-evaluate the 2011 projection statistics using current data, and revisit water and wastewater consolidation opportunities. A majority of the data was provided via the City of Missouri City (COMC [City]) and the individual Municipal Utility Districts (MUDs). Where necessary, additional data was obtained from the Texas Commission on Environmental Quality (TCEQ) Central Registry and Drinking Water Watch databases, as well as the Environmental Protection Agency's Enforcement and Compliance History Online (ECHO) database. In general, a majority of the growth projection methods utilized in the 2011 Study (derived from the 2008 Joint Groundwater Reduction Plan [GRP]) were maintained for this Study.

After 2011, several important projects were completed or undertaken within the region. Specifically, the City completed a 10 million gallon per day (MGD) regional surface water treatment plant (SWTP) located in Sienna Plantation MUD #12. This facility has allowed the City to reduce its dependence on groundwater in several of the adjacent MUDs. An expansion is planned at the SWTP, which will increase the treatment capacity to 20 MGD and further reduce groundwater use. Similarly, a new water plant was constructed in Sienna Plantation MUD #4 that exclusively uses surface water from the regional SWTP. On the wastewater side, a new wastewater treatment plant (WWTP) is currently being constructed in Sienna Plantation MUD #6. Smaller projects were also completed at the Quail Valley Utility District and Harris County MUD #122 WWTPs to rehabilitate and, in the case of Harris County, upgrade some of the existing equipment. Aside from these changes, the landscape remains generally unchanged since 2011.

Updating the projection statistics over the planning horizon (through 2040) began with assessing current connection data compared to equivalent 2018 projections from the 2011 Study. Not surprisingly, estimates from 2011 differed from actual connection data. Thus, the growth rates or timing of anticipate growth from the 2011 Planning Study were adjusted to reconcile the differences for each MUD. These adjustments were then extended through 2040. In several cases, updated projections were provided by independent engineering firms on behalf of the MUDs and incorporated into the updated statistics. In general, the connection projections suggested that growth occurred more slowly than anticipated in the 2011 Planning Study.

As with the connection projections, the population, water demand, and wastewater statistics were also lower compared to the estimates developed in the 2011 Planning Study. In terms of population estimates, using an average of 3.07 persons per connection in accordance with the 2011 Planning Study resulted in an average population projection approximately 22% lower in 2040 relative to the equivalent figure in the 2011 Planning Study. When updated water demands were evaluated, the current data showed that total consumption for the MUDs participating in the Joint GRP averaged approximately 15,700 gallons per connection per month (GPCM). Previously, the average consumption was higher at approximately 18,100 GPCM but did not account for water demands in Fort Bend County (FBC) MUD #23 and #24 (Joint GRP participants) that were accounted for in the 2018 Study. With less use in 2018 coupled with lower connection projections, the corresponding water demand projections were considerably less than the estimates in the 2011 Planning Study. From 2018 until 2040, the average water demand was approximately 23% lower than predicted over the same timeframe in the 2011 Planning Study. As for wastewater demand, the current projections reported in this Study are even lower. This was driven by a lower percentage of wastewater flow relative to water demand (approximately 50% on average) compared to the 60% observed in 2011. As a result, wastewater demand from 2018–2040 averaged approximately 42% less with the updated data set compared to previous estimates for the same timeframe.

From a consolidation perspective, no significant changes were proposed for the water infrastructure relative to previous recommendations. An emphasis on establishing inter-MUD water connections, constructing elevated storage tanks (ESTs), and using a limited number of regional water treatment plants (WTPs) is still warranted. As such, and updated assessment of the water consolidation economics from the 2011 Planning Study was not performed.

As for wastewater consolidation, five options were evaluated as part of this update. The first option (Option 1) consisted of maintaining the existing infrastructure with the exception of performing necessary rehabilitation and upgrade (R&U) or expansion and upgrade (E&U) projects at the WWTPs to address service life issues or build out capacity requirements. In the subsequent options (Option 2–5), the number of WWTPs would be reduced to five regional plants, then four, then three, and finally two master regional plants. In addition, for each option a hypothetical sub option was evaluated to divert flows from the Harris County MUD #122, Harris County Water Control and Improvement District (WC&ID)-Fondren Road, and Southwest Harris County MUD #1 WWTPs to the Fort Bend County WC&ID No. 2 WWTP, which lies outside the City's Extraterritorial Jurisdiction (ETJ). As requested by the City, operating and maintenance (O&M) costs for the network of MUD-owned levees throughout the study area were also accounted for in the wastewater consolidation cost analyses. For Options 2 through 5, conceptual capital and O&M costs were also assembled for the anticipated infrastructure associated with the consolidation efforts. Thereafter, a 30-year life cycle cost analysis was used to compare the options from an economic standpoint. Of the options, utilizing the City's Steep Bank / Flat Bank (SBFB) WWTP and the new WWTP in Sienna Plantation MUD #6 as master regional WWTPs provided the lowest life-cycle cost (approximately $132M compared to $220M for Option 1). In general, this finding is consistent with the 2011 Planning Study, which showed the lowest life cycle cost could be achieved by regionalizing to a single super-regional WWTP at the SBFB location.

Finally, from an implementation stance, the City and MUDs must coordinate and come to an agreement if water and wastewater consolidation is to be successful and provide long-term value. The 2008 Joint GRP provided some inertia for the water consolidation effort, whereas the wastewater side of the consolidation equation still merits consideration.

SECTION 1: INTRODUCTION AND BACKGROUND

Historically, the City has relied on individual utility districts to provide water and wastewater (W&WW) services for residents and businesses within the city limits and ETJ. Although this approach has ensured that utility needs are met, it has also resulted in duplication and inefficiencies across the community. When the most recent regionalization study was issued in 2011, there were 24 WTPs and 11 WWTPs operating within the COMC's ETJ. In 2018, the statistics include two new WTPs and one new WWTP that is currently being constructed. Two additional WTPs, located outside the COMC's ETJ in FBC MUD #23, are also included in this updated Study because FBC MUD #23 and #24 are part of the Joint GRP (FBC MUD #24 receives groundwater from FBC MUD #23; however, the WWTP in FBC MUD #23 was not considered in the updated Study. In addition, several wastewater improvement projects have been planned and/or completed since 2011.

1.1 Project Scope

The primary objective addressed in this Study is how wastewater consolidation options might be accomplished and whether they are technically and economically feasible. A majority of the information and findings from the 2011 Planning Study have not changed; however, several aspects have been updated to more accurately reflect 2018 conditions. For example, current and projected connection and population statistics, as well as current and projected water and wastewater demands were compiled and compared to the forecasts from 2011. In addition, the wastewater consolidation opportunities have been re-organized. For this updated Study, the City also requested that O&M costs for the network of MUD-owned levees throughout the region be incorporated into the wastewater regionalization options presented later in this report. Aside from these core topics, the updated information has intentionally been condensed relative to the 2011 Planning Study, and information not presented in this report should be solicited from the prior report.

1.2 Participants and Study Area

The study area includes the 31 individual utility districts that are listed in Table 1-1. In general, all of the listed participants lie within the City's ETJ. The City and a majority of the utility districts are primarily located in Fort Bend County, but Harris County MUD #122, Harris County WC&ID-Fondren Road, and Southwest Harris County MUD #1 are located in Harris County. A map of the study area is provided for reference in Appendix A.

Excluding a small section of FBC MUD #23, both FBC MUD #23 and FBC MUD #24 are outside the ETJ. Although water demands from the WTPs in these MUDs were evaluated in this Study, the Districts are not participants in this Study. A detailed assessment of Fort Bend County WC&ID #2 was also excluded because all of its WTPs and WWTPs are outside of the City's ETJ, and any service connections that lie within the ETJ obtain utility services from FBC WC&ID #2.

Table 1-1: Regional Planning Participants

Participant Name	
Blue Ridge West MUD	Palmer Plantation MUD #2
COMC Mustang Bayou USA	Quail Valley Utility District
First Colony MUD #9	Sienna Plantation Management District
Fort Bend County MUD #26	Sienna Plantation MUD #1
Fort Bend County MUD #42	Sienna Plantation MUD #2
Fort Bend County MUD #46	Sienna Plantation MUD #3
Fort Bend County MUD #47	Sienna Plantation MUD #4
Fort Bend County MUD #48	Sienna Plantation MUD #5
Fort Bend County MUD #49	Sienna Plantation MUD #6
Fort Bend County MUD #115	Sienna Plantation MUD #7
Fort Bend County MUD #129	Sienna Plantation MUD #10
Fort Bend County MUD #149	Sienna Plantation MUD #12
Harris County MUD #122	Sienna Plantation MUD #13 (The Woods)
Harris County WC&ID - Fondren Road	Southwest Harris County MUD #1
Meadowcreek MUD	Thunderbird Utility District (UD)
Palmer Plantation MUD #1	

Note: Fort Bend County MUD #23 and #24 are not included.

1.3 Existing Water Treatment Facilities

With two exceptions, the water treatment landscape across the City is relatively unchanged since 2011. Most notably in 2012, construction was completed on the first phase (Phase I) of the City's regional SWTP. During construction of the SWTP, transmission water lines were also installed to supply water to Sienna Plantation WTP #1 and #2. Since 2012, additional transmission projects have been undertaken to provide surface water to several other MUDs in the study area. In general, the surface water reduces dependence on groundwater at each of the receiving districts but does not completely eliminate the use of groundwater at these locations. Design efforts for the second phase (Phase II) expansion of the SWTP began in the spring of 2017, with construction anticipated to begin in 2019. When completed, Phase II will increase the Plant's treatment capacity from 10 to 20 MGD and help to lessen the City's dependence on groundwater.

In addition, a new water plant was constructed in Sienna Plantation MUD #4 (Sienna WTP No. 3). The Sienna WTP No. 3 utilizes a 600,000-gallon groundwater storage tank (GST) and 20,000 Hydropneumatic Tank (HT). The plant was completed in 2017 and currently provides drinking water to developments in Sienna Plantation MUD #4. Unlike other WTPs in the adjacent districts, Sienna WTP No. 3 relies solely on surface water from the regional SWTP.

A summary of the MUD WTP capacities is provided in Table 1-2 and the locations the WTPs are also shown in Appendix B. As mentioned earlier, the two WTPs in FBC MUD #23 are also included since the District is part of the Joint GRP. A list of WTPs and corresponding MUDs currently receiving water from the City's regional SWTP is provided in Table 1-3.

Table 1-2: Existing MUD Water Plants and Capacities

Number	WTP	Location	Permitted Capacity, MGD
1	Blue Ridge West MUD – WTP No. 1	1415 FM 2234	3.168
2	Blue Ridge West MUD – WTP No. 2	903 Manor Glen	
3	COMC Regional SWTP	4655 1/2 Bees Creek Ct	10
4	COMC Mustang Bayou USA – WTP No. 1	2880 Watts Plantation Dr.	3.159
5	COMC Mustang Bayou USA – WTP No. 2 [a]	2775 Senior Rd.	1.440
6	First Colony MUD #9	Ringrose Dr.	3.024
7	Fort Bend County MUD #23 – WTP No. 1	1575 Rabb Rd.	6.34
8	Fort Bend County MUD #23 – WTP No. 2	2926 1/2 Valiant Elm St.	
9	Fort Bend County MUD #26	1812 Freshmeadow Drive	2.728
10	Fort Bend County MUD #42	1819 1/2 Lake Winds	2.304
11	Fort Bend County MUD #46	Sable River Drive	1.440
12	Fort Bend County MUD #115	20425 University Blvd.	2.174
13	Fort Bend County MUD #149	5603 1/2 Rising Walk Lane	0.648
14	Harris County WC&ID - Fondren Road – WTP No. 1	11802 1/2 McClain Blvd.	3.760
15	Harris County WC&ID - Fondren Road – WTP No. 2	9380 S. Sam Houston Pkwy. W.	
16	Meadowcreek MUD	3100 N. Park	1.158
17	Palmer Plantation MUD #1	Kenwick Street	2.138
18	Palmer Plantation MUD #2	1603 Lake Olympia Pkwy.	1.728
19	Quail Valley Utility District – WTP No. 1	2935 Blue Lakes Ln.	8.524
20	Quail Valley Utility District – WTP No. 2	2143 Cartwright	
21	Quail Valley Utility District – WTP No. 3	1930 Rothwell	
22	Sienna Plantation MUD #2 – Sienna WTP No. 1	Murray Ct.	7.380
23	Sienna Plantation MUD #10 – Sienna WTP No. 2	9 Mile Lane	
24	Sienna Plantation MUD #4 – Sienna WTP No. 3	2024 ½ Scanlan Rd.	2.88
25	Southwest Harris County MUD #1	7843 La Rochelle Cir.	0.748
26	Thunderbird Utility District (System 1) – WTP No. 1	6605 Highway 6	3.060
27	Thunderbird Utility District (System 1) – WTP No. 2	3003 Glenn Lakes Dr.	
28	Thunderbird Utility District (System 2) – WTP No. 1	1455 Turtle Creek	0.959
Total Permitted Capacity			68.76

[a] Formerly Vicksburg Joint Powers

Table 1-3: Regional SWTP Water Users

WTPs Receiving Water from Regional SWTP	Districts Served
Fort Bend County MUD #115	Residing District Fort Bend County MUD #129
Fort Bend County MUD #149	Residing District only
Fort Bend County MUD #46	Residing District only
Sienna Plantation MUD #2 – Sienna WTP No. 1	Sienna Plantation Management District Sienna Plantation MUD #2, 3, 10, 12, and 13
Sienna Plantation MUD #10 – Sienna WTP No. 2	
Sienna Plantation MUD #4 – Sienna WTP No. 3	Residing District only

1.4 Existing Wastewater Treatment Facilities

With few exceptions, the wastewater treatment scene remains unchanged in 2018. Two of the WWTPs are City-owned (SBFB and Mustang Bayou [MB]), with the remaining WWTPs owned and operated by the MUDs (refer to Appendix A for approximate locations of the WWTPs). Since 2011, two noteworthy wastewater projects were completed by Quail Valley Utility District (QVUD) and Harris County (HC) MUD #122. In particular, QVUD performed minor rehabilitation of ancillary equipment at its WWTP. Similarly, HC MUD #122 upgraded its WWTP around 2013 to replace the contact stabilization treatment process with an extended aeration treatment process. However, the upgrade consisted of equipment modifications rather than complete replacement. Treatment capacities at the rehabilitated QVUD and upgraded HC MUD #122 WWTPs were not affected. Accordingly, the permitted capacities the WWTPs are summarized in Table 1-4. The capacities were obtained from the TCEQ Central Registry database. A list of the MUDs served by each WWTP is also provided in Table 1-5.

As noted in the 2011 Planning Study, a majority of the WWTPs are package treatment plants. While package plants are attractive from a simplicity of design and ease of construction perspective, the plants themselves do not have long service lives. In particular, the 2011 Planning Study estimated that all but the MB and SBFB WWTPs had remaining service lives of 5-10 years. Seven years later, these facilities are at, or near the end of their intended service lives.

Table 1-4: Existing Wastewater Treatment Plants

Number	WWTP	Location	Permitted Capacity, MGD
1	Blue Ridge West MUD (BRW)	8103 Independence Blvd.	1.3
2	COMC Mustang Bayou USA (MB)	3650 Trammel Fresno Rd.	0.95
3	Fort Bend County MUD #26 (FBC #26)	1403 Lazy Spring Dr.	0.5
4	Harris County MUD #122 (HC #122)	760 Cravens Rd.	0.25
5	Harris County WC&ID - Fondren Road (HC-Fondren)	15164 E. Hampton Cr.	0.6
6	Palmer Plantation MUD #1 (PP)	2415 Lake Olympia Pkwy.	0.6
7	Quail Valley Utility District (QVUD)	2939 Blue Lakes Ln.	4.0
8	Sienna Plantation MUD #10 (Sienna North)	Discovery Ln.	0.902
9	Sienna Plantation MUD #3 (Sienna South)	200 Waters Lake Blvd.	1.2
10	Southwest Harris County MUD #1 (SWHC #1)	15103 East Hampton Cir.	0.40
11	Steep Bank / Flat Bank (SBFB)	6310 Oilfield Rd.	3.0
Total Permitted Capacity			13.7

Notes:

1. Permitted capacities were extracted from current TPDES permits obtained through the TCEQ's Central Registry
2. A new Sienna South WWTP is currently being constructed in Sienna Plantation MUD #6. Once completed, the new Sienna South WWTP will have a permitted capacity of 1.8 MGD. Flows from the existing Sienna South WWTP will be diverted to the new Sienna South WWTP and the existing Sienna South WWTP will be decommissioned and used as a transfer pump station.
3. The WWTP in FBC MUD #24 was not included in this Study.

Table 1-5: MUD Allocations by Wastewater Treatment Plant

WWTP	Districts Served
BRW	Residing District only
MB	Residing District Fort Bend County MUD #47 and 48
FBC #26	Residing District only
HC #122	Residing District only
HC-Fondren	Residing District only
PP	Palmer Plantation MUD #1 and 2 Fort Bend County MUD #49
QVUD	Residing District Thunderbird UD Meadowcreek
Sienna North	Residing District Sienna Plantation MUD #12 Sienna Plantation Management District
Sienna South	Residing District Sienna Plantation MUD #1, 2, 4, 5, 6, 7, and 13
SWHC #1	Residing District only
SBFB	First Colony MUD #9 Fort Bend County MUD #42, 46, 115, 129, and 149

1.5 Water and Wastewater Capital Improvement Plans

Capital improvement plans (CIPs) were requested from the MUDs to examine significant improvements that are planned over the next five years. The intent was to account for new water or wastewater treatment facilities that may impact the consolidation alternatives presented later in this report.

Fort Bend County MUD #26, FBC MUD #49, Harris County WC&ID - Fondren Road, Meadowcreak MUD, Palmer Plantation (PP) MUD #1, QVUD, and Sienna Plantation MUD #1 all provided CIPs; although, not all of the plans were for the coming five years. Regardless, a majority of the plans emphasized costs for various water and/or wastewater maintenance activities and relatively minor equipment replacement or repair costs. Aside from the CIPs, the COMC is also in the conceptual planning phase for expansion of its MB WWTP from 0.95 to about 1.85 MGD.

Sienna Plantation MUD #1 was the only district that reported a major project in the near future. As of May 2018, approximately $30 million (M) in Texas Water Development Board (TWDB) funding was approved for the construction of a new south WWTP (located in Sienna Plantation MUD #6).[1] When completed the existing south WWTP (located in Sienna Plantation MUD #3) will be abandoned and the site will be used as a transfer station to pump wastewater to the new facility. In addition, a portion of the funding has been allocated for conversion of the existing north WWTP (located in Sienna Plantation MUD #10) into a regional lift station to pump wastewater to the City's Steep Bank / Flat Bank WWTP. If Sienna Plantation elects to transfer flows to the SBFB facility, the north WWTP would be abandoned. Construction on the new south WWTP is anticipated to be completed in late 2019 or early 2020.

[1] TWDB press release available online at www.twdb.texas.gov/newsmedia/press_releases/2018/05/sienna.asp

SECTION 2: STUDY AREA STATISTICS

A core objective of the 2018 Study was to determine updated connection and population projections, as well as the corresponding water and wastewater demands. A majority of the updated statistics were provided by the utility districts; however, not all of the data were available at the time this report was updated. In addition, it should be noted that the projections in this updated Study are largely based on growth rates from the 2011 Planning Study, which were derived from the 2008 Joint GRP. Actual development in certain areas, such as the MB area, have differed considerably. As a result, the projections and demands should be confirmed with the individual utility districts if the data are to be used as engineering design criteria. The connection/population projections and corresponding demands are presented separately below.

2.1 Current and Projected Connections

Although the previous projections were based on the 2008 Joint GRP and 2010 U.S. Census data, all of the MUDs except FBC MUD #23 and #24 (not included in the 2011 Study) reported connection counts in 2018 that differed from the equivalent projections from 2011. Some of the MUDs grew more slowly than anticipated, while others reported stronger growth compared to earlier estimates. Alternatively, some MUDs saw no growth from 2010–2018 and others even appeared to contract. Excluding FBC MUD #23 and #24, examples of the growth conditions for the remaining MUDs are presented to discuss how the connection projections were prepared.

In the case of faster or slower growth, the 2018 connection data from each utility district was compared to the equivalent projection from the 2011 Planning Study. The growth rate from 2010–2018 was adjusted up or down accordingly until the two connection counts agreed. Once the adjusted growth rate for the 2010–2018 period was determined, the growth rate reported in the 2011 Planning Study beyond 2018 was also adjusted by the same factor. For example, the First Colony MUD #9 system in 2010 had 2,677 connections and was expected to have 2,757 connections in 2018. In reality, there were 2,685 connections reported in 2018, yielding an average growth rate of approximately 90% lower than originally projected. Correspondingly, the growth rate beyond 2018 was also decreased by 90%. Similar adjustments were also made for the following MUDs:

- FBC MUD #42, 49, and 149;
- Harris County WC&ID - Fondren Road;
- Palmer Plantation MUD #1 and 2;
- Sienna Plantation (SP) Mgmt. District; and
- SP MUD #4, 5, 6, 7, 10 and 12.

Alternatively, the 2011 statistics estimated that several of the districts would experience growth from 2010–2018 but reach build out or stop growing around 2018. This was the case for Blue Ridge West MUD and FBC MUD #115, which had slightly fewer connections in 2018 than were originally projected in 2011. In general, FBC MUD #46 and 129 also fell into this category, but each had considerably fewer connections than projected for 2018. Similarly, the 2011 Planning Study indicated that SP MUD #2 and 3 were not expected to experience any growth through 2040, so the current connection data was maintained for the entire projection horizon. For SP MUD #2 this assumption appeared to be appropriate in that the current connection data showed 1,781 connections compared to an estimated 1,784 connections from the earlier study. Sienna Plantation MUD #3 reported measurable growth, but the current connections were maintained through 2040 to provide continuity with the methods used in 2011 and correspondingly in the 2008 Joint GRP.

In some instances, the data indicated that quantifiable growth had taken place since 2010, even though growth was not originally projected until after 2018. This was the case for FBC MUD #26, Thunderbird UD, QVUD, and SP MUD #13. As a result, the anticipated growth beyond 2018 was shifted forward until the 2011 Planning Study connection data matched current conditions. Then, the accelerated growth rate from 2010–2018 was determined and applied to the expected growth beyond 2018.

Several of the utility districts also showed negligible or negative growth since 2010 but were originally projected to grow from 2010–2018. Harris County MUD #122, Meadowcreek MUD, SP MUD #1, and SWHC MUD #1 fell into this category; however, the projected growth beyond 2018 in the 2011 Planning Study was maintained for these MUDs.

Finally, growth projections for the COMC MB area and FBC MUD #47 and #48 were not based on the previous 2011 Study growth rates. Instead, updated projections were provided by Jones|Carter (J|C) and included current connection data for 2018 and a projected connection count in 2028. To estimate the number of connections beyond 2028, the growth rate from 2018–2040 was assumed to be linear and extrapolated to predict future growth through 2040. Although revised projections were available for these districts, the following general comparisons were made from the 2011 Study:

- The COMC MB area grew slower than expected between 2010 and 2018, with a 2011 Study projection of 2,221 connections in 2018 compared to 984 current connections;

- FBC MUD #47 also had slower growth from 2010–2018, with 942 connections anticipated by 2018 compared to an actual count of 651 connections; and

- FBC MUD #48 grew faster since 2010, with 1,198 current connections as opposed to 668 connections projected for 2018 in the 2011 Study.

2.1.1 Fort Bend County MUD #23 and #24

Unlike the 2011 Study, connection projections were also prepared for FBC MUD #23 and #24 because these MUDs are part of the Joint GRP and the data is necessary for the water demand projections presented later in this Study. For these MUDs, connection projections were based on data provided by the MUD Engineering Firm. The connection projections for FBC MUD #23 and #24 were provided in five-year increments beginning with 2020 and ending in 2040.

2.1.2 Build Out Projections

With the exception of FBC MUD #23, #24, and #48 and the COMC MB area, the build out projections from the 2011 Planning Study were retained in the updated projections. Since the J|C 2028 projection for FBC MUD #48 (1,671 connections) was greater than the corresponding build out projection in the 2011 Study, the 2028 value was used instead of the 1,370 connections listed the 2011 Study. Conversely, the projection from the 2011 Study for the COMC MB area (12,273 connections) was reduced by approximately 32% to reflect the slower growth in that area than previously expected. Thus, an estimated 3,900 connections at build out was assumed for the MB area. Build out projections for FBC MUD #23 and #24 were estimated from the data provided by the MUD Engineering firm.

2.1.3 Results

When all of the projection adjustments were completed, slower growth was the overarching trend. Excluding FBC MUD #23 and #24, the current connection count in 2018 (34,786 connections) was approximately 6% lower than the 2011 Planning Study projection of 36,988 connections in 2018. Beyond 2020, the gap widens and by 2040, the updated projections are approximately 22% lower than the corresponding connection forecasts from the 2011 Planning Study.[2] The updated connection projections are summarized in Table 2-1.

[2] Percentage calculated as the difference between the current and equivalent 2011 Planning Study value divided by the 2011 Planning Study value.

Table 2-1: 2018 Connections and Projections

District	Estimated 2018 Connections from 2011 Planning Study	2018 Current Connections [a]	2020	2025	2030	2035	2040	Build Out
Blue Ridge West MUD	2,507	2,482	2,482	2,482	2,482	2,482	2,482	2,509
COMC Mustang Bayou USA	2,221	984 [b]	1,198	1,733	2,268	2,803	3,338	3,900
First Colony MUD #9	2,757	2,685 [c]	2,687	2,692	2,697	2,702	2,707	3,300
Fort Bend County MUD #23	na	4,480 [d]	4,613	4,703	4,792	4,792	4,792	4,792
Fort Bend County MUD #24	na	887 [d]	933	1,533	2,150	2,725	3,300	3,300
Fort Bend County MUD #26	1,486	1,502 [c]	1,507	1,518	1,529	1,540	1,552	2,145
Fort Bend County MUD #42	1,471	1,350 [c]	1,362	1,391	1,421	1,450	1,479	1,507
Fort Bend County MUD #46	1,035	784	784	784	784	784	784	1,073
Fort Bend County MUD #47	942	651 [b]	700	822	944	1,000	1,000	1,000
Fort Bend County MUD #48	668	1,198 [b]	1,293	1,529	1,671	1,671	1,671	1,671
Fort Bend County MUD #49	362	347 [c]	349	354	359	364	369	396
Fort Bend County MUD #115	580	571	571	571	571	571	571	580
Fort Bend County MUD #129	1,550	1,461	1,461	1,461	1,461	1,461	1,461	1,550
Fort Bend County MUD #149	1,480	1,247	1,529	1,700	1,700	1,700	1,700	1,700
Harris County MUD #122	522	409 [c]	437	507	577	647	713	714
Harris County WC&ID - Fondren Road	1,202	1,021 [c]	1,022	1,025	1,028	1,031	1,034	1,566
Meadowcreek MUD	939	848	852	862	872	882	892	985
Palmer Plantation MUD #1	700	652	654	659	664	669	674	798
Palmer Plantation MUD #2	890	821	825	835	845	855	865	1,000
Quail Valley Utility District	4,427	4,439	4,443	4,453	4,463	4,473	4,483	4,514
Sienna Plantation Management District	120	155	206	332	453	453	453	453
Sienna Plantation MUD #1	19	14	14	15	16	18	20	25
Sienna Plantation MUD #2	1,784	1,781	1,781	1,781	1,781	1,781	1,781	1,781
Sienna Plantation MUD #3	2,455	2,614	2,614	2,614	2,614	2,614	2,614	2,614
Sienna Plantation MUD #4, 5, 6, & 7	1,800	815	1,177	2,536	3,894	5,252	6,611	10,000
Sienna Plantation MUD #10	1,916	2,113	2,222	2,433	2,433	2,433	2,433	2,433
Sienna Plantation MUD #12	403	1,256	1,439	1,439	1,439	1,439	1,439	1,439
Sienna Plantation MUD #13 (The Woods)	55	114	224	499	774	1,049	1,194	1,194
Southwest Harris County MUD #1	779	528	591	749	906	1,064	1,064	1,315
Thunderbird Utility District	1,918	1,944	1,951	1,969	1,986	1,986	1,986	1,986
Total (excluding FBC MUD #23 & #24)	36,988	34,786	36,373	39,745	42,632	45,174	47,369	54,148
Total from 2011 Study (excluding FBC MUD #23 & #24)			*39,835*	*47,603*	*54,622*	*59,133*	*60,539*	*62,365*

Note: Build out projections in this Study are lower than those reported in the 2011 Study due to a significantly decreased estimate for the COMC MB area.
na = not applicable
[a] District-provided records data unless noted otherwise
[b] Data provided by Jones|Carter
[c] Obtained from TCEQ Drinking Water Watch Website available online at http://dww2.tceq.texas.gov/DWW/
[d] Data provided by MUD Engineer

2.2 Current and Projected Population

All of the updated population data provided by the MUDs originated from the TCEQ's Drinking Water Watch (DWW) website. Once compiled and compared to the current connection data for 2018, an average of 2.85 persons per connection was obtained. According to the 2008 Joint GRP and 2011 Planning Study, historical rates have been closer to 3.04 and 3.07 persons per connection, respectively. Given the sharp discrepancy between the current and historical rates, 3.07 persons per connection was maintained for the updated population projections listed in Table 2-2. Population statistics were not prepared for FBC MUD #23 or #24.

Table 2-2: 2018 Population Projections

District	2018 Current Population	2020	2025	2030	2035	2040	Build Out
Blue Ridge West MUD	7,620	7,620	7,620	7,620	7,620	7,620	7,703
COMC Mustang Bayou USA	3,021	3,678	5,320	6,963	8,605	10,248	11,983
First Colony MUD #9	8,243	8,249	8,264	8,280	8,295	8,310	10,131
Fort Bend County MUD #26	4,611	4,625	4,659	4,694	4,729	4,763	6,585
Fort Bend County MUD #42	4,145	4,181	4,271	4,361	4,451	4,541	4,626
Fort Bend County MUD #46	2,407	2,407	2,407	2,407	2,407	2,407	3,294
Fort Bend County MUD #47	1,999	2,148	2,523	2,897	3,069	3,069	3,070
Fort Bend County MUD #48	3,678	3,968	4,694	5,130	5,130	5,130	5,130
Fort Bend County MUD #49	1,065	1,071	1,087	1,102	1,117	1,133	1,216
Fort Bend County MUD #115	1,753	1,753	1,753	1,753	1,753	1,753	1,781
Fort Bend County MUD #129	4,485	4,485	4,485	4,485	4,485	4,485	4,759
Fort Bend County MUD #149	3,828	4,693	5,219	5,219	5,219	5,219	5,219
Harris County MUD #122	1,256	1,342	1,556	1,771	1,986	2,189	2,192
Harris County WC&ID - Fondren Road	3,134	3,138	3,148	3,156	3,165	3,173	4,808
Meadowcreek MUD	2,603	2,616	2,646	2,677	2,708	2,738	3,024
Palmer Plantation MUD #1	2,002	2,008	2,023	2,038	2,054	2,069	2,450
Palmer Plantation MUD #2	2,520	2,533	2,563	2,594	2,625	2,656	3,070
Quail Valley Utility District	13,628	13,640	13,671	13,701	13,732	13,763	13,858
Sienna Plantation Management District	476	631	1,019	1,391	1,391	1,391	1,391
Sienna Plantation MUD #1	43	43	46	49	55	61	77
Sienna Plantation MUD #2	5,468	5,468	5,468	5,468	5,468	5,468	5,468
Sienna Plantation MUD #3	8,025	8,025	8,025	8,025	8,025	8,025	8,025
Sienna Plantation MUD #4, 5, 6, & 7	2,502	3,614	7,784	11,954	16,124	20,294	30,700
Sienna Plantation MUD #10	6,487	6,822	7,469	7,469	7,469	7,469	7,469
Sienna Plantation MUD #12	3,856	4,418	4,418	4,418	4,418	4,418	4,418
Sienna Plantation MUD #13 (The Woods)	350	688	1,532	2,376	3,220	3,666	3,666
Southwest Harris County MUD #1	1,621	1,815	2,300	2,782	3,267	3,267	4,037
Thunderbird Utility District	5,968	5,990	6,043	6,097	6,097	6,097	6,097
Total	106,793	111,666	122,016	130,879	138,684	145,422	166,234

Note: Current population projections were determined assuming 3.07 persons per connection.

Because 3.07 persons per connection was used for the updated data set, the previous projections from 2011 and updated 2018 projections differed by the same percentages summarized earlier in the Current and Projected Connections section. Similarly, the updated 2018 projections were generally lower than the original 2008 Joint GRP projections, with differences averaging approximately 7%. Conversely, the current projections were approximately 12 and 22% higher in 2020 and 2030, respectively, than the population projections from the TWDB. The population data from the various sources are presented in Table 2-3.

Table 2-3: Population Projections Comparison

Source	2018	2020	2025	2030	2035	2040
2008 Joint GRP	121,164	127,887	147,732	166,282	na	na
TWDB	na	106,669	na	125,545	na	142,770
2011 Planning Study	113,554	122,293	146,141	167,690	181,538	185,855
Current Study	106,793	111,666	122,016	130,879	138,684	145,422

2.3 Current and Projected Water Demand

In general, a majority of the utility districts provided updated water usage data. This data was used in conjunction with the current connection data for 2018 to determine average monthly demands for each participating district in the Joint GRP (including FBC MUD #23 and #24) on a GPCM basis. Current data from HC MUD #122, SP Management District, SP MUD #1 and 13, and SWHC MUD #1 was not available at the time this report was assembled. Consequently, data for these districts was derived from the 2011 Planning Study.

Neglecting the effects FBC MUD #23 and #24, a majority of the districts had lower average monthly demands in 2018 compared to the equivalent average monthly demands from 2011. On average, approximately 18,100 GPCM was reported in the 2011 Study, whereas approximately 16,000 GPCM was currently used. Coupled with the lower connection projections, the projected water demands through 2040 were also considerably lower compared to their equivalent projections from the previous study. Specifically, the current demands averaged nearly 31% lower for 2018–2040. When water usage in FBC MUD #23 and #24 are accounted for, the average monthly demand decreases slightly to approximately 15,700 GPCM, resulting in demands that average approximately 23% lower for 2018–2040. Updated water projections are provided in Table 2-4.

Table 2-4: Current and Projected Monthly Water Demands

District	GPCM (2018 Estimate from 2011 Study)	GPCM (Current)	Monthly Water Demand, Gallons						
			2018	2020	2025	2030	2035	2040	Build Out
Blue Ridge West MUD	11,538	7,888	19,576,833	19,576,833	19,576,833	19,576,833	19,576,833	19,576,833	19,789,796
COMC Mustang Bayou USA	11,873	26,046	25,629,333	31,203,192	45,137,840	59,072,488	73,007,136	86,941,783	101,579,675
First Colony MUD #9	12,372	10,603	28,469,833	28,491,040	28,544,056	28,597,073	28,650,089	28,703,106	34,990,857
Fort Bend County MUD #23 & #24	na	7,455	40,011,667	41,346,134	46,490,172	51,753,492	56,040,190	60,326,888	60,326,888
Fort Bend County MUD #26	8,393	6,675	10,025,833	10,055,871	10,130,964	10,206,058	10,281,152	10,356,245	14,317,851
Fort Bend County MUD #42	12,825	11,029	14,888,667	15,018,253	15,342,220	15,666,186	15,990,152	16,314,119	16,620,163
Fort Bend County MUD #46	16,620	14,007	10,981,292	10,981,292	10,981,292	10,981,292	10,981,292	10,981,292	15,029,242
Fort Bend County MUD #47	12,783	9,736	6,337,917	6,813,017	8,000,768	9,188,519	9,731,769	9,731,769	9,735,663
Fort Bend County MUD #48	12,783	6,460	7,738,667	8,349,750	9,877,458	10,794,083	10,794,083	10,794,083	10,794,083
Fort Bend County MUD #49	26,448	9,194	3,190,333	3,208,721	3,254,692	3,300,662	3,346,632	3,392,602	3,640,841
Fort Bend County MUD #115	22,008	19,926	11,377,667	11,377,667	11,377,667	11,377,667	11,377,667	11,377,667	11,556,999
Fort Bend County MUD #129	22,008	13,046	19,059,533	19,059,533	19,059,533	19,059,533	19,059,533	19,059,533	20,220,586
Fort Bend County MUD #149	11,873	7,663	9,556,083	11,713,559	13,027,539	13,027,539	13,027,539	13,027,539	13,027,539
Harris County MUD #122	8,190	10,453	4,275,180	4,567,857	5,299,551	6,031,244	6,762,938	7,452,820	7,463,273
Harris County WC&ID - Fondren Road	6,750	7,766	7,929,500	7,937,811	7,964,118	7,985,063	8,006,008	8,026,953	12,162,191
Meadowcreek MUD	8,762	7,197	6,102,917	6,131,704	6,203,672	6,275,641	6,347,609	6,419,577	7,088,883
Palmer Plantation MUD #1	26,448	12,862	8,386,083	8,411,808	8,476,118	8,540,428	8,604,739	8,669,049	10,263,949
Palmer Plantation MUD #2	14,003	14,247	11,696,583	11,753,570	11,896,038	12,038,505	12,180,973	12,323,440	14,246,752
Quail Valley Utility District	10,940	7,301	32,410,167	32,439,372	32,512,384	32,585,396	32,658,409	32,731,421	32,957,759
Sienna Plantation Management District	64,350	49,819	7,722,000	10,242,273	16,542,956	22,568,168	22,568,168	22,568,168	22,568,168
Sienna Plantation MUD #1	81,425	110,505	1,547,075	1,547,075	1,657,580	1,768,086	1,989,096	2,210,107	2,762,634
Sienna Plantation MUD #2	14,618	12,788	22,776,083	22,776,083	22,776,083	22,776,083	22,776,083	22,776,083	22,776,083
Sienna Plantation MUD #3	14,618	10,424	27,248,850	27,248,850	27,248,850	27,248,850	27,248,850	27,248,850	27,248,850
Sienna Plantation MUD #4, 5, 6, & 7	14,618	9,210	7,506,307	10,842,444	23,352,956	35,863,469	48,373,981	60,884,494	92,101,932
Sienna Plantation MUD #10	14,618	10,379	21,931,750	23,065,031	25,253,170	25,253,170	25,253,170	25,253,170	25,253,170
Sienna Plantation MUD #12	14,618	16,859	21,175,250	24,260,497	24,260,497	24,260,497	24,260,497	24,260,497	24,260,497
Sienna Plantation MUD #13 (The Woods)	14,618	7,053	803,990	1,579,770	3,519,219	5,458,669	7,398,119	8,420,737	8,420,737
Southwest Harris County MUD #1	5,310	7,832	4,135,428	4,630,426	5,867,922	7,097,585	8,335,080	8,335,080	10,299,409
Thunderbird Utility District	10,344	10,244	19,914,917	19,986,627	20,165,902	20,345,177	20,345,177	20,345,177	20,345,177
Total	-	-	412,405,739	434,616,062	483,798,052	528,697,457	564,972,964	598,509,085	671,849,650
Equivalent Daily Flow, MGD	-	-	13.6	14.3	15.9	17.4	18.6	19.7	22.1

na = not applicable

2.3.1 TCEQ Regulatory Requirements

As the City and its associated utility districts continue to grow, it is important that water demands be monitored and periodically assessed to ensure compliance with TCEQ requirements. In the absence of an Alternative Capacity Requirement (ACR), the TCEQ requires that a water production facility must have sufficient capacity to supply 0.6 gallons per minute (gpm) per connection.[3] By comparison, the current average demand for all of the districts within the study area was approximately 0.36 gpm per connection. Given the difference, monthly water demands based on TCEQ requirements are substantially higher as shown in Table 2-5.

Table 2-5: TCEQ vs. Actual Water Demand Projections

Basis	Monthly Water Demand, gallons						
	2018	2020	2025	2030	2035	2040	Build Out
TCEQ Requirement	1,055,115,720	1,101,643,167	1,208,368,769	1,302,792,714	1,384,719,437	1,457,505,976	1,635,667,200
2018 Projections	412,405,739	434,616,062	483,798,052	528,697,457	564,972,964	598,509,085	671,849,650
Difference	642,709,981	667,027,106	724,570,717	774,095,257	819,746,473	858,996,891	963,817,550
Equivalent MGD [a]	21.1	21.9	23.8	25.4	27.0	28.2	31.7

[a] Based on the difference

The TCEQ-based water projections were assembled to compare current demands with regulatory requirements and should not be interpreted as a capacity assessment. Instead, a separate analysis may be justified to determine if the difference between the TCEQ and actual projections warrants an ACR application.

2.3.2 Groundwater Reduction Regulatory Requirements

In accordance with the Fort Bend Subsidence District, which resulted in the 2008 Joint GRP, the City and MUDs are required to reduce groundwater usage in two tiers. By 2013, groundwater cannot make up more than 70% of the total water demand in the region. This is reduced further in 2025 to 40%.[4] Using the demands presented earlier in Table 2-4, the corresponding Joint GRP requirements are summarized in Table 2-6.

[3] Title 30 of the Texas Administrative Code (TAC) Chapter 290.42 and 290.45

[4] Fort Bend Subsidence District 2013 Regulatory Plan available online at https://fortbendsubsidence.org/documents/

Table 2-6: Water Demand Projections and Joint GRP Requirements by Water Source

Parameter	2018 (Current)	2020	2025	2030	2035	2040
Total daily water demand, MGD	13.56	14.29	15.91	17.38	18.57	19.68
Joint GRP conversion requirement, %						
Groundwater	70	70	40	40	40	40
Surface water & alternate supply	30	30	60	60	60	60
Water distribution, MGD						
Groundwater	9.49	10.00	6.36	6.95	7.43	7.87
Surface water & alternate supply	4.07	4.29	9.54	10.43	11.14	11.81

Details regarding how the City achieves the Joint GRP are beyond the scope of this Study. Instead the data presented above are for information purposes only.

2.4 Current and Projected Wastewater Production

In accordance with the 2011 Planning Study, wastewater demands were determined by first estimating the percentage of wastewater demand relative to water demand for each WWTP's service area (on a GPCM basis). Updated wastewater demands at a majority of the WWTPs were provided by the utility districts (except for FBC MUD #23 and #24 that were not evaluated in this section); however, recent data was not available from the following plants:

- Blue Ridge West MUD;
- COMC Mustang Bayou USA;
- Harris County MUD #122;
- Southwest Harris County MUD #1; and
- Steep Bank / Flat Bank.

For these districts and facilities, current data over the last year was extracted from the Environmental Protection Agency's ECHO database. Water demand data was also unavailable for HC MUD #122 and SWHC MUD #1 so equivalent 2018 data was pulled from the 2011 Planning Study.

On average, the current wastewater demand accounts for approximately 50% of the water demand as summarized in Table 2-7. This figure was multiplied by the water demand projections to determine projected wastewater demands for each district, which are provided in Table 2-7. Overall, the wastewater demands averaged roughly 42% lower than the corresponding projections from 2011 for the 2018–2040 time period.

Table 2-7: Current Wastewater Demand as a Percentage of Water Demand

WWTP	Average Daily Flow, MGD	Total Connections Served	Wastewater Demand, GPCM	Water Demand, GPCM	Wastewater Demand vs Water Demand, %
BRW	0.666	2,482	8,157	7,888	103
MB	0.630	2,833	6,759	14,080	48
FBC #26	0.326	1,502	6,605	6,675	99
HC #122	0.083	409	6,154	10,453	59
HC-Fondren	0.229	1,021	6,825	7,766	88
PP	0.282	1,820	4,721	12,101	39
QVUD	1.641	7,231	6,901	8,247	84
Sienna North	0.782	3,524	6,760	25,686	26
Sienna South	1.002	5,338	5,709	29,996	19
SWHC #1	0.102	528	5,859	7,832	75
SBFB	2.001	8,098	7,515	12,712	59
Total	7.74	34,786	-	-	-
Average	0.704	-	6,542	13,040	50 [a]

Note: Average daily flow for BRW, MB, HC #122, SWHC #1, and SBFB determined as 2018 Monthly WW demand (from 2011 Study) x 12 months/year ÷ 365 days/year.

[a] Calculated as the average wastewater demand GPCM divided by the average water demand GPCM

Table 2-8: Projected Wastewater Demands

District	Monthly Wastewater Demand, gallons						
	2018	2020	2025	2030	2035	2040	Build Out
Blue Ridge West MUD	9,822,027	9,822,027	9,822,027	9,822,027	9,822,027	9,822,027	9,928,874
COMC Mustang Bayou USA	12,858,668	15,655,167	22,646,414	29,637,662	36,628,909	43,620,157	50,964,233
First Colony MUD #9	14,283,795	14,294,435	14,321,034	14,347,633	14,374,232	14,400,831	17,555,502
Fort Bend County MUD #26	5,030,129	5,045,200	5,082,875	5,120,551	5,158,227	5,195,903	7,183,507
Fort Bend County MUD #42	7,469,895	7,534,911	7,697,450	7,859,989	8,022,529	8,185,068	8,338,616
Fort Bend County MUD #46	5,509,499	5,509,499	5,509,499	5,509,499	5,509,499	5,509,499	7,540,424
Fort Bend County MUD #47	3,179,840	3,418,205	4,014,120	4,610,035	4,882,592	4,882,592	4,884,546
Fort Bend County MUD #48	3,882,619	4,189,210	4,955,687	5,415,573	5,415,573	5,415,573	5,415,573
Fort Bend County MUD #49	1,600,644	1,609,870	1,632,934	1,655,998	1,679,062	1,702,126	1,826,671
Fort Bend County MUD #115	5,708,367	5,708,367	5,708,367	5,708,367	5,708,367	5,708,367	5,798,341
Fort Bend County MUD #129	9,562,489	9,562,489	9,562,489	9,562,489	9,562,489	9,562,489	10,145,009
Fort Bend County MUD #149	4,794,448	5,876,890	6,536,136	6,536,136	6,536,136	6,536,136	6,536,136
Harris County MUD #122	2,144,930	2,291,771	2,658,874	3,025,977	3,393,080	3,739,205	3,744,450
Harris County WC&ID - Fondren Road	3,978,364	3,982,533	3,995,732	4,006,241	4,016,749	4,027,257	6,101,976
Meadowcreek MUD	3,061,936	3,076,379	3,112,487	3,148,595	3,184,702	3,220,810	3,556,612
Palmer Plantation MUD #1	4,207,439	4,220,345	4,252,611	4,284,877	4,317,142	4,349,408	5,149,596
Palmer Plantation MUD #2	5,868,373	5,896,964	5,968,443	6,039,921	6,111,399	6,182,878	7,147,835
Quail Valley Utility District	16,260,726	16,275,379	16,312,011	16,348,642	16,385,274	16,421,905	16,535,463
Sienna Plantation Management District	3,874,257	5,138,721	8,299,880	11,322,830	11,322,830	11,322,830	11,322,830
Sienna Plantation MUD #1	776,194	776,194	831,636	887,078	997,963	1,108,848	1,386,060
Sienna Plantation MUD #2	11,427,145	11,427,145	11,427,145	11,427,145	11,427,145	11,427,145	11,427,145
Sienna Plantation MUD #3	13,671,207	13,671,207	13,671,207	13,671,207	13,671,207	13,671,207	13,671,207
Sienna Plantation MUD #4, 5, 6, & 7	3,766,041	5,439,837	11,716,572	17,993,306	24,270,041	30,546,776	46,209,090
Sienna Plantation MUD #10	11,003,528	11,572,114	12,669,941	12,669,941	12,669,941	12,669,941	12,669,941
Sienna Plantation MUD #12	10,623,980	12,171,900	12,171,900	12,171,900	12,171,900	12,171,900	12,171,900
Sienna Plantation MUD #13 (The Woods)	403,375	792,597	1,765,652	2,738,706	3,711,761	4,224,826	4,224,826
Southwest Harris County MUD #1	2,074,814	2,323,163	2,944,035	3,560,978	4,181,850	4,181,850	5,167,387
Thunderbird Utility District	9,991,649	10,027,627	10,117,573	10,207,518	10,207,518	10,207,518	10,207,518
Total	186,836,377	197,310,145	219,404,728	239,290,819	255,340,143	270,015,071	306,811,268
Equivalent Daily Flow, MGD	6.1	6.5	7.2	7.9	8.4	8.9	10.1

Notes:

1. Current population projections were determined assuming 3.07 persons per connection.
2. The build out projection for Mustang Bayou is the result of the large build out connection estimate (12,273 connections) compounded by the high average water usage (26,046 GPCM) for the area.

Currently, 6.1 MGD of wastewater demand accounts for approximately 45% of the total treatment capacity (13.7 MGD) within area. At build-out, the updated figure (8.1 MGD) corresponds to approximately 74% of the existing treatment capacity.

2.5 Levee Infrastructure

In an effort to prevent flooding during major storm events, the City maintains a large network of levees throughout the region. From an O&M perspective, the City and MUDs coordinate activities associated with maintaining the levee system such as mowing, erosion control, and inspection. Based on data provided by the City, the MUD-owned levees included in this study span approximately 18,800 ft (3.6 miles) as summarized in Table 2-9. A map of the MUD-owned levees and other levees throughout the City is provided for reference in Appendix C.

Table 2-9: Existing MUD-Owned Levee Infrastructure

Nearby District	Levee Length, feet
Fort Bend County MUD #46	6,772
Fort Bend County MUD #49	10,236
Palmer Plantation MUD #1	1,815
Total	18,823

Although a relatively short section of levee also cuts through the FBC WC&ID #2 area, this portion of the levee infrastructure was excluded from consideration in this Study.

SECTION 3: WATER TREATMENT AND DISTRIBUTION ALTERNATIVES

Excluding changes already imparted by the City's regional SWTP and transmission water lines to the receiving utility districts, the water treatment and distribution alternatives highlighted in 2011 have not changed. For example, the previous Study identified opportunities regarding the following general options:

- Establishing new or utilizing existing interconnects between the districts to improve pressure control, water quality, and fire protection, as well as to provide water service to undeveloped areas and to facilitate the transition from groundwater to surface water at several of the districts.

- Installing ESTs across the study area to improve pressure control for those districts relying on groundwater and to buffer surface water flows for those districts receiving water from the regional SWTP.

- Using a regional SWTP vs. multiple small SWTPs to reduce the City's dependence on groundwater.

As emphasized in 2011, continued efforts to transition from groundwater to surface water will also require that many of the utility districts replace their chlorine disinfection systems with chloramine-based disinfection systems.

SECTION 4: WASTEWATER COLLECTION AND TREATMENT ALTERANTIVES

Although much of the existing WWTP infrastructure remains unchanged since 2011, several noteworthy projects have been undertaken. A new, 1.8 MGD Sienna South (new Sienna South) WWTP is being constructed in Sienna Plantation MUD #6. At build out, the new Sienna South WWTP will be expanded to 3.5 MGD. Once completed, flows will be diverted from the existing Sienna South WWTP plant in Sienna Plantation MUD #3 to the new WWTP, and the existing south plant will be decommissioned and converted into a transfer station. Initially when the 1.8 MGD new Sienna South WWTP begins operations, the total treatment capacity for the region will increase from 13.7 MGD to 14.3 MGD. Similarly, diverting wastewater from the Sienna North WWTP to the City's Steep Bank / Flat Bank WWTP is being considered by Sienna Plantation MUD #10 and City. If pursued, the existing Sienna North WWTP will be converted into a transfer station and the SBFB facility would be expanded to accommodate the added demand.[5] Minor equipment improvements were also completed at the QVUD plant. Finally, Harris County MUD #122 completed an upgrade of the WWTP to replace the contact stabilization basin with an extended aeration basin to maintain compliance with nitrogen discharge limits that were implemented at the facility.

A majority of the WWTPs are still independently owned and operated by the different utility districts. While demands are currently being met, the existing infrastructure is not well suited for long-term demands. Many of the package-type treatment plants are at, or near the end of their intended service life.

Unlike 2011, in which alternatives were presented on a plant-by-plant basis, the options presented in this Study are organized by the extent of consolidation across the study area. In general, the options represent independent scenarios, but each includes a common sub-option that would consist of transferring flows from the HC #122, HC-Fondren, and SWHC #1 WWTPs to the Fort Bend County WC&ID #2 (WC&ID #2) WWTP, which lies outside the City's ETJ. To accomplish this, flows from SWHC #1 would be diverted to HC-Fondren, which would also be diverted to HC #122. Finally, the combined wastewater at HC #122 would be diverted to the WC&ID #2 WWTP. Excluding SWHC #1, the WWTPs at each of the northern districts would ultimately be abandoned and replaced with pump stations (PSs) to accommodate the flow diversions. For simplicity, a description of the sub option is not repeated for each of the options presented below. In addition, the WWTP in FBC MUD #23, as well as the wastewater demands for FBC MUD #23 and #34 were not included in any of the consolidation analyses.

In addition, O&M costs for the MUD-owned levee infrastructure were accounted for in the O&M costs presented in each consolidation option. Assuming $57 per foot of levee (provided by the City), an estimated $1,072,900 per year is needed to maintain the MUD-owned levee infrastructure. Of this, PP MUD #1 and FBC MUD #49 (associated with the PP WWTP) account for $686,900 and FBC MUD #46 (associated with the SBFB WWTP) accounts for $386,000.

4.1 Option 1 – Retain Existing WWTPs

For this option, regional consolidation would not be pursued with the exception of transferring flows from the existing Sienna South WWTP to the new Sienna South WWTP. Although regionalization opportunities would simplify the treatment landscape and provide economies of scale, one key advantage to retaining the existing infrastructure lies in the inherent treatment flexibility from one service area to the next. For example, when previous improvements were made at the HC-Fondren WWTP, flows were temporarily transferred to the adjacent SWHC #1 WWTP. By contrast,

[5] http://www.twdb.texas.gov/newsmedia/press_releases/2018/05/sienna.asp

maintaining separate, smaller WWTPs leads to higher O&M costs, as well as higher overall costs in general. At a minimum, the existing WWTPs would require a R&U or E&U project to extend service life, address current and build out capacity limitations, and remedy solids handling limitations.

4.1.2 Projected Total Life Cycle Costs

Aside from the implications of the new Sienna South, MB, and SBFB WWTPs, the updated cost analysis for Option 1 utilized the R&U Opinion of Probable Project Cost (OPPC) and annual O&M costs from the 2011 Planning Study after adjusting for current daily plant flows and correcting for inflation (and incorporating pro-rated O&M costs for the levee infrastructure). The OPPC, annual O&M costs, and 30-year life cycle costs (using an interest rate of 3.0%) are summarized in Table 4-1.

Table 4-1: Cost Analysis for Option 1

Item	WWTP	Description of Improvements	OPPC, $	Annual O&M Cost, $	30-Year Life Cycle Cost, $ [a]
1	BRW	R&U, including solids improvements	14,043,000	402,000	22,159,000
2	MB [b]	E&U to 1.85 MGD, including structure rehab & equip. replacement	12,852,000	349,000	19,898,000
3	FBC #26	R&U, including structure rehab and equip. replacement	5,401,000	270,000	10,852,000
4	HC #122	R&U, including solids improvements	2,701,000	54,000	3,791,000
5	HC-Fondren	R&U, including solids improvements	6,481,000	101,000	8,520,000
6	PP	R&U, including structure rehab and equip. replacement	6,481,000	805,907	22,751,000
7	QVUD	R&U, including structure rehab and equip. replacement	14,402,000	1,624,000	47,188,000
8	Sienna North [c]	R&U, including structure rehab and equip. replacement	9,722,000	327,000	16,324,000
9	Sienna South	Construct PS, transfer WW flows to regional new Sienna South	2,200,000	11,000	2,422,000
10	New Sienna South	New WWTP	22,403,000	106,000	24,543,000
11	SWHC #1	R&U, including solids improvements	4,321,000	36,000	5,048,000
12	SBFB [d]	E&U to 5.0 MGD, including structure rehab and equip. replacement	20,036,000	798,004	36,146,000
Total			121,043,000	4,883,911	219,642,000

Note: The costs neglect offsite collection improvements and assume that other major capital improvements are not needed over the project life.
[a] Life cycle costs utilized an interest rate of 3%.
[b] Build out capacity projection is 2.7 MGD for MB. Estimated capacity limitation at existing site is 1.85 MGD with partial rehabilitation of existing treatment process, addition to two Sequencing Batch Reactor treatment basins, and no additional land purchase.
[c] Build out capacity projection is 1.6 MGD for Sienna North. Space constraints at existing site limit capacity at 0.9 MGD with current treatment process.
[d] Build out capacity projection was 3.0 MGD for SBFB. Used 5.0 MGD in cost estimates to permit future transfer of at least a portion of flows from Sienna North to maintain compliance with TCEQ at that WWTP.

As mentioned at the beginning of this section, the three northern WWTPs could also be consolidated using the WC&ID #2 WWTP. Based on build out projections, an estimated 0.7 MGD of additional capacity would be required at the WC&ID #2 plant. Assuming expansion at the WC&ID #2 WWTP is necessary for the added capacity, approximately $8,000,000 (OPPC) was allocated for the plant expansion. In addition, capital estimates were assembled for the pump stations at HC #122 and HC-Fondren. Finally, pro-rated capital

and O&M costs for each plant were estimated using current flows to establish cost allocations for the three WWTPs (HC #122, HC-Fondren, and SWHC #1). Although the wastewater flows would be diverted outside the study area, the pro-rated levee O&M costs would still be covered by the three north WWTPs. The total costs for this alternative are listed in Table 4-2. Overall, this approach reduces total life cycle costs by approximately $5.7M compared to retaining all of the existing infrastructure.

Table 4-2: Alternative Cost Analysis for Option 1 using Fort Bend County WC&ID #2

Item	WWTP	Description of Improvements	OPPC, $	Annual O&M Cost, $	30-Year Life Cycle Cost, $ [a]
1	BRW	Rehab & upgrade (R&U), including solids improvements	14,043,000	402,000	22,159,000
2	MB [b]	Expand & upgrade (E&U) to 1.85 MGD, including structure rehab & equip. replacement	12,852,000	349,000	19,898,000
3	FBC #26	R&U, including structure rehab and equip. replacement	5,401,000	270,000	10,852,000
4	HC #122	Construct PS, transfer flows to expanded WC&ID #2	2,695,000	31,000	3,321,000
5	HC-Fondren	Construct PS, transfer flows to HC #122 PS	3,751,000	50,000	4,760,000
6	PP	R&U, including structure rehab and equip. replacement	6,481,000	805,907	22,751,000
7	QVUD	R&U, including structure rehab and equip. replacement	14,402,000	1,624,000	47,188,000
8	Sienna North [c]	R&U, including structure rehab and equip. replacement	9,722,000	327,000	16,324,000
9	Sienna South	Construct PS, transfer WW flows to regional new Sienna South	2,200,000	11,000	2,422,000
10	New Sienna South	New WWTP	22,403,000	106,000	24,543,000
11	SWHC #1	Transfer flows to HC-Fondren PS	2,753,000	42,000	3,601,000
12	SBFB [d]	E&U to 5.0 MGD, including structure rehab and equip. replacement	20,036,000	798,004	36,146,000
Total			116,739,000	4,815,911	213,965,000

Note: The costs neglect offsite collection improvements and assume that other major capital improvements are not needed over the project life.

[a] Life cycle costs utilized an interest rate of 3%.

[b] Build out capacity projection is 2.7 MGD for MB. Estimated capacity limitation at existing site is 1.85 MGD with partial rehabilitation of existing treatment process, addition to two Sequencing Batch Reactor treatment basins, and no additional land purchase.

[c] Build out capacity projection is 1.6 MGD for Sienna North. Space constraints at the site limit capacity to 0.9 MGD with current treatment process.

[d] Build out capacity projection was 3.0 MGD for SBFB. Used 5.0 MGD in cost estimates to permit future transfer of at least a portion of flows from Sienna North to maintain compliance with TCEQ at that WWTP.

4.2 Option 2 – Consolidation to Five Treatment Facilities

Reducing the number of WWTPs to five regional facilities can be accomplished using the following as regional WWTPs:

- Blue Ridge West MUD;
- Quail Valley Utility District;
- Harris County WC&ID - Fondren Road;
- Sienna Plantation MUD #6 (New Sienna South); and

- Steep Bank / Flat Bank.

Accordingly, the regional WWTPs would serve those districts summarized in Table 4-3 and any existing WWTPs in the adjacent districts would be converted into transfer pump stations with the exception of SWHC #1, which would simply divert flows to the adjacent HC-Fondren WWTP. A map of the study area under Option 2 is provided in Appendix D.

Table 4-3: Consolidation with Five Regional WWTPs

Regional WWTP	Districts Served
BRW	Residing District Fort Bend County MUD #26
HC-Fondren	Residing District Harris County MUD #122 Southwest Harris County MUD #1
QVUD	COMC Mustang Bayou USA Fort Bend County MUD #47, 48, and 49 Meadowcreek Palmer Plantation MUD #1 and 2 Quail Valley Utility District Thunderbird UD
New Sienna South	Residing District Sienna Plantation MUD #1–5, 7, 10 (SE portion), and 13
SBFB	First Colony MUD #9 Fort Bend County MUD #42, 46, 115, 129, and 149 Sienna Plantation MUD #10 (NW portion) and 12 Sienna Plantation Management District

Although a case could also be made to use the PP or MB sites as the regional WWTP, QVUD was selected over PP or MB because it was thought to represent a worst-case life cycle cost scenario for consolidating to five WWTPs. Examining the worst-case was of interest when comparing Option 2 to the other options.

Regardless of where the combined flows are ultimately treated, the projected build out demand for the MB, PP, and QVUD and their service areas will require approximately 5.0 MGD of treatment capacity. Of the 5.0 MGD, MB accounts for approximately 2.7 MGD. Coupled with roughly 0.6 MGD from PP, transferring flows from MB and PP northwest to QVUD was anticipated to have the greatest capital and O&M costs (less levee considerations) compared to sending QVUD and PP to MB or sending QVUD and MB to PP. Accordingly, the conceptual OPPC and O&M and Life Cycle costs for consolidating flows at the QVUD site are summarized in Table 4-4. Based on the life cycle cost estimates (including O&M costs for the levee infrastructure), approximately $47M could potentially be saved by reducing the number of WWTPs from twelve to five.

Table 4-4: Cost Analysis for Option 2

Item	WWTP	Description of Improvements	OPPC, $	Annual O&M Cost, $	30-Year Life Cycle Cost, $ [a]
1	BRW [b]	R&U, including solids improvements	9,423,000	402,000	17,539,000
2	MB	Construct PS, transfer flows to PP pump station	22,433,000	353,000	29,560,000
3	FBC #26	Construct PS, transfer flows to regional BRW	5,120,000	202,500	9,208,000
4	HC #122	Construct PS, transfer flows to regional HC-Fondren	2,370,000	80,000	3,985,000
5	HC-Fondren [c]	E&U to 1.0 MGD, including solids improvements	3,455,000	126,000	5,999,000
6	PP	Construct PS, transfer combined flows to regional QVUD	4,883,000	764,907	20,325,000
7	QVUD [d]	E&U to 5.0 MGD, including solids improvements	10,034,000	159,000	13,244,000
8	Sienna North	Construct PS, transfer flows to regional SBFB	8,719,000	236,000	13,483,000
9	Sienna South	Construct PS, transfer WW flows to regional new Sienna South	2,200,000	11,000	2,422,000
10	New Sienna South	New WWTP	22,403,000	106,000	24,543,000
11	SWHC #1	Transfer flows to regional HC-Fondren	2,925,000	107,000	5,085,000
12	SBFB [e]	E&U to 5.0 MGD, including structure rehab and equip. replacement	12,167,000	733,004	26,965,000
Total			106,132,000	3,280,411	172,358,000

Note: The costs neglect offsite collection improvements and assume that other major capital improvements are not needed over the project life.
[a] Life cycle costs utilized an interest rate of 3%.
[b] Build out capacity projection is 0.8 MGD for combined BRW and FBC #26 flows so existing capacity was retained.
[c] Build out capacity projection is 1.0 MGD (rounded from 0.7) for HC-Fondren.
[d] Build out capacity is projected at 5.0 MGD for QVUD.
[e] Build out capacity projection is 5.0 MGD for SBFB.

As with Option 1, the costs associated with diverting the three north WWTPs to WC&ID #2 were assembled as shown in Table 4-5. Under this alternative, the life cycle costs could be reduced by approximately $3.4M relative to the costs presented in Table 4-4.

Table 4-5: Alternative Cost Analysis for Option 2 using Fort Bend County WC&ID #2

Item	WWTP	Description of Improvements	OPPC, $	Annual O&M Cost, $	30-Year Life Cycle Cost, $ [a]
1	BRW [b]	R&U, including solids improvements	9,423,000	402,000	17,539,000
2	MB	Construct PS, transfer flows to PP pump station	22,433,000	353,000	29,560,000
3	FBC #26	Construct PS, transfer flows to regional BRW	5,120,000	202,500	9,208,000
4	HC #122	Construct PS, transfer flows to expanded WC&ID #2	2,695,000	31,000	3,321,000
5	HC-Fondren	Construct PS, transfer flows to HC #122 PS	3,751,000	50,000	4,760,000
6	PP	Construct PS, transfer combined flows to regional QVUD	4,883,000	764,907	20,325,000
7	QVUD [c]	E&U to 5.0 MGD, including solids improvements	10,034,000	159,000	13,244,000
8	Sienna North	Construct PS, transfer flows to regional SBFB	8,719,000	236,000	13,483,000
9	Sienna South	Construct PS, transfer WW flows to regional new Sienna South	2,200,000	11,000	2,422,000
10	New Sienna South	New WWTP	22,403,000	106,000	24,543,000
11	SWHC #1	Transfer flows to HC-Fondren PS	2,753,000	42,000	3,601,000
12	SBFB [d]	E&U to 5.0 MGD, including structure rehab and equip. replacement	12,167,000	733,004	26,965,000
Total			106,581,000	3,090,411	168,971,000

Note: The costs neglect offsite collection improvements and assume that other major capital improvements are not needed over the project life.
[a] Life cycle costs utilized an interest rate of 3%.
[b] Build out capacity projection is 0.8 MGD for combined BRW and FBC #26 flows so existing capacity was retained.
[c] Build out capacity is projected at 5.5 MGD for QVUD.
[d] Build out capacity projection is 5.0 MGD for SBFB.

4.3 Option 3 – Consolidation to Four Treatment Facilities

Further consolidation to four regional WWTPs could be accomplished by diverting BRW to FBC #26 and then onto QVUD according to Table 4-6 (refer to Appendix E for a map of the study area according to this option). For reasons mentioned in Option 2, QVUD was used as the regional WWTP as it was believed to represent the worst-case scenario in terms of life-cycle costs. The cost analysis results (including levee O&M considerations) are summarized in Table 4-7 with the alternative scenario for the three north WWTPs provided in Table 4-8.

Based on the cost analysis, the added capital and O&M costs for expanding QVUD to 5.5 MGD ($41,250,000 estimated OPPC and $741,000 O&M less levee costs) and constructing a PS at both of the BRW and FBC #26 WWTPs is offset by a net reduction in total life cycle costs for this option. Compared to Option 2, eliminating the BRW and FBC #26 WWTPs could potential reduce life cycle costs by approximately $15M. Alternatively, sending the three north WWTP flows to WC&ID #2 would provide a small economic benefit of approximately $3.4M (total life-cycle cost).

Table 4-6: Consolidation Option 3 with Four Regional WWTPs

Regional WWTP	Districts Served
QVUD	Blue Ridge West MUD COMC Mustang Bayou USA Fort Bend County MUD #26, 47, 48, and 49 Meadowcreek Palmer Plantation MUD #1 and 2 Quail Valley Utility District Thunderbird UD
HC-Fondren	Residing District Harris County MUD #122 Southwest Harris County MUD #1
New Sienna South	Residing District Sienna Plantation MUD #1–5, 7, 10 (SE portion), and 13
SBFB	First Colony MUD #9 Fort Bend County MUD #42, 46, 115, 129, and 149 Sienna Plantation MUD #10 (NW portion) and 12 Sienna Plantation Management District

Table 4-7: Cost Analysis for Option 3

Item	WWTP	Description of Improvements	OPPC, $	Annual O&M Cost, $	30-Year Life Cycle Cost, $ [a]
1	BRW	Construct PS, transfer flows to FB #26 PS	4,054,000	71,000	5,487,000
2	MB	Construct PS, transfer flows to PP pump station	22,723,000	401,000	30,819,000
3	FBC #26	Construct PS, transfer combined flows to regional QVUD	2,644,000	47,000	3,593,000
4	HC #122	Construct PS, transfer flows to regional HC-Fondren	2,370,000	80,000	3,985,000
5	HC-Fondren [b]	E&U to 1.0 MGD, including solids improvements	3,455,000	126,000	5,999,000
6	PP	Construct PS, transfer combined flows to regional QVUD	4,950,000	775,907	20,614,000
7	QVUD [c]	E&U to 5.5 MGD, including solids improvements	10,178,000	183,000	13,872,000
8	Sienna North	Construct PS, transfer flows to regional SBFB	8,719,000	236,000	13,483,000
9	Sienna South	Construct PS, transfer WW flows to regional new Sienna South	2,200,000	11,000	2,422,000
10	New Sienna South	New WWTP	22,403,000	106,000	24,543,000
11	SWHC #1	Transfer flows to regional HC-Fondren	2,925,000	107,000	5,085,000
12	SBFB [d]	E&U to 5.0 MGD, including structure rehab and equip. replacement	12,167,000	733,004	26,965,000
Total			98,788,000	2,876,911	156,867,000

Note: The costs neglect offsite collection improvements and assume that other major capital improvements are not needed over the project life.
[a] Life cycle costs utilized an interest rate of 3%.
[b] Build out capacity projection is 1.0 MGD (rounded from 0.7) for HC-Fondren.
[c] Build out capacity is projected at 5.5 MGD for QVUD.
[d] Build out capacity projection is 5.0 MGD for SBFB.

Table 4-8: Alternative Cost Analysis for Option 3 using Fort Bend County WC&ID #2

Item	WWTP	Description of Improvements	OPPC, $	Annual O&M Cost, $	30-Year Life Cycle Cost, $ [a]
1	BRW [b]	Construct PS, transfer flows to FB #26 PS	4,054,000	71,000	5,487,000
2	MB	Construct PS, transfer flows to PP pump station	22,723,000	401,000	30,819,000
3	FBC #26	Construct PS, transfer combined flows to regional QVUD	2,644,000	47,000	3,593,000
4	HC #122	Construct PS, transfer flows to expanded WC&ID #2	2,695,000	31,000	3,321,000
5	HC-Fondren	Construct PS, transfer flows to HC #122 PS	3,751,000	50,000	4,760,000
6	PP	Construct PS, transfer combined flows to regional QVUD	4,950,000	775,907	20,614,000
7	QVUD [c]	E&U to 5.5 MGD, including solids improvements	10,178,000	183,000	13,872,000
8	Sienna North	Construct PS, transfer flows to regional SBFB	8,719,000	236,000	13,483,000
9	Sienna South	Construct PS, transfer WW flows to regional new Sienna South	2,200,000	11,000	2,422,000
10	New Sienna South	New WWTP	22,403,000	106,000	24,543,000
11	SWHC #1	Transfer flows to HC-Fondren PS	2,753,000	42,000	3,601,000
12	SBFB [d]	E&U to 5.0 MGD, including structure rehab and equip. replacement	12,167,000	733,004	26,965,000
Total			99,237,000	2,686,911	153,480,000

Note: The costs neglect offsite collection improvements and assume that other major capital improvements are not needed over the project life.

[a] Life cycle costs utilized an interest rate of 3%.

[c] Build out capacity is projected at 5.5 MGD for QVUD.

[d] Build out capacity projection is 5.0 MGD for SBFB.

4.4 Option 4 – Consolidation to Three Treatment Facilities

Regionalizing to three WWTPs could be accomplished several different ways; however, for the purposes of this study, eHT was asked to evaluate using the MB, SBFB, and the new Sienna South WWTPs. To accomplish this approach, the three regional WWTPs would serve those districts listed in Table 4-9 and flows from the remaining MUDs would be diverted via transfer pump stations as needed. For example, flows from the three north WWTPs (HC #122, HC-Fondren, and SWHC #1) would be transferred to a pump station at the BRW WWTP site. From there, the combined flows would be pumped to a subsequent pump station at FBC MUD 26, followed by a transfer to PP and ultimately be transferred to SBFB. Wastewater from QVUD would be diverted directly to SBFB, as would flows from the pump station at the Sienna North WWTP site. Appendix F provides a map of the study area for Option 4.

Table 4-9: Consolidation Option 4 with Three Regional WWTPs

Regional WWTP	Districts Served
MB	Residing District Fort Bend County MUD #47 & 48
New Sienna South	Residing District Sienna Plantation MUD #1–5, 7, 10 (SE portion), and 13
SBFB	Blue Ridge West MUD First Colony MUD #9 Fort Bend County MUD #26, 42, 46, 49, 115, 129, and 149 Harris County MUD #122 Harris County WC&ID - Fondren Road Meadowcreek Palmer Plantation MUD #1 and 2 Quail Valley Utility District Sienna Plantation MUD #10 (NW portion) and 12 Sienna Plantation Management District Southwest Harris County MUD #1 Thunderbird UD

Although the build out demand for the MB service area is estimated at 2.7 MGD, the existing site is limited to approximately 1.85 MGD even with advanced treatment technologies such as a Sequencing Batch Reactor (SBR) or Membrane Bioreactor (MBR). For the present analysis, the costs associated with purchasing additional land and building a WWTP rated for 2.7 MGD were not considered. These factors should be evaluated in more detail if the MB site is used as a regional WWTP in the long run. Regardless, the capital and O&M costs (less levee O&M costs) for the E&U MB treatment facility were consistent with those values used for Option 1 ($12,852,000 capital cost, $349,000 O&M cost). As for SBFB, the build out capacity for the WWTP under this option is estimated at 7.5 MGD. The capital and O&M costs (excluding levee considerations) for expanding SBFB were estimated at $49.5M and $986,000, and pro-rated costs were allocated to each MUD sending wastewater to the SBFB regional WWTP. The overall capital, O&M (including levee costs), and life-cycle costs for Option 4 are summarized in Table 4-10, with the alternative scenario for sending flows from the three north WWTPs to WC&ID #2 provided in Table 4-11.

Aside from the site assumptions for MB, consolidating to three WWTPs could save approximately $13M compared to Option 3 with four WWTPs. However, diverting the three north WWTPs to WC&ID #2 negatively impacts the life cycle costs. This is driven by the higher cost of the infrastructure needed to divert and treat the wastewater flows to WC&ID #2 compared to the improvements needed to divert and treat the wastewater flows within the study area.

Table 4-10: Cost Analysis for Option 4

Item	WWTP	Description of Improvements	OPPC, $	Annual O&M Cost, $	30-Year Life Cycle Cost, $ [a]
1	BRW	Construct PS, transfer combined flows to FBC #26 PS	3,574,000	67,000	4,927,000
2	MB [b]	E&U to 1.85 MGD, including structure rehab & equip. replacement	12,852,000	349,000	19,898,000
3	FBC #26	Construct PS, transfer combined flows to PP pump station	2,428,000	46,000	3,357,000
4	HC #122	Construct PS, transfer flows to HC – Fondren PS	1,723,000	31,000	2,349,000
5	HC-Fondren	Construct PS, transfer combined flows to BRW PS	2,400,000	47,000	3,349,000
6	PP	Construct PS, transfer combined flows to master regional SBFB	4,421,000	774,907	20,065,000
7	QVUD	Construct PS, transfer flows to master regional SBFB	9,694,000	189,000	13,510,000
8	Sienna North	Construct PS, transfer flows to master regional SBFB	11,466,000	222,000	15,948,000
9	Sienna South	Construct PS, transfer WW flows to new Sienna South regional WWTP	2,200,000	11,000	2,422,000
10	New Sienna South	New WWTP	22,403,000	106,000	24,543,000
11	SWHC #1	Transfer flows to HC – Fondren PS	2,033,000	40,000	2,841,000
12	SBFB [c]	E&U to 7.5 MGD to accommodate various district flows	16,413,000	713,004	30,807,000
Total			91,607,000	2,595,911	144,016,000

Note: The costs neglect offsite collection improvements and assume that other major capital improvements are not needed over the project life.

[a] Life cycle costs utilized an interest rate of 3%.

[b] Build out capacity projection is 2.7 MGD for MB. Estimated capacity limitation at existing site is 1.85 MGD with partial rehabilitation of existing treatment process, addition to two Sequencing Batch Reactor treatment basins, and no additional land purchase.

[c] Build out capacity projection is 7.5 MGD for SBFB.

Table 4-11: Alternative Cost Analysis for Option 4 using Fort Bend County WC&ID #2

Item	WWTP	Description of Improvements	OPPC, $	Annual O&M Cost, $	30-Year Life Cycle Cost, $ [a]
1	BRW	Construct PS, transfer flows to FBC #26 PS	4,053,000	78,000	5,628,000
2	MB [b]	E&U to 1.85 MGD, including structure rehab & equip. replacement	12,852,000	349,000	19,898,000
3	FBC #26	Construct PS, transfer combined flows to PP pump station	2,643,000	52,000	3,693,000
4	HC #122	Construct PS, transfer flows to expanded WC&ID #2	2,695,000	31,000	3,321,000
5	HC-Fondren	Construct PS, transfer flows to HC #122 PS	3,751,000	50,000	4,760,000
6	PP	Construct PS, transfer combined flows to master regional SBFB	4,743,000	781,907	20,528,000
7	QVUD	Construct PS, transfer flows to master regional SBFB	10,189,000	203,000	14,287,000
8	Sienna North	Construct PS, transfer flows to master regional SBFB	12,056,000	239,000	16,881,000
9	Sienna South	Construct PS, transfer WW flows to new Sienna South regional WWTP	2,200,000	11,000	2,422,000
10	New Sienna South	New WWTP	22,403,000	106,000	24,543,000
11	SWHC #1	Transfer flows to HC – Fondren PS	2,753,000	42,000	3,601,000
12	SBFB [c]	E&U to 7 MGD to accommodate various district flows	17,326,000	739,004	32,245,000
Total			97,664,000	2,681,911	151,807,000

Note: The costs neglect offsite collection improvements and assume that other major capital improvements are not needed over the project life.

[a] Life cycle costs utilized an interest rate of 3%.

[b] Build out capacity projection is 2.7 MGD for MB. Estimated capacity limitation at existing site is 1.85 MGD with partial rehabilitation of existing treatment process, addition to two Sequencing Batch Reactor treatment basins, and no additional land purchase.

[c] Build out capacity projection is 7 MGD for SBFB if the three north WWTPs are diverted to the WC&ID #2 WWTP.

4.5 Option 5 – New Sienna South and Steep Bank / Flat Bank Regional Master WWTPs

Consolidation from four to two regional master WWTPs is likely the greatest extent that regionalization can occur. The new Sienna South WWTP would essentially serve the Sienna districts and the SBFB WWTP would serve the remaining districts as summarized in Table 4-9. Given the capacity requirements at SBFB for this option, an advanced treatment process using SBR or MBR technologies is recommended. Assuming a SBR or MBR treatment process is implemented, the conceptual OPPC for the SBFB master regional WWTP was estimated at $55.4M. For the cost analysis, it was also assumed that HC #122 flows would be transferred to HC-Fondren, with SWHC #1 flows also being diverted to HC-Fondren. From there, flow would be transferred to a regional pump station at BRW and then on to FBC #26. A larger regional PS would also be installed at FBC #26 to transfer the combined flows to PP, which would ultimately send flows to SBFB. Similarly, MB flows would be pumped to PP and then onto SBFB. Finally, the QVUD and Sienna North flows would be transferred to SBFB. The cost analysis for this option is presented in Table 4-10. A map of the region for Option 5 is provided in Appendix G.

Table 4-12: Consolidation with Two Master Regional WWTPs

Master Regional WWTP	Districts Served
New Sienna South	Residing District Sienna Plantation MUD #1–5, 7, 10 (SE portion), and 13
SBFB	Blue Ridge West MUD COMC Mustang Bayou USA First Colony MUD #9 Fort Bend County MUD #26, 42, 46–49, 115, 129, and 149 Harris County MUD #122 Harris County WC&ID - Fondren Road Meadowcreek Palmer Plantation MUD #1 and 2 Quail Valley Utility District Sienna Plantation MUD #10 (NW portion) and 12 Sienna Plantation Management District Southwest Harris County MUD #1 Thunderbird UD

Table 4-13: Cost Analysis for Option 5

Item	WWTP	Description of Improvements	OPPC, $	Annual O&M Cost, $	30-Year Life Cycle Cost, $ [a]
1	BRW	Construct PS, transfer combined flows to FBC #26 PS	2,991,000	50,000	4,000,000
2	MB	Construct PS, transfer flows to PP pump station	16,826,000	288,000	22,640,000
3	FBC #26	Construct PS, transfer combined flows to PP pump station	2,005,000	34,000	2,691,000
4	HC #122	Construct PS, transfer flows to HC – Fondren PS	1,503,000	25,000	2,008,000
5	HC-Fondren	Construct PS, transfer combined flows to BRW PS	2,041,000	36,000	2,768,000
6	PP	Construct PS, transfer combined flows to master regional SBFB	3,591,000	749,907	18,730,000
7	QVUD	Construct PS, transfer flows to master regional SBFB	8,102,000	140,000	10,928,000
8	Sienna North	Construct PS, transfer flows to master regional SBFB	9,565,000	164,000	12,876,000
9	Sienna South	Construct PS, transfer WW flows to new Sienna South regional WWTP	2,200,000	11,000	2,422,000
10	New Sienna South	New WWTP	22,403,000	106,000	24,543,000
11	SWHC #1	Transfer flows to HC – Fondren PS	1,728,000	31,000	2,354,000
12	SBFB [b]	E&U to 10.5 MGD to accommodate various district flows	13,474,000	622,004	26,031,000
Total			86,429,000	2,256,911	131,991,000

Note: The costs neglect offsite collection improvements and assume that other major capital improvements are not needed over the project life.
[a] Life cycle costs utilized an interest rate of 3%.
[b] Build out capacity projection is 10.5 MGD for SBFB.

Although the SBFB expansion and upgrade presents considerable capital costs, the potential economic benefits warrant consideration. Specifically, regionalizing from three to two WWTPs suggested that approximately $12M (total life cycle cost) could be saved relative to Option 4. The savings are driven by greater economies of scale at 10.5 MGD for SBFB compared to 7.5 MGD in Option 4, coupled with the capital costs being shared by more MUDs. In addition, the O&M costs are also expected to be lower with two master regional WWTPs instead of three regional WWTPs.

As with Option 4, diverting the three north WWTP flows to WC&ID #2 negatively impacts the economic benefit of utilizing two master regional WWTPs. In general, the higher costs are driven by the additional capital associated with expanding the WC&ID #2 infrastructure, as well as by the higher pro-rated costs that must be absorbed by those remaining districts being served by SBFB. In particular, diverting the three north plants only reduces the treatment capacity requirement for SBFB from 10.5 to 10 MGD, and the upfront capital cost savings at SBFB are not enough to offset the capital costs needed to expand the WC&ID #2 infrastructure. As a result, WC&ID #2 would not be recommended if two master regional WWTPs were pursued.

Table 4-14: Alternative Cost Analysis for Option 5 using Fort Bend County WC&ID #2

Item	WWTP	Description of Improvements	OPPC, $	Annual O&M Cost, $	30-Year Life Cycle Cost, $ [a]
1	BRW	Construct PS, transfer flows to FBC #26 PS	3,351,000	56,000	4,482,000
2	MB	Construct PS, transfer flows to PP pump station	17,490,000	291,000	23,365,000
3	FBC #26	Construct PS, transfer combined flows to PP pump station	2,135,000	37,000	2,882,000
4	HC #122	Construct PS, transfer flows to expanded WC&ID #2	2,695,000	31,000	3,321,000
5	HC-Fondren	Construct PS, transfer flows to HC #122 PS	3,751,000	50,000	4,760,000
6	PP	Construct PS, transfer combined flows to master regional SBFB	3,744,000	749,907	18,883,000
7	QVUD	Construct PS, transfer flows to master regional SBFB	8,414,000	142,000	11,281,000
8	Sienna North	Construct PS, transfer flows to master regional SBFB	9,938,000	166,000	13,289,000
9	Sienna South	Construct PS, transfer WW flows to new Sienna South regional WWTP	2,200,000	11,000	2,422,000
10	New Sienna South	New WWTP	22,403,000	106,000	24,543,000
11	SWHC #1	Transfer flows to HC-Fondren PS	2,753,000	42,000	3,601,000
12	SBFB [b]	E&U to 10 MGD to accommodate various district flows	14,051,000	625,004	26,669,000
Total			92,925,000	2,306,911	139,498,000

Note: The costs neglect offsite collection improvements and assume that other major capital improvements are not needed over the project life.

[a] Life cycle costs utilized an interest rate of 3%.

[b] Build out capacity projection is 10 MGD for SBFB if the three north WWTPs are diverted to the WC&ID #2 WWTP.

SECTION 5: RECOMMENDED CONSOLIDATION PROJECTS AND COSTS

In general, the recommended water treatment and distribution projects are still consistent with those highlighted in the 2011 Planning Study. Because the City is already pursuing the Phase II expansion at its regional SWTP, the need for storage and efficient distribution is of growing importance. Elevated storage tanks are still the recommended means of water storage and utilizing existing or new interconnects is also necessary to improve pressure control, water quality, etc. across the study area. As a result, the implementation strategy for the water treatment and distribution projects has not changed from 2011 other than perhaps shifting the schedule to account for current conditions.

5.1 Wastewater Consolidation

As was the case in 2011, the cost analysis summarized in Table 5-1 supports reducing the number of WWTPs. However, it is important to note that cost factors for easements, land acquisitions, and fluctuations in commodity prices were not included in the cost analyses. Similarly, existing debt service was not incorporated into the cost analyses and should be considered.

Table 5-1: Summarized Total Costs for Options 1–4

Option	Extent of Regionalization	OPPC, $	Annual O&M Cost, $	30-Year Life Cycle Cost, $
1	Maintain existing WWTP infrastructure	121,043,000	4,883,911	219,642,000
	Existing WWTP infrastructure & WC&ID #2	116,739,000	4,815,911	213,965,000
2	Five regional WWTPs	106,132,000	3,280,411	172,358,000
	Five regional WWTPs & WC&ID #2	106,581,000	3,090,411	168,971,000
3	Four regional WWTPs	98,788,000	2,876,911	156,867,000
	Four regional WWTPs & WC&ID #2	99,237,000	2,686,911	153,480,000
4	Three regional WWTPs	91,607,000	2,595,911	144,016,000
	Three regional WWTPs & WC&ID #2	97,664,000	2,681,911	151,807,000
5	Two master regional WWTPs	86,429,000	2,256,911	131,991,000
	Two master regional WWTPs & WC&ID #2	92,925,000	2,306,911	139,498,000

Note: Refer to Section 4 for assumptions regarding life cycle analysis and plant specific assumptions

Even with the simplifying assumptions and accounting for the levee O&M costs, the most cost-effective option would consist of consolidating all wastewater treatment into two master regional locations at the SBFB and new Sienna South WWTPs. Utilizing these two WWTPs as master regional facilities would incur a 30-year life cycle cost of roughly $132M, which is approximately $88M less than retaining all of the existing infrastructure. Correspondingly, the estimated OPPC for the two, master regional WWTPs was approximately $86M. Aside from economic benefits, external benefits such as the following could be gained with the two, master regional WWTPs:

- Smaller environmental impact by reducing the number discharge streams and implementing an advanced treatment process at SBFB;
- Potential to increase bed and banks water rights; and
- Possibility of expanding reclaimed water supply if bed and banks rights are not pursued.

As noted in the 2011 Planning Study, one of the important challenges tied with consolidating to fewer WWTPs lies in the coordination needed among the utility districts to operate and maintain multiple rate structures. Similarly, a perceived loss of ownership by the utility districts may limit interest in consolidation. Nonetheless, the economics support wastewater treatment consolidation, with an ultimate reduction from twelve to two WWTPs.

SECTION 6: IMPLEMENTATION PLAN

If the Districts and COMC decide to pursue wastewater consolidation, an incremental approach is recommended for transitioning to two master regional WWTPs. However, two situations exist that that could impact the transition timeframe that were not as critical in 2011. First, the current daily flows suggest the Sienna North WWTP is above 75% of its permitted capacity. Based on TCEQ regulations, plans for expansion should be underway when the capacity at a WWTP exceeds 75%, and by 90%, construction should already have begun (TCEQ 75/90 Rule). In addition, much of the infrastructure was already at, or near the end of its intended life in 2011. While several smaller rehabilitation efforts have been undertaken at some of the WWTPs, the infrastructure as a whole needs significant overhauling in the very near future. To address these issues in accordance with Option 5, the following hypothetical implementation plant could be followed:

- 2018-2025 – Consolidation to Five WWTPs
    - Expand SBFB to 10.5 MGD absorb MB, PP, and Sienna North flows (evaluate and utilize MBR or SBR given long-term intent to use the WWTP as a master regional facility), size the MB, PP, and Sienna North PSs for projected build out demands including future consolidation according to Option 5;
    - Consolidate HC #122, SWHC #1, and HC-Fondren into BRW (retain 1.3 MGD capacity), size HC #122 and HC-Fondren PSs for build out projections; and
    - Transfer Sienna South flows to new Sienna South WWTP.
- 2025-2030 – Consolidation to Two WWTPs
    - Consolidate QVUD into SBFB, size PS for projected build out demands; and
    - Consolidate BRW and FBC #26 into PP pump station, size BRW and FBC #26 PSs for projected build out demands.

Although the above schedule alludes to rapid consolidation with aging infrastructure and TCEQ regulations in mind, several factors could impact the actual implementation timeframe. For example, growth could occur more slowly than projected. Also, coordination efforts between the districts and the City is critical to the long-term success of the regionalization efforts, and billing rate structures and allocation of costs must be set ahead of time. Furthermore, preliminary engineering design and right-of-way logistics with local utilities (power, railroad, etc.) and land owners could delay the project(s). Last, but not least, identifying and securing funding would obviously impact the implementation timeframe.

Ultimately, the consolidation effort and timeframe are left up to the City and the utility districts.

SECTION 7: CONCLUSIONS AND RECOMMENDATIONS

Three major changes have taken place across the study area since 2011. These changes include the City's 10 MGD regional SWTP, the new 2.88 MGD Sienna WTP No. 3, and the new 1.8 MGD Sienna South WWTP. The water treatment changes have helped the City reduce its dependence on groundwater in accordance with the GRP and provide water to ongoing developments in the adjacent MUDs. As the City implements Phase II at the regional SWTP, additional groundwater demands can be augmented or replaced with surface water. Similarly, the new Sienna South WWTP will utilize an MBR treatment process to accommodate wastewater flows for much of the southern Sienna Plantation region.

In terms of updated projections, the 2018 statistics overwhelmingly trended lower than the corresponding projections from 2011. In general, connection and population projections were lower by approximately 6–24% for the 2018–2040 timeframe, and the water and wastewater projections averaged approximately 23% (including FBC MUD #23 and #24) and 42% lower, respectively. Although the projection methods were primarily consistent with the most recent regionalization study, these statistics were derived from projections that were originally developed 10 years ago in the 2008 Joint GRP. As a result, the projection estimates should not be used as engineering design criteria for City- or MUD-specific water and wastewater projects.

Regionalization opportunities still exist for water supply and distribution, as well as wastewater treatment. Water interconnects, ESTs, and regionalized SWTP projects highlighted in 2011 warrant consideration and/or implementation. In addition, the deteriorating condition and age of a majority of the WWTPs presents a timely opportunity to regionalize at least some of the wastewater infrastructure. Consolidation from 12 down to two master regional WWTPs was shown to be most economical from a 30-year life cycle perspective. However, an aggressive implementation plan would be necessary to achieve this level of regionalization within the remaining service life of the existing WWTPs. Ultimately, the City and individual utility districts must come to an agreement regarding the timing and extent of regionalization efforts.

APPENDIX A

Study Area Map

Municipal Utility Districts & Service Areas

Map By:
GIS Division
January 2018

missouri CITY TEXAS

Legend

- Water Treatment Plant
- Surface Water Treatment Plant
- Waste Water Treatment Plant
- City Limits Line
- ETJ Line
- Water Feature
- Marsh

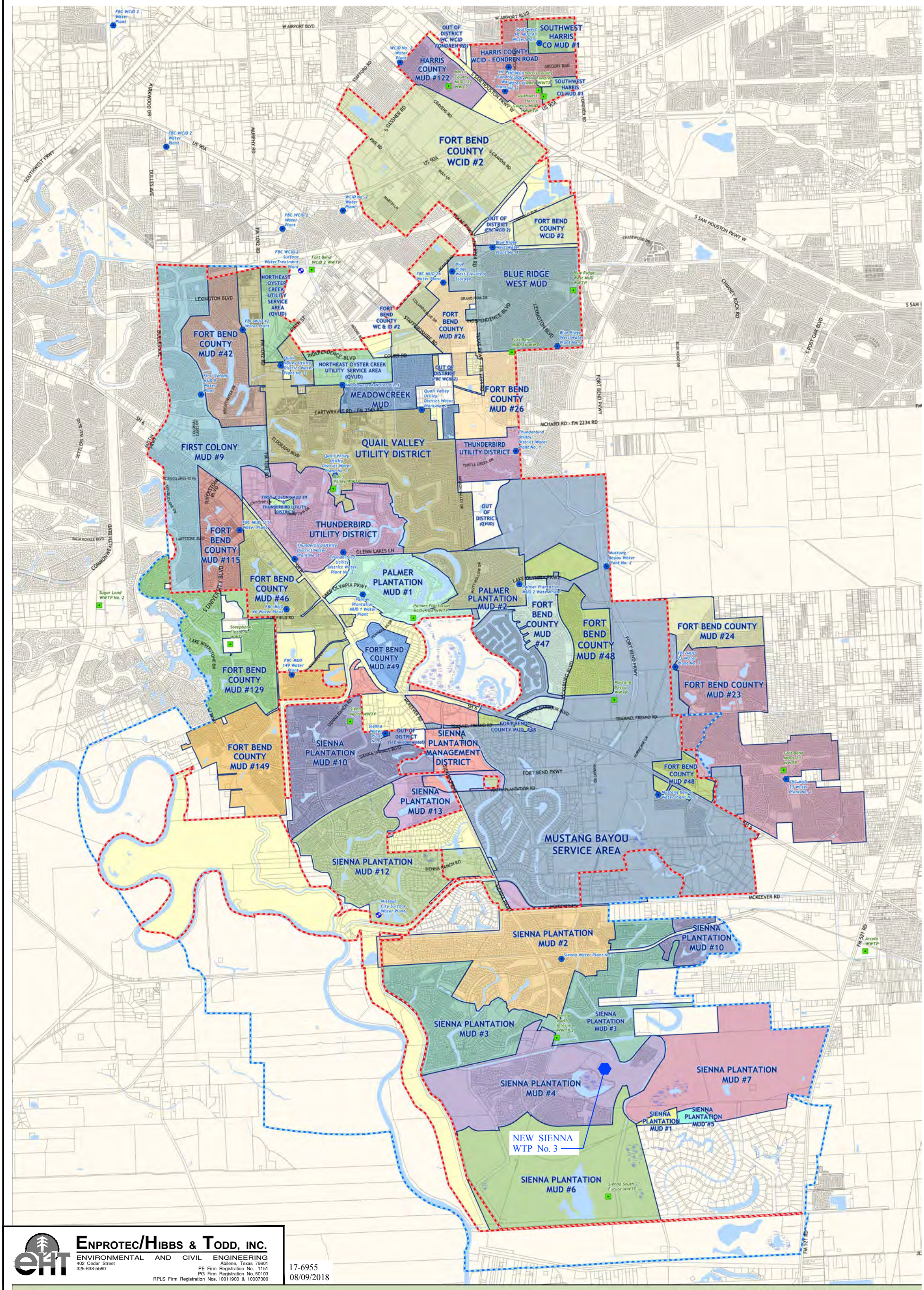
0 1,500 3,000 6,000 9,000 Feet

Geographic Coordinate System North American Datum 1983 (NAD83)

The information on this map is provided and maintained by various agencies, including county departments, municipal governments, state and federal agencies.The map is designed to serve as a secondary representation of real property found within this jurisdiction, and is compiled from the recorded deeds, plats, and other public records, which are primary sources for this public information. The data layers do not take the place of a legal survey or other primary source documentation.The City and its vendors assume no legal responsibility for the information on this map.

APPENDIX B

New Sienna Plantation Water Treatment Plant No. 3



ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street, Abilene, Texas 79601
325-698-5560
PE Firm Registration No. 1151
PG Firm Registration No. 50103
RPLS Firm Registration Nos. 10011900 & 10007300

17-6955
08/09/2018

Map By:
GIS Division
January 2018

missouri CITY TEXAS

Municipal Utility Districts & Service Areas

Legend
- Water Treatment Plant
- Surface Water Treatment Plant
- Waste Water Treatment Plant
- City Limits Line
- ETJ Line
- Water Feature
- Marsh

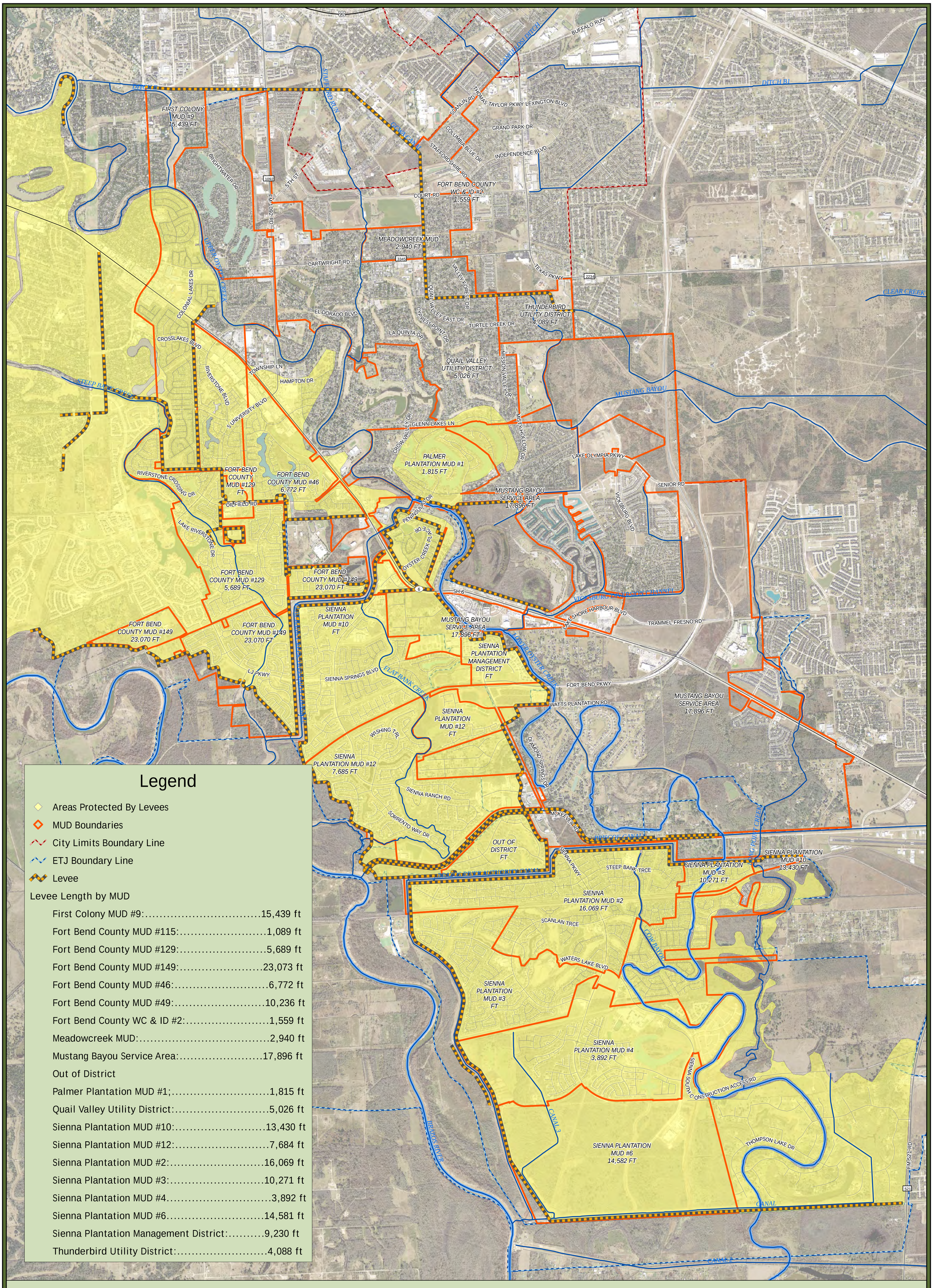
0 1,500 3,000 6,000 9,000 Feet

Geographic Coordinate System North American Datum 1983 (NAD83)

The information on this map is provided and maintained by various agencies, including county departments, municipal governments, state and federal agencies. The map is designed to serve as a secondary representation of real property found within this jurisdiction, and is compiled from the recorded deeds, plats, and other public records, which are primary sources for this public information. The data layers do not take the place of a legal survey or other primary source documentation. The City and its vendors assume no legal responsibility for the information on this map.

APPENDIX C

Levee Map



Legend

- Areas Protected By Levees
- MUD Boundaries
- City Limits Boundary Line
- ETJ Boundary Line
- Levee

Levee Length by MUD

First Colony MUD #9:	15,439 ft
Fort Bend County MUD #115:	1,089 ft
Fort Bend County MUD #129:	5,689 ft
Fort Bend County MUD #149:	23,073 ft
Fort Bend County MUD #46:	6,772 ft
Fort Bend County MUD #49:	10,236 ft
Fort Bend County WC & ID #2:	1,559 ft
Meadowcreek MUD:	2,940 ft
Mustang Bayou Service Area:	17,896 ft
Out of District	
Palmer Plantation MUD #1;	1,815 ft
Quail Valley Utility District:	5,026 ft
Sienna Plantation MUD #10:	13,430 ft
Sienna Plantation MUD #12:	7,684 ft
Sienna Plantation MUD #2:	16,069 ft
Sienna Plantation MUD #3:	10,271 ft
Sienna Plantation MUD #4	3,892 ft
Sienna Plantation MUD #6	14,581 ft
Sienna Plantation Management District:	9,230 ft
Thunderbird Utility District:	4,088 ft

Map By:
GIS Division
December 2018

missouri CITY TEXAS

Levee Length by MUD

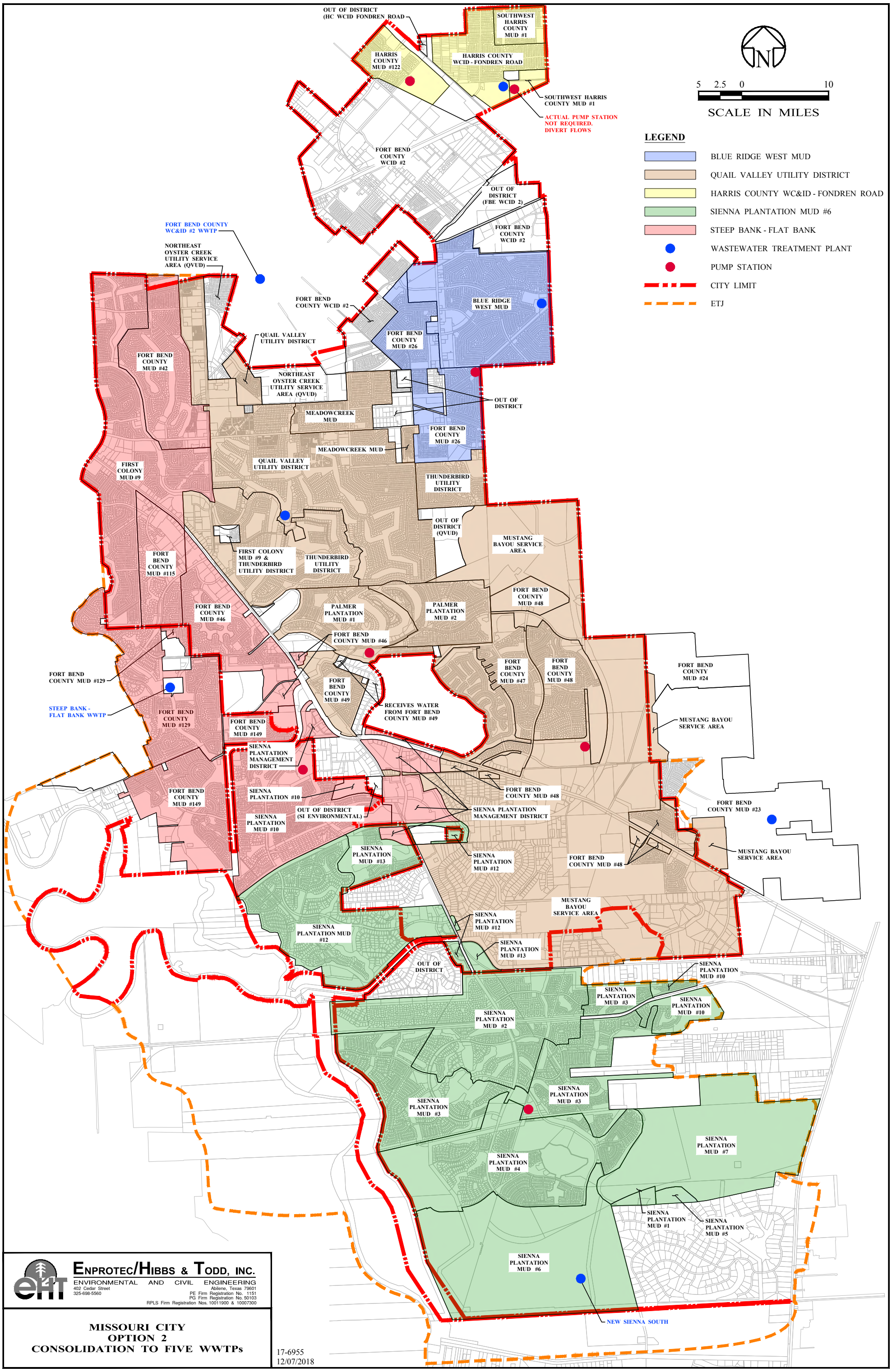
0 1,000 2,000 4,000 6,000 8,000 10,000 Feet

Geographic Coordinate System North American Datum 1983 (NAD83)

The information on this map is provided and maintained by various agencies, including county departments, municipal governments, state and federal agencies. The map is designed to serve as a secondary representation of real property found within this jurisdiction, and is compiled from the recorded deeds, plats, and various other public records, which are primary sources for this public information. These data layers do not take the place of a legal survey or any other primary source documentation.The City and its vendors assume no legal responsibility for the information on this map.

APPENDIX D

Wastewater Consolidation Option 2
Five Regional WWTPs



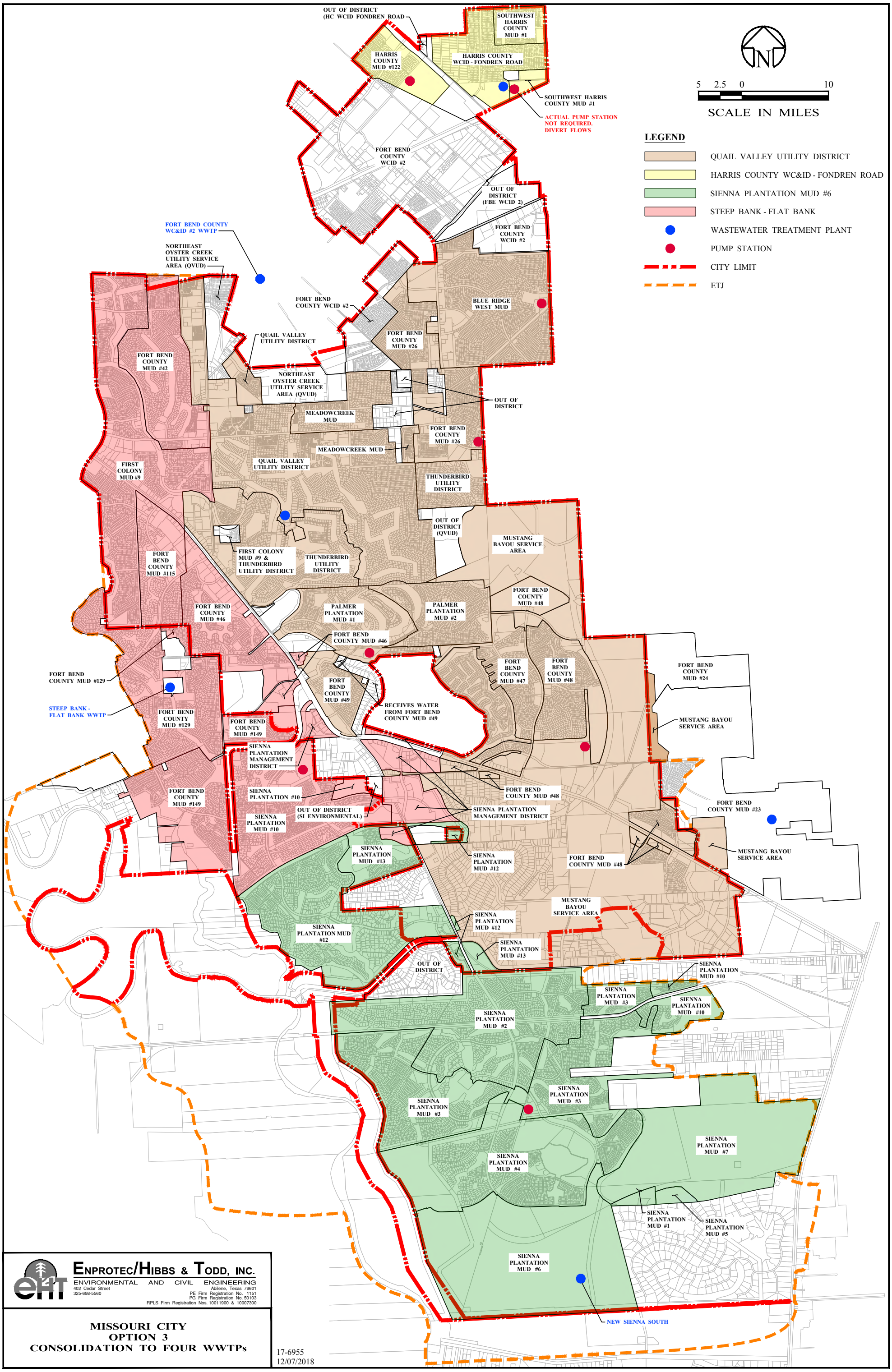
ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560
PE Firm Registration No. 1151
PG Firm Registration No. 50103
RPLS Firm Registration Nos. 10011900 & 10007300

MISSOURI CITY
OPTION 2
CONSOLIDATION TO FIVE WWTPs

17-6955
12/07/2018

APPENDIX E

Wastewater Consolidation Option 3
Four Regional WWTPs



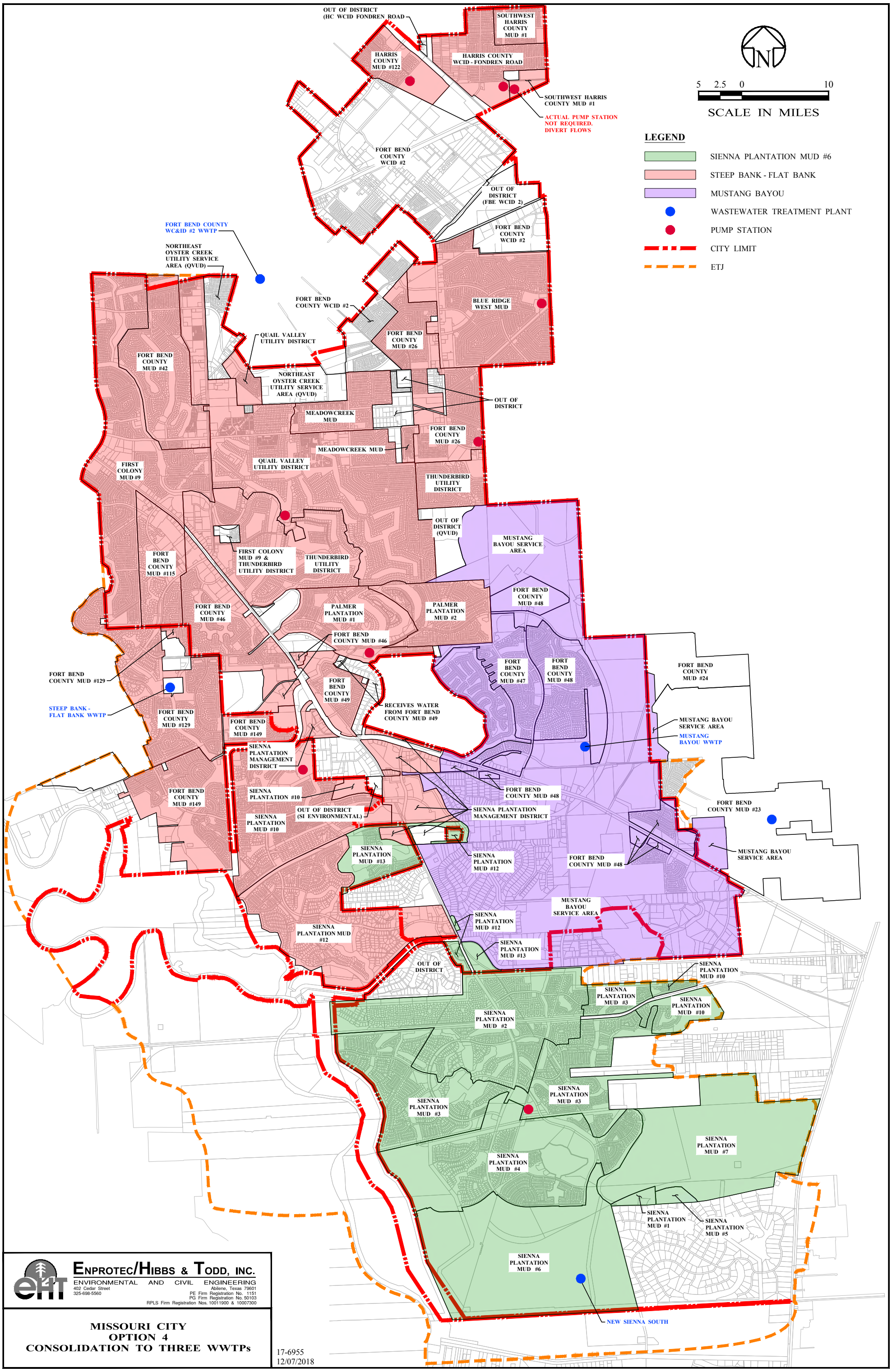
ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
325-698-5560
PE Firm Registration No. 1151
PG Firm Registration No. 50103
RPLS Firm Registration Nos. 10011900 & 10007300

MISSOURI CITY
OPTION 3
CONSOLIDATION TO FOUR WWTPs

17-6955
12/07/2018

APPENDIX F

Wastewater Consolidation Option 4
Three Regional WWTPs



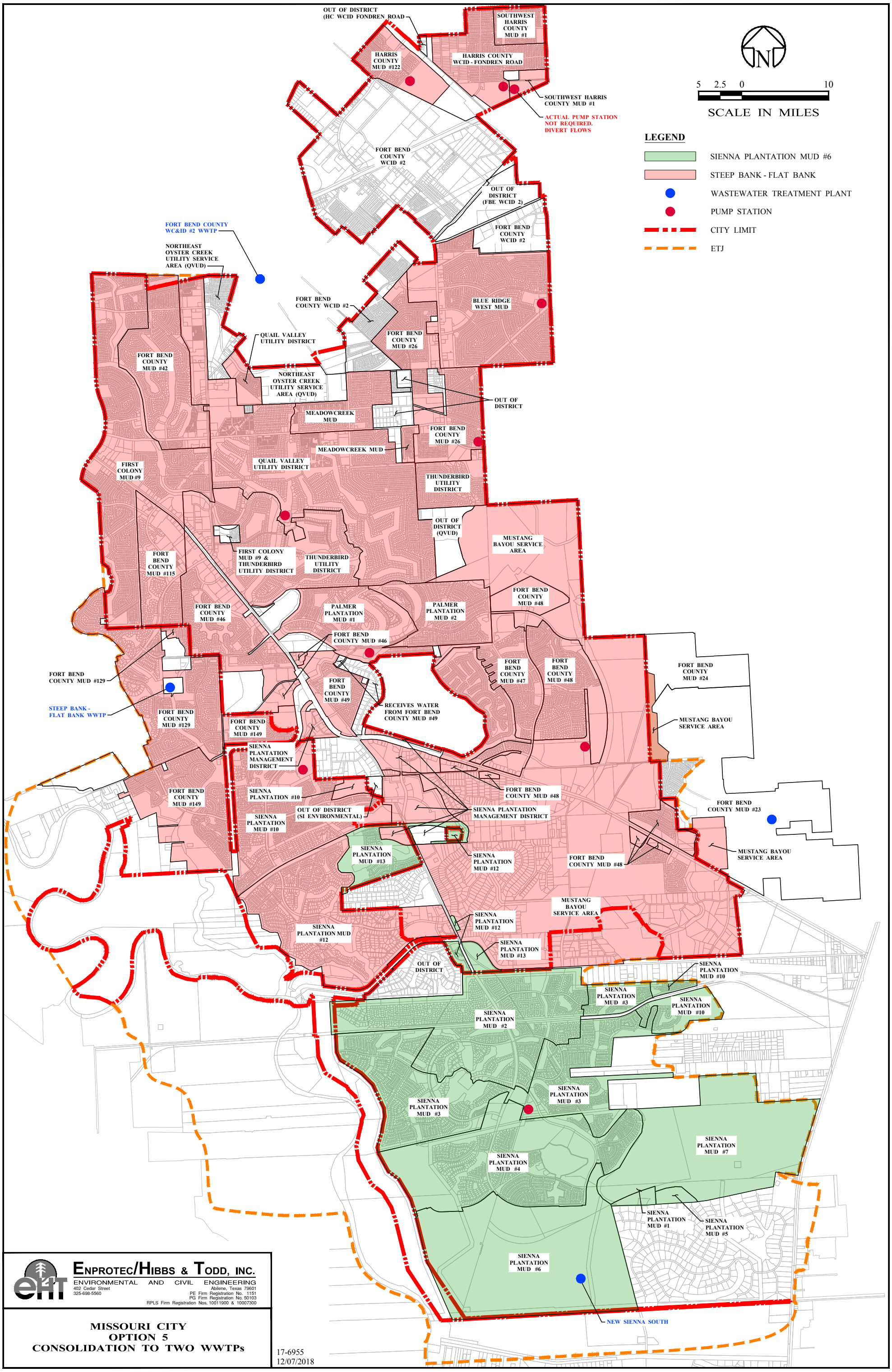
ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
PE Firm Registration No. 1151
PG Firm Registration No. 50103
RPLS Firm Registration Nos. 10011900 & 10007300

MISSOURI CITY
OPTION 4
CONSOLIDATION TO THREE WWTPs

17-6955
12/07/2018

APPENDIX G

Wastewater Consolidation Option 5
Two Master Regional WWTPs



ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street
Abilene, Texas 79601
325-698-5560
PE Firm Registration No. 1151
PG Firm Registration No. 50103
RPLS Firm Registration Nos. 10011900 & 10007300

MISSOURI CITY
OPTION 5
CONSOLIDATION TO TWO WWTPs

17-6955
12/07/2018

Appendix G
NewGen Report on Scenario 1: MUDs with Annexation Agreements

NewGen Strategies & Solutions
3420 Executive Center Drive
Suite 165
Austin, TX 78731
Phone: (512) 479-7900

Memorandum

To: Greenberg Traurig, P.A.

From: Dave Yanke, President – Environmental Practice, NewGen
Grant Rabon, Executive Consultant, NewGen

Date: July 30, 2019

Re: **Missouri City Feasibility Analysis Regarding Regionalization of Water/Wastewater Utility Providers for the City and the City's Extra Territorial Jurisdiction (Study): Financial Feasibility – Scenario 1: MUDs with Annexation Agreements**

Background

Greenberg Traurig, P.A., retained NewGen Strategies & Solutions, LLC (NewGen) to provide a financial feasibility analysis related to the Study, including evaluating several Study consolidation scenarios as directed by City staff regarding the potential consolidation of several municipal utility districts (MUDs) located in and/or near the City of Missouri City (City) with the City's existing water/wastewater utility systems. In establishing the scenarios to analyze, NewGen with input from City staff identified geographically, technically, and developmentally related MUDs to be considered as natural groupings for consolidation.

In this scenario, NewGen evaluated several sub scenarios of MUDs with annexation agreements. As part of this analysis, NewGen evaluated the forecasted customer growth, revenue, capital costs, debt service, and operations and maintenance (O&M) costs over a 30-year period (FY 2020 – FY 2049) to evaluate the financial impact that a consolidation may have on the City.

Methodology

For this scenario, NewGen studied the following MUDs in these three sub scenarios:

- Scenario 1.1: Riverstone MUDs
  - Fort Bend County MUD #129
  - Fort Bend County MUD #149
- Scenario 1.2: Sienna Plantation #1
  - Sienna Plantation #1
  - Sienna Plantation #2
  - Sienna Plantation #3
  - Sienna Plantation #10
  - Sienna Plantation #12
  - Sienna Plantation #13[1]

[1] Sienna Plantation #13 (aka "the Woods") is consolidated and reported with the financials for Sienna Plantation #1

  - Sienna Plantation Management District

- Scenario 1.3: Sienna Plantation #5
  - Sienna Plantation #4
  - Sienna Plantation #5
  - Sienna Plantation #6[2]
  - Sienna Plantation #7[3]

The sub scenarios were created to help align with the way each of the MUDs are controlled. Sienna Planation MUD #1 controls the MUDs in Scenario 1.2 and Sienna Plantation MUD #5 controls the MUDs in Scenario 1.3.

Table 1
Revenue and Expense Categories

Revenues	Expenses
Contracted Wastewater Fees	Administrative Expenses
Garbage Service[1]	Capital Outlay
Groundwater Reduction Fees[2]	Connection Fees
Other Revenues[2]	Contracted Services[1]
Other Tax	Depreciation & Amortization[1]
Participant Billings[2]	Groundwater Reduction Fees
Property Tax	Lease
Surface Water Fees[2]	Other
Tap Connection and Inspection Fees	Professional Fees
Wastewater Service[2]	Purchase of Capacity
Water Service[2]	Purchased Services[1]
Water Impact Fee	Purchased Sewer Services[1]
Wastewater Impact Fee	Purchased Water Services[1]
	Renewals & Replacements
	Repairs & Maintenance[1]
	Salaries and Benefits
	Solid Waste
	Surface Water Fee[2]
	Utilities[2]
	Payments to Master ("Connection Charges")[2]

1. Annual growth in forecast based on 50% inflation plus 50% inflation and customer growth combined

[2] The Texas Water Code did not require an audited financial statement for Sienna Plantation Municipal Utility District No. 6 for fiscal year end April 30, 2018.

[3] The Texas Water Code did not require an audited financial statement for Sienna Plantation Municipal Utility District No. 7 for fiscal year end April 30, 2018. There were reportedly no active connections in this MUD at that time.

2. Annual growth in forecast based on inflation and customer growth

The financial audits for each MUD were used to develop a test year for the utilities. A test year reflects expected recurring revenue and expense line items, including existing debt service. The most recent financial audits available to NewGen were used. The test year was then used to develop a 30-year forecast. Table 1 shows the revenue and expense categories used for the 30-year forecast, as applicable.

All categories were forecasted to increase at 2% per year to reflect inflation, except the bolded categories, which were forecasted based on a combination of inflation and customer growth (as identified in the footnotes of Table 1). For customer growth, NewGen utilized the growth projections from the 2018 Regional Water & Wastewater Planning Study Update (2018 eHT Study) prepared by Enprotec/Hibbs & Todd, Inc. (eHT) for the Study, which were validated by City staff. Table 2 shows the connection projections for the MUDs in this scenario. Note that NewGen did not independently verify the eHT projections, and any material change in actual customer growth (compared with the projections) could have a material impact on the financial analyses.

Table 2
Connection Projections [1]

MUD	Current	2020	2025	2030	2035	2040	Build Out
Scenario 1.1: Riverstone MUDs							
Fort Bend Colony MUD #129	1,461	1,461	1,461	1,461	1,461	1,461	1,550
Fort Bend Colony MUD #149	1,247	1,529	1,700	1,700	1,700	1,700	1,700
Scenario 1.2: Sienna Plantation #1							
Sienna Plantation #1	14	14	15	16	18	20	25
Sienna Plantation #2	1,781	1,781	1,781	1,781	1,781	1,781	1,781
Sienna Plantation #3	2,614	2,614	2,614	2,614	2,614	2,614	2,614
Sienna Plantation #10	2,113	2,222	2,433	2,433	2,433	2,433	2,433
Sienna Plantation #12	1,256	1,439	1,439	1,439	1,439	1,439	1,439
Sienna Plantation #13	114	224	499	774	1,049	1,194	1,194
Sienna Plantation Management District	155	206	332	453	453	453	453
Scenario 1.3: Sienna Plantation #5							
Sienna Plantation #4,5,6 & 7 [2]	815	1,177	2,536	3,894	5,252	6,611	10,000
Total Connections	11,570	12,667	14,810	16,565	18,200	19,706	23,189

1. Source: 2018 Regional Water & Wastewater Planning Study Update by eHT
2. Projections combined all four MUDs

NewGen developed its scenario analysis based on two potential consolidation implementation structures – 1) annexation of each MUD, title acquisition by the City of each MUD's assets (including both water/wastewater assets and all other assets of the MUD), and assumption by the City of all of the MUD's liabilities and obligations (including MUD debt and all operating expense obligations); and 2) voluntary negotiated transfer by each MUD of its water/wastewater utility assets to the City (with each MUD continuing in existence), and no assumption by the City of MUD liabilities and obligations (except continuing utility intergovernmental agreements).

Asset Acquisition

In the asset acquisition option, the MUDs would voluntarily divest themselves of their utility system assets without remuneration from the City, but would continue to exist as governmental entities to provide non-utility services (parks, roads, etc.). In this option, the MUDs would continue to service outstanding water/wastewater debt and would continue to levy and collect at current levels the MUD property taxes to fund the MUDs' administrative costs, remaining non-utility operating expenses, and existing and future utility debt service, which would not be assumed by the City. The analysis assumes that the City would initially continue the existing MUD utility rates in place, with annual adjustments to address inflated costs, but would not raise rates to fund the acquisition. The analysis also assumes that the MUD will continue to collect the water/wastewater operating expenses imbedded in the MUDs property tax levy and transfer those funds to the City for the same purpose. For purposes of our financial analyses, we have assumed that the amount the MUD collects from property taxes in excess of its administrative costs, non-utility operating expenses, and debt service is equal to the portion of water/wastewater utility operating expenses currently used in addition to revenues from utility rates to fund its water/wastewater utility service (i.e., the subsidy). This available property tax portion for funding water/wastewater utility operating costs would be transferred annually to the City to pay the water/wastewater operating costs not covered by rate revenues (mirroring the existing funding mechanism of the MUDs so that existing MUDs utility customers would see no utility financial change as a result of the acquisition).[4]

MUD Annexation

In the MUD annexation option, the City would annex the MUDs' territory and dissolve the MUDs, which would cause the MUDs to cease to exist as governmental entities. By law, upon annexation of the MUDs, the City would obtain title to all of the MUDs' assets and assume all the MUDs' expenses, debts and other obligations. The City would not assume the MUDs' ability to levy a MUD property tax to fund the expenses, debts and other assumed obligations, and would have to identify other funding sources within the City to pay such assumed obligations. Since most MUDs are using property tax revenue to pay water/wastewater utility debt, and to supplement utility rate revenues to pay operating expenses, the loss of MUD property tax revenue support has a very negative effect on the financial feasibility of this option. Under this option, the former MUD water/wastewater customers would face a lower overall tax burden as the MUD property tax expired, but the City would have to either substantially raise the former MUD customers' water/wastewater utility rates, or allocate general City tax revenues to subsidize the cost of water/wastewater utility service to the former MUD customers (and if general revenues were not sufficient, the City would have to raise additional general tax revenues City-wide to support such assumed cost burden). In addition, the existing debt of each MUD would have to be paid off by the City via a new debt issuance by the City, with the City funding the debt service either through increased water/wastewater utility rates or City general fund revenues. Note: The City could not assume the MUDs' existing debt as the debt is secured by MUD property taxes, which the City would have no recourse to. Finally, under this option, the City would have to assume the provision of all other governmental services being provided by the MUDs in addition to water/wastewater services, again without recourse to the MUDs property tax levies currently funding operation of those services.

[4] Alternatively, for the purposes of this analysis, the assumption could equally be that the City would be able to increase utility revenues equal to the subsidy in the first year of the forecast. However, factoring in political considerations NewGen believes that option is less likely.

Future Capital Plans

Upon acquisition of the MUDs water/wastewater facilities under both options, the City would assume the continuing future obligation to maintain, upgrade, expand and replace the water/wastewater utility system infrastructure acquired, as conveyed in a Capital Improvement Plan (CIP). Based on input from eHT, the water/wastewater CIP were assumed to be the same in both the MUD annexation and asset acquisition options.

The relevant water CIP projects were taken from Table 4-20 of the 2011 Regional Water and Wastewater Planning Study (2011 eHT Study) developed by eHT. Since the CIP project costs in the 2011 eHT Study were not in current dollars, NewGen increased the costs taken from the 2011 eHT Study by either approximately 3.6%[5] per year for interconnection projects or approximately 1.3%[6] per year for elevated storage tank projects. While the 2011 eHT Study lists 15 different water interconnection and storage projects, for this analysis NewGen focused on the projects directly related to the MUDs in the analysis. In this case, NewGen identified several relevant water projects and allocated the costs to the relevant participants based on build out connection counts, as shown in Schedule 3 (in 2011 dollars), and then inflated the costs to 2019 dollars. The water capital costs included in the analysis are listed in Table 3 and assumed to be incurred in the first year of the forecast.

Table 3
Capital Projects

Utility	Project Description	Project Cost
	Scenario 1.1: Riverstone MUDs	
Water	New Interconnects	$ 112,548 [1]
Water	New Elevated Storage Tanks	903,580 [1]
Wastewater	Consolidation into two master regional WWTPs (without WC&ID #2)	5,074,507 [2]
	Scenario 1.2: Sienna Plantation #1	
Water	New Interconnects	$ 2,320,593 [1]
Water	New Elevated Storage Tanks	11,811,308 [1]
Wastewater	Consolidation into two master regional WWTPs (without WC&ID #2)	15,518,623 [2]
	Scenario 1.3: Sienna Plantation #5	
Water	New Interconnects	$ 900,937 [1]
Water	New Elevated Storage Tanks	-
Wastewater	Consolidation into two master regional WWTPs (without WC&ID #2)	15,613,867 [2]

1. Costs have been inflated to 2019 dollars using an appropriate inflation factor and project cost reflects pro-rata share of the overall project cost based on build out connection counts of all participants in the project
2. Project cost reflects pro-rata share of the overall project cost based on build out connection counts of all participants in the project

[5] Based on the annualized change in the Handy Whitman Index cost for water mains (NARUC 331) within the South Central region of the country between January 2011 and January 2018

[6] Based on the annualized change in the Handy Whitman Index cost for elevated steel tanks (NARUC 330) within the South Central region of the country between January 2011 and January 2018

For wastewater CIP projects, per input from eHT and City staff, the most cost-effective means of providing wastewater service to the area would be to consolidate down to two master regional wastewater treatment plants (WWTPs) as seen in Option 5 in Table 5-1 in the 2018 eHT Study. Since the costs for this project cannot be pinpointed to each individual MUD, the costs were allocated based on the total build out size of each participant, as found in the 2018 eHT Study. The wastewater project cost shown in Table 3 represents the pro-rata share allocated to the relevant MUDs.

Since there are no projected revenues identified currently to fund the CIP, we have assumed the City would fund the CIP with the issuance of new debt. The timing of debt incurred to fund the wastewater CIP is assumed to be 10% of the total in year 1 of the forecast, 65% in year 5, and the remaining 25% in year 10. It is assumed that all capital projects will be debt funded over a 30-year term with a 5% interest rate and a 2% issuance fee.

Implementation of the wastewater CIP presents opportunities for O&M cost savings. By modernizing and consolidating facilities, eHT estimates that the overall wastewater O&M cost should decrease by approximately 54%[7] when compared to the status quo. Similar to the capital spending, the O&M savings are assumed to be phased in over time. The cost savings were applied in the financial forecast to the Purchased Sewer Services line item for Scenario 1.1 and Contracted Services for Scenarios 1.2 and 1.3. Since Contracted Services presumably includes both water and wastewater expenses, NewGen assumed a 60/40 split in Contracted Services between water and sewer, respectively, for the purpose of calculating the wastewater O&M cost savings. The timing for the utility debt issuances and the O&M savings is shown in Table 4.

Table 4
Capital Project Debt and Savings Schedule

	Debt Issuance [1]		O&M [2]	
Year	Capital Debt %	Cumulative %	O&M Savings %	Cumulative %
2020	10%	10%	10%	10%
2024	65%	75%	40%	50%
2029	25%	100%	50%	100%

1. 10% of debt is issued in 2020, 65% of debt in 2024, and 25% in 2029 based on input from eHT
2. 10% of the 54% total O&M savings is realized in 2020, an additional 40% in 2024, and the final 50% in 2029 based on input from eHT

[7] Per Table 5-1 in the 2018 eHT Study

It is assumed that the depreciation (a non-cash item) included within the cash flow forecast will sufficiently fund any necessary capital renewals and replacements. It is also assumed that the CIP projects identified in Table 3 and the O&M savings discussed in the 2018 eHT report are realized as forecasted.

Analysis

Methodology

NewGen's analysis for both options will focus on changes in revenue, operating expenses, and debt service expenses. Table 5 summarizes several of the key differences between an asset acquisition and an annexation of the MUDs.

Table 5
Relevant Components for Each Option

Asset Acquisition	Annexation
Revenues • Water Service • Property Tax Support [1, 2] • Wastewater Service • Tap Connection & Inspection Fees • Participant Billings • Surface Water Fees	Revenues • Water Service • No Property Taxes • Wastewater Service • Garbage Service (if any) • Other Revenues • Tap Connection & Inspection Fees • Participant Billings • Surface Water Fees • Other Tax
Operating Expenses • Treated the same, except excludes "Other" operating expenses, which remain with the MUD	Operating Expenses • Treated the same, except includes "Other" operating expenses
Debt Service • Debt Service for new capital projects	Debt Service • Debt Service for new capital projects • Plus MUD Debt defeasance costs • Plus MUD developer reimbursement obligations

1. MUD Property Tax Revenue + Revenues for services retained by the MUD – MUD Debt Service – Expenses for services retained by the MUD = Portion of Tax Revenue Assigned to the City
   Ex (from Scenario 1.1): Property Tax Revenue in 2020 = $4,526,513;
   Other MUD revenue for services in 2020 = $520,970;
   MUD Expenses for services in 2020 = $428,142; MUD Debt Service in 2020 = $3,380,962;
   City Tax Revenue Portion = $4,526,513 + $520,970 – $428,142 – $3,380,962 = $1,238,379
2. Amount City receives in 2020 is constant throughout the 30-year forecast.

Asset Acquisition

In the asset acquisition option, one key assumption involves the continuation of MUDs property tax revenue collected by the MUD to offset water/wastewater operating costs, which will then be transferred to the City by the MUDs to supplement water/wastewater utility rate revenues. Tables 6, 7, and 8 show the cash flow in the asset acquisition option for each sub scenario. Schedule 1 shows a detailed breakdown of the cash flow.

Table 6
Cash Flow Analysis – Asset Acquisition – Scenario 1.1: Riverstone MUDs

Categories	2020	2025	2030	2035	2040	2045	2049
Revenues[1]	$4,184,541	$4,637,171	$4,899,650	$5,280,718	$5,701,448	$6,165,967	$6,572,159
Expenses[2]	4,294,394	4,780,976	5,174,473	5,713,036	6,307,654	6,964,159	7,538,230
Net Income before Debt Service	($109,853)	($143,805)	($274,823)	($432,318)	($606,206)	($798,192)	($966,071)
Debt Service[3]	100,558	318,257	401,988	401,988	401,988	401,988	401,988
Net Income after Debt Service	($210,411)	($462,062)	($676,810)	($834,306)	($1,008,193)	($1,200,179)	($1,368,058)

1. Includes the share of property taxes assumed to be transferred to the City by the MUDs
2. Includes operating expenses except debt service
3. Debt service on debt to be issued by the City to fund the CIP

As shown in Table 6, for each year in the scenario, the MUDs collectively show a negative net operating income, with expenses exceeding revenues. Accordingly, if the City wants the asset acquisition in Scenario 1.1 to be self-supporting the City would need to increase utility rates charged to the MUD customers or receive a larger portion of the MUDs' property tax revenues than is currently shown as funding utility operating expenses in order to acquire the MUDs' utility assets and fund the identified capital projects.

Conversely, as shown in Table 7, in Scenario 1.2 the asset acquisition is forecasted to be self-supporting based on the existing utility rates and the share of the MUDs' property tax revenues assumed to be provided to the City as financial support.

Table 7
Cash Flow Analysis – Asset Acquisition – Scenario 1.2: Sienna Plantation #1

Categories	2020	2025	2030	2035	2040	2045	2049
Revenues[1]	$21,094,335	$24,231,616	$27,261,657	$30,503,505	$34,506,650	$38,967,761	$43,085,429
Expenses[2]	19,754,935	21,943,092	24,748,609	28,272,656	32,244,008	36,644,294	40,633,334
Net Income before Debt Service	$1,339,400	$2,288,524	$2,513,048	$2,230,849	$2,262,642	$2,323,467	$2,452,094
Debt Service[3]	1,035,143	1,700,901	1,956,962	1,956,962	1,956,962	1,956,962	1,956,962
Net Income after Debt Service	$304,257	$587,623	$556,086	$273,887	$305,680	$366,505	$495,132

1. Includes the share of property taxes assumed to be transferred to the City by the MUDs
2. Includes operating expenses except debt service
3. Debt service on debt to be issued by the City to fund the CIP

The MUDs in Scenario 1.3 proved to be unique in the Study. These MUDs were recently created and are forecasted to have significant operating losses in the near-term. However, Sienna Plantation MUD #5, the master MUD for Scenario 1.3, has an agreement with the developer to obtain developer advances to offset any operating losses. Thus, this called for special treatment in the Study and NewGen assumed that developer advances would exactly offset any operating losses (before debt service).

Table 8
Cash Flow Analysis – Asset Acquisition – Scenario 1.3: Sienna Plantation #5

Categories	2020	2025	2030	2035	2040	2045	2049
Revenues[1]	$4,085,882	$7,615,406	$11,332,600	$15,389,159	$20,078,144	$30,578,375	$33,009,167
Expenses[2]	3,923,366	6,783,046	10,242,607	14,299,166	18,988,152	29,488,383	31,919,174
Net Income before Debt Service	$162,516	$832,360	$1,089,992	$1,089,992	$1,089,992	$1,089,992	$1,089,992
Debt Service[3]	162,516	832,360	1,089,992	1,089,992	1,089,992	1,089,992	1,089,992
Net Income after Debt Service	$0	$0	$0	$0	$0	$0	$0

1. Includes the share of property taxes assumed to be transferred to the City by the MUDs as well as additional support from the developer
2. Includes operating expenses except debt service
3. Debt service on debt to be issued by the City to fund the CIP

It is likely that at some point in the future incremental rate revenue or property taxes not currently forecasted in our analysis would make continued developer advances unnecessary, but NewGen has assumed the developer advances continue throughout the forecast to represent these additional revenues. An additional unique assumption for Scenario 1.3 is that the MUDs will pay for future capital projects identified in this scenario either directly or, in the case of the accompanying analysis, through additional revenue sharing to pay the debt service associated with future water and wastewater capital projects. Table 8 shows the forecasted results for the MUDs in Scenario 1.3 under these unique assumptions.

Annexation

The MUDs in Scenario 1 have annexation agreements with the City that prevent the City from annexing the MUDs until certain future events transpire. Generally, the City cannot annex one of these MUDs until 90 percent of developable acreage in the MUD has been developed with water, wastewater, and drainage facilities. Based on the build out connection forecast provided by eHT, NewGen estimates this would prevent the City from annexing the MUDs in Scenario 1.1 until approximately 2021, the MUDs in Scenario 1.2 until approximately 2032, and the MUDs in Scenario 1.3 until approximately 2044. Despite this limitation, NewGen has developed the future annexation comparison option analysis based on an assessment of what the financial impact would be if the City annexed the MUDs in 2019. A myriad of changes could take place between now and when annexation would be allowed by the annexation agreements, and these changes would be difficult to quantify and forecast. Further, NewGen does not think the result of the analysis will be meaningfully different if the annexation is modeled to occur in some future year when the annexation conditions might be triggered because the MUDs are expected to continue to issue new debt over time concurrent with new customer growth. Thus, NewGen suggests the analysis conducted is a reasonable approximation of the financial impact of annexation at the projected future dates, regardless of when the annexations may transpire.

One of the key differences between the MUDs annexation option and the MUDs asset acquisition option is the requirement that the City repay existing MUD debt upon annexation. This amounts to approximately $44.2 million, $214.5 million, and $37.4 million of debt principal to be repaid for the MUDs in Scenarios 1.1, 1.2, and 1.3, respectively. The City will also inherit the responsibility for all outstanding developer reimbursement obligations, which amount to $0.8 million, $28.7 million, and $38.9 million for the MUDs in Scenarios 1.1, 1.2, and 1.3, respectively. It is important to recognize that these obligations reflect a snapshot in time and these obligations could increase meaningfully in a short period of time. For example, each MUD could (and likely will) issue additional debt. Also, some MUDs are already committed to additional developer reimbursement obligations that are not yet reflected on the MUDs' balance sheets (or the amounts listed above) because the projects are not yet complete. These additional developer reimbursement obligations, which were not included in the analysis herein, amount to $2.8 million and $17.3 million for the MUDs in Scenarios 1.2 and 1.3, respectively. In the analysis, the defeasance of existing MUD debt and payment of currently outstanding developer reimbursement obligations is facilitated by a new debt issue with the same term, rate, and issuance fees assumptions as the issuances for capital projects.

A second key difference between the MUDs annexation option and the MUDs asset acquisition option is the loss of City access to MUD property tax revenues to fund water/wastewater operating expenses. Tables 9, 10, and 11 show a cash flow analysis for the annexation option in each sub scenario. Schedule

2 shows a detailed breakdown of the cash flow. All annexation options result in significant operating losses even before any capital or debt service is considered. This is primarily due to the loss of property tax revenues. Thus, annexation is not forecasted to be self-supporting in any sub-scenario.

Table 9
Cash Flow Analysis – Annexation – Scenario 1.1: Riverstone MUDs

Categories	2020	2025	2030	2035	2040	2045	2049
Revenues[1]	$3,467,132	$4,002,940	$4,328,299	$4,778,792	$5,276,172	$5,825,320	$6,305,514
Expenses[2]	4,645,333	5,168,440	5,602,264	6,185,353	6,829,129	7,539,910	8,161,441
Net Income before Debt Service	($1,178,201)	($1,165,500)	($1,273,966)	($1,406,561)	($1,552,957)	($1,714,590)	($1,855,927)
Debt Service[3]	3,072,848	3,290,547	3,374,278	3,374,278	3,374,278	3,374,278	3,374,278
Net Income after Debt Service	($4,251,049)	($4,456,048)	($4,648,244)	($4,780,839)	($4,927,235)	($5,088,868)	($5,230,205)

1. Includes no property taxes
2. Includes operating expenses except debt service
3. Debt service on debt to be issued by the City to repay the MUDs' outstanding debt, repay all outstanding developer reimbursement obligations, and fund the CIP

Table 10
Cash Flow Analysis – Annexation – Scenario 1.2: Sienna Plantation #1

Categories	2020	2025	2030	2035	2040	2045	2049
Revenues[1]	$21,918,811	$26,152,461	$30,340,943	$35,046,958	$40,719,162	$47,039,194	$52,867,059
Expenses[2]	24,156,734	26,803,034	30,114,377	34,196,898	38,784,849	43,865,911	48,450,245
Net Income before Debt Service	($2,237,924)	($650,573)	$226,565	$850,061	$1,934,313	$3,173,283	$4,416,813
Debt Service[3]	17,088,952	17,754,710	18,010,771	18,010,771	18,010,771	18,010,771	18,010,771
Net Income after Debt Service	($19,326,876)	($18,405,284)	($17,784,206)	($17,160,710)	($16,076,458)	($14,837,488)	($13,593,958)

1. Includes no property taxes
2. Includes operating expenses except debt service
3. Debt service on debt to be issued by the City to repay the MUDs' outstanding debt, repay all outstanding developer reimbursement obligations, and fund the CIP

Table 11
Cash Flow Analysis – Annexation – Scenario 1.3: Sienna Plantation #5

Categories	2020	2025	2030	2035	2040	2045	2049
Revenues[1]	$2,802,222	$6,093,968	$10,001,794	$14,631,926	$20,100,158	$32,990,646	$35,024,132
Expenses[2]	4,227,793	7,119,158	10,613,702	14,708,884	19,440,514	29,987,827	32,459,789
Net Income before Debt Service	($1,425,571)	($1,025,190)	($611,908)	($76,958)	$659,644	$3,002,818	$2,564,343
Debt Service[3]	5,201,045	5,870,890	6,128,522	6,128,522	6,128,522	6,128,522	6,128,522
Net Income after Debt Service	($6,626,616)	($6,896,079)	($6,740,430)	($6,205,481)	($5,468,878)	($3,125,704)	($3,564,179)

1. Includes no property taxes
2. Includes operating expenses except debt service
3. Debt service on debt to be issued by the City to repay the MUDs' outstanding debt, repay all outstanding developer reimbursement obligations, and fund the CIP

Net Present Value Analysis

NewGen developed a net present value (NPV) analysis that calculates the payback, if any, from each option over a 30-year period based on the net income after debt service and operating expenses. The NPV analysis takes into account the relative timing of CIP and O&M expenditures and the impact they have on cash flow. If the NPV is negative, it indicates the existing water/wastewater utility revenues (even with customer growth and adjustments to rates for inflation) are not sufficient to keep the City from having to financially support the MUDs water/wastewater expenses from utility rate increases and/or general City revenues. In calculating the NPV analysis, NewGen utilized a 5% discount rate.

Table 12 summarizes the NPV for each option over the FY 2020 – FY 2049 timeframe. For the asset acquisition option to break-even (on an NPV basis) the City would need to increase annual water/wastewater utility rate revenue or annual general fund subsidy by approximately $0.7 million in Scenario 1.1 to achieve an NPV of $0. Scenario 1.2, as mentioned earlier, has a positive cash flow and, therefore, a positive NPV of approximately $6.2 million. Scenario 1.3 has an NPV of $0 due to the commitment of developer advances and funding of future capital improvements by the MUD or the developer. Without the unique developer support and capital funding assumptions included in Scenario 1.3, the NPV would have been a negative $31.7 million.

For the annexation option to break-even (on an NPV basis) an annual revenue increase of $4.6 million in Scenario 1.1, $17.5 million in Scenario 1.2, or $6.1 million in Scenario 1.3 would be needed.

Table 12
Net Present Value Analysis

Option	NPV [1]	
Scenario 1.1		
Asset Acquisition	($10,396,835)	unfavorable
Annexation	($71,398,108)	unfavorable
Scenario 1.2		
Asset Acquisition	$6,178,851	favorable
Annexation	($269,621,643)	unfavorable
Scenario 1.3		
Asset Acquisition[2]	$0	favorable
Annexation	($93,942,989)	unfavorable

1. Based on a 5% discount rate
2. Reflects unique assumptions regarding developer support and capital funding, without which the NPV would be negative $31.7 million

Findings

Based on NewGen's financial analysis, we make the following findings as part of the Study for consideration by the City:

1. **The most feasible option from all three sub-scenarios would be an Asset Acquisition from Sienna Plantation MUD #1 and its participating subservient MUDs (Scenario 1.2).** This is the only scenario/option that has a positive NPV without unique assumptions related to developer support or capital funding.[8]

   One contributing factor to this outcome is that Participant Billings (i.e., revenues reported by Sienna Plantation MUD #1 based on payments by the participant MUDs) were greater than the total of payments to Sienna Plantation MUD #1 (aka, Connection Charges) reported by the participant MUDs in Scenario 1.2 in the most recent financial reports available to NewGen. **If this happens to be atypical, or the result of a timing difference in reporting, then the results of this analysis may be misleading.**

   In Scenario 1.3, Sienna Plantation MUD #5 reported Participant Billings that were somewhat similar in magnitude to what was reported by Sienna Plantation MUD #4 as payments to the master MUD.[9] However, Sienna Plantation MUD #5 reported $735,247 in payments to a master MUD that were presumably paid to Sienna Plantation MUD #1. This could be the source of (or a contributing factor to) the incremental Participant Billings reported by Sienna Plantation MUD #1 in Scenario 1.2. The nature and magnitude of Participant Billings and Connection Charges should

[8] This option requires voluntary cooperation of MUDs, and cannot be unilaterally imposed by the City, unlike the annexation option.

[9] Sienna Plantation MUD #6 and Sienna Plantation MUD #7 did not report any payments to a master MUD in the most recent financials available to NewGen

be more carefully studied and confirmed before the City makes any final decisions with regard to these results.

It is also worth noting that the existing Sienna Plantation MUD #2 debt is due to be paid in full in FY 2026 and NewGen received indications that Sienna Plantation MUD #2 and Sienna Plantation MUD #3 may be done issuing new debt.

2. **An Asset Acquisition from Sienna Plantation MUD #5 and its participating subservient MUDs (Scenario 1.3) could be financially feasible IF the unique assumptions regarding developer support and capital funding can be agreed to with the MUDs.**
3. **All other options do not represent a viable financial transaction as they would require substantial increases in utility rates and/or general fund subsidies due to the negative NPV**.
4. The requirement to repay all of the MUD's existing debt and developer reimbursement obligations, and the inability to supplement utility rate revenues via MUDs continuing property tax revenues, means that the City would require significant utility rate increases and/or subsidies from the City's general funds under any annexation scenarios (likely regardless of the timing).
5. The City should reexamine the analysis when the date allowing annexation of each MUD approaches to evaluate the outstanding debt and developer reimbursement obligations the MUD has at that time. If these obligations have been reduced at that time, it may alter the results of the financial analysis.

City of Missouri City
Scenario 1.1: Riverstone MUDs

Line No.		Actual	Adjustments	Test Year		Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	Year 11 2030	Year 12 2031	Year 13 2032	Year 14 2033	Year 15 2034
1	**Revenues**																			
2	Water Service	$ 577,132	$ -	$ 577,132	B	$ 588,675	$ 605,446	$ 622,761	$ 640,637	$ 659,096	$ 678,157	$ 691,720	$ 705,555	$ 719,666	$ 734,059	$ 748,740	$ 763,715	$ 778,989	$ 794,569	$ 810,461
3	Property Tax	4,437,758	-	4,437,758	C	1,238,379	1,238,379	1,238,379	1,238,379	1,238,379	1,238,379	1,238,379	1,238,379	1,238,379	1,238,379	1,238,379	1,238,379	1,238,379	1,238,379	1,238,379
4	Wastewater Service	1,531,797	-	1,531,797	B	1,562,433	1,608,720	1,656,556	1,705,998	1,757,104	1,809,936	1,846,135	1,883,058	1,920,719	1,959,133	1,998,316	2,038,282	2,079,048	2,120,629	2,163,041
5	Garbage Service	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	Other Revenues	510,755	-	510,755	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Tap Connection and Inspection Fees	113,435	-	113,435	I	74,873	76,371	77,898	79,456	81,045	82,666	-	-	-	-	-	-	-	-	-
8	Contracted Wastewater Fees	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	Groundwater Reduction Fees	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Participant Billings	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	Surface Water Fees	706,060	-	706,060	B	720,181	740,413	761,290	782,836	805,075	828,032	844,593	861,485	878,714	896,289	914,214	932,499	951,149	970,172	989,575
12	Other Tax	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	Water Impact Fee	-	-	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	Wastewater Impact Fee	-	-	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15		$ 7,876,937	$ -	$ 7,876,937		$ 4,184,541	$ 4,269,329	$ 4,356,884	$ 4,447,307	$ 4,540,700	$ 4,637,171	$ 4,620,827	$ 4,688,476	$ 4,757,478	$ 4,827,860	$ 4,899,650	$ 4,972,875	$ 5,047,565	$ 5,123,749	$ 5,201,456
16																				
17	**Operating Expenses**																			
18	Purchased Water Services	$ 1,025,021	$ -	$ 1,025,021	L	$ 1,045,521	$ 1,070,911	$ 1,096,946	$ 1,123,644	$ 1,151,021	$ 1,179,097	$ 1,202,679	$ 1,226,733	$ 1,251,268	$ 1,276,293	$ 1,301,819	$ 1,327,855	$ 1,354,412	$ 1,381,500	$ 1,409,130
19	Contracted Services	1,347,733	-	1,347,733	L	1,374,688	1,409,711	1,445,665	1,482,577	1,520,473	1,559,381	1,590,568	1,622,380	1,654,827	1,687,924	1,721,682	1,756,116	1,791,238	1,827,063	1,863,604
20	Repairs & Maintenance	255,415	-	255,415	L	260,523	267,578	274,830	282,286	289,951	297,831	303,788	309,863	316,061	322,382	328,829	335,406	342,114	348,956	355,936
21	Professional Fees	224,706	-	224,706	A	229,200	233,784	238,460	243,229	248,094	253,055	258,117	263,279	268,544	273,915	279,394	284,982	290,681	296,495	302,425
22	Depreciation & Amortization	1,063,233	-	1,063,233	L K	1,084,498	1,111,651	1,139,516	1,168,111	1,197,456	1,227,571	1,252,123	1,277,165	1,302,708	1,328,763	1,355,338	1,382,445	1,410,094	1,438,295	1,467,061
23	Purchased Sewer Services	304,271	-	304,271	F	293,663	300,898	308,321	315,935	250,130	256,321	261,447	266,676	272,009	175,380	178,888	182,466	186,115	189,837	193,634
24	Other	344,057	-	344,057	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	Solid Waste	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	Utilities	6,178	-	6,178	B	6,302	6,563	6,835	7,118	7,413	7,720	7,874	8,032	8,192	8,356	8,523	8,694	8,867	9,045	9,226
27	Purchased Services	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	Capital Outlay	-	-	-	K	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	Payments to Master ("Connection Charges")	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	Lease	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	Purchase of Capacity	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
32	Renewals & Replacements	-	-	-	K	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
33	Salaries and Benefits	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
34	Surface Water Fee	-	-	-	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
35	Groundwater Reduction Fees	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36		$ 4,570,614	$ -	$ 4,570,614		$ 4,294,394	$ 4,401,096	$ 4,510,572	$ 4,622,899	$ 4,664,537	$ 4,780,976	$ 4,876,595	$ 4,974,127	$ 5,073,610	$ 5,073,013	$ 5,174,473	$ 5,277,962	$ 5,383,522	$ 5,491,192	$ 5,601,016
37																				
38	**Net Income before Debt Service**	$ 3,306,323	$ -	$ 3,306,323		$ (109,853)	$ (131,767)	$ (153,688)	$ (175,592)	$ (123,838)	$ (143,805)	$ (255,768)	$ (285,651)	$ (316,132)	$ (245,152)	$ (274,823)	$ (305,087)	$ (335,956)	$ (367,443)	$ (399,559)
39																				
40																				
41	Capital Improvement Plan - Water																			
42	Cost	$ 1,016,128			G															
43	Principal					$ 15,433	$ 16,215	$ 17,036	$ 17,898	$ 18,804	$ 19,756	$ 20,756	$ 21,807	$ 22,911	$ 24,071	$ 25,289	$ 26,570	$ 27,915	$ 29,328	$ 30,813
44	Interest					51,632	50,851	50,030	49,167	48,261	47,309	46,309	45,258	44,154	42,995	41,776	40,496	39,151	37,737	36,253
45	Total					$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065
46																				
47	Capital Improvement Plan - Wastewater																			
48	Cost	$ 5,074,507			H															
49	Principal					$ 7,707	$ 8,098	$ 8,508	$ 8,938	$ 59,489	$ 62,500	$ 65,664	$ 68,989	$ 72,481	$ 95,419	$ 100,250	$ 105,325	$ 110,657	$ 116,259	$ 122,144
50	Interest					25,785	25,395	24,985	24,554	191,703	188,691	185,527	182,203	178,710	239,503	234,673	229,597	224,265	218,663	212,778
51	Total					$ 33,492	$ 33,492	$ 33,492	$ 33,492	$ 251,192	$ 251,192	$ 251,192	$ 251,192	$ 251,192	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922
52																				
53	**Total Debt Service**					$ 100,558	$ 100,558	$ 100,558	$ 100,558	$ 318,257	$ 318,257	$ 318,257	$ 318,257	$ 318,257	$ 401,988	$ 401,988	$ 401,988	$ 401,988	$ 401,988	$ 401,988
54																				
55	**Net Income after Debt Service**					$ (210,411)	$ (232,324)	$ (254,246)	$ (276,150)	$ (442,095)	$ (462,062)	$ (574,025)	$ (603,908)	$ (634,389)	$ (647,140)	$ (676,810)	$ (707,075)	$ (737,944)	$ (769,431)	$ (801,547)
56																				
57	**Net Present Value (at 5% discount rate)**	($10,396,835)																		
58																				

City of Missouri City
Scenario 1.1: Riverstone MUDs

Schedule 1
Asset Acquisition
Scenario 1.1

Line No.		Actual	Adjustments	Test Year		Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	Year 11 2030	Year 12 2031	Year 13 2032	Year 14 2033	Year 15 2034
59	MUD Revenues																			
60	Other Revenues	$ 510,755	$ -	$ 510,755	L	$ 520,970	$ 536,519	$ 552,592	$ 569,208	$ 586,386	$ 604,148	$ 616,231	$ 628,556	$ 641,127	$ 653,949	$ 667,028	$ 680,369	$ 693,976	$ 707,856	$ 722,013
61	Other Tax	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
62	Revenue Total	$ 510,755	$ -	$ 510,755		$ 520,970	$ 536,519	$ 552,592	$ 569,208	$ 586,386	$ 604,148	$ 616,231	$ 628,556	$ 641,127	$ 653,949	$ 667,028	$ 680,369	$ 693,976	$ 707,856	$ 722,013
63																				
64	MUD Expenses				J															
65	Administrative Expenses	$ 75,690	$ -	$ 75,690	A	$ 77,204	$ 78,748	$ 80,323	$ 81,929	$ 83,568	$ 85,239	$ 86,944	$ 88,683	$ 90,457	$ 92,266	$ 94,111	$ 95,993	$ 97,913	$ 99,871	$ 101,869
66	Other	344,057	-	344,057	A	350,938	357,957	365,116	372,418	379,867	387,464	395,213	403,118	411,180	419,404	427,792	436,347	445,074	453,976	463,055
67	Capital Outlay	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
68	Lease	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
69	Transfers for Debt Service	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
70	Salaries and Benefits	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
68	Expense Total	$ 419,747	$ -	$ 419,747		$ 428,142	$ 436,705	$ 445,439	$ 454,348	$ 463,435	$ 472,703	$ 482,157	$ 491,801	$ 501,637	$ 511,669	$ 521,903	$ 532,341	$ 542,988	$ 553,847	$ 564,924
71																				
72	Debt Service Schedule																			
73	Principal				E	$ 1,795,000	$ 1,845,000	$ 1,895,000	$ 1,960,000	$ 2,025,000	$ 2,090,000	$ 2,170,000	$ 2,250,000	$ 2,330,000	$ 2,420,000	$ 2,515,000	$ 2,605,000	$ 2,705,000	$ 2,800,000	$ 2,905,000
74	Interest				E	1,585,962	1,533,850	1,482,839	1,425,442	1,363,730	1,296,937	1,222,366	1,143,133	1,059,460	971,221	877,892	779,771	676,355	567,781	454,138
75	Total					$ 3,380,962	$ 3,378,850	$ 3,377,839	$ 3,385,442	$ 3,388,730	$ 3,386,937	$ 3,392,366	$ 3,393,133	$ 3,389,460	$ 3,391,221	$ 3,392,892	$ 3,384,771	$ 3,381,355	$ 3,367,781	$ 3,359,138
76																				
77	Expense and Debt Total					$ 3,809,104	$ 3,815,555	$ 3,823,278	$ 3,839,790	$ 3,852,165	$ 3,859,640	$ 3,874,523	$ 3,884,934	$ 3,891,097	$ 3,902,890	$ 3,914,795	$ 3,917,112	$ 3,924,343	$ 3,921,628	$ 3,924,062
78																				
79	Net Income before Property Tax					$ (3,288,134)	$ (3,279,035)	$ (3,270,686)	$ (3,270,582)	$ (3,265,779)	$ (3,255,492)	$ (3,258,292)	$ (3,256,378)	$ (3,249,970)	$ (3,248,941)	$ (3,247,766)	$ (3,236,743)	$ (3,230,366)	$ (3,213,773)	$ (3,202,049)
80																				
81	Property Tax	$ 4,437,758	$ -	$ 4,437,758	A	$ 4,526,513	$ 4,617,043	$ 4,709,384	$ 4,803,572	$ 4,899,643	$ 4,997,636	$ 5,097,589	$ 5,199,541	$ 5,303,532	$ 5,409,602	$ 5,517,794	$ 5,628,150	$ 5,740,713	$ 5,855,527	$ 5,972,638
82																				
83	Net Property Tax Revenue After Debt & Expenses					$ 1,238,379	$ 1,338,008	$ 1,438,699	$ 1,532,990	$ 1,633,865	$ 1,742,144	$ 1,839,297	$ 1,943,163	$ 2,053,562	$ 2,160,661	$ 2,270,028	$ 2,391,407	$ 2,510,347	$ 2,641,755	$ 2,770,589
84																				
85	Net Benefit to the City of Missouri City				C	$ 1,238,379	$ 1,238,379	$ 1,238,379	$ 1,238,379	$ 1,238,379	$ 1,238,379	$ 1,238,379	$ 1,238,379	$ 1,238,379	$ 1,238,379	$ 1,238,379	$ 1,238,379	$ 1,238,379	$ 1,238,379	$ 1,238,379

Notes:

A Annual increases in forecast based on inflation only

B Annual increases in forecast based on inflation and customer growth

C Net property tax revenue for the benefit of the City of Missouri City is based on one of two equivalent concepts:
1) The MUDs will pass along any property tax revenue not needed for debt service, administration, or other services retained by the MUDs in year 1 of the forecast and will continue to pass along this dollar amount each year for the remainder of the forecast; OR
2) The MUDs will decrease property taxes in year 1 of the forecast by an amount equal to the amount identified in 1) and the City of Missouri City will be able to increase rates for these customers by an equal dollar amount.

D The City does not charge its impact fees to the MUDs

E Forecast of existing principal and interest based on debt service schedule for existing debt for each utility

F Wastewater O&M expense reflects payments to the City of Missouri City and is forecasted based on inflation less savings projection from eHT report

G Based on the applicable water capital projects in the 2011 eHT report (Table 4-20) updated to today's dollars; does not include any capital costs for the new transmission lines (which are complete) or the new raw water treatment plant (which is already out for bid)

H Based on Option 5 (without WC&ID #2) in the 2018 eHT report (Table 5-1) allocated to the MUDs based on total buildout connection counts

I Assumes inspection fees are negligible and tap fee revenue will increase with inflation and end at buildout

J Developer reimbursements, if any, would remain the obligation of the MUDs

K Assumes depreciation will fully fund capital needs for renewal and replacements

L Annual increases in forecast based on 50% inflation plus 50% inflation and customer growth combined

M Assumed to say with the MUD

N It is assumed that the expense of paying the City of Missouri City for surface water is contained within one of the expenses listed (e.g., Purchased Water Services) given that it is not separately listed as an expense in the financial statements.

City of Missouri City
Scenario 1.1: Riverstone MUDs

Line No.		Year 16 2035	Year 17 2036	Year 18 2037	Year 19 2038	Year 20 2039	Year 21 2040	Year 22 2041	Year 23 2042	Year 24 2043	Year 25 2044	Year 26 2045	Year 27 2046	Year 28 2047	Year 29 2048	Year 30 2049
1	**Revenues**															
2	Water Service	$ 826,670	$ 843,203	$ 860,067	$ 877,269	$ 894,814	$ 912,710	$ 930,964	$ 949,584	$ 968,575	$ 987,947	$ 1,007,706	$ 1,027,860	$ 1,048,417	$ 1,069,385	$ 1,090,773
3	Property Tax	1,238,379	1,238,379	1,238,379	1,238,379	1,238,379	1,238,379	1,238,379	1,238,379	1,238,379	1,238,379	1,238,379	1,238,379	1,238,379	1,238,379	1,238,379
4	Wastewater Service	2,206,302	2,250,428	2,295,437	2,341,346	2,388,173	2,435,936	2,484,655	2,534,348	2,585,035	2,636,735	2,689,470	2,743,260	2,798,125	2,854,087	2,911,169
5	Garbage Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	Other Revenues	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Tap Connection and Inspection Fees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	Contracted Wastewater Fees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	Groundwater Reduction Fees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Participant Billings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	Surface Water Fees	1,009,367	1,029,554	1,050,145	1,071,148	1,092,571	1,114,422	1,136,711	1,159,445	1,182,634	1,206,287	1,230,412	1,255,020	1,280,121	1,305,723	1,331,838
12	Other Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	Water Impact Fee	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	Wastewater Impact Fee	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15		$ 5,280,718	$ 5,361,565	$ 5,444,028	$ 5,528,141	$ 5,613,937	$ 5,701,448	$ 5,790,709	$ 5,881,756	$ 5,974,623	$ 6,069,348	$ 6,165,967	$ 6,264,519	$ 6,365,042	$ 6,467,575	$ 6,572,159
16																
17	**Operating Expenses**															
18	Purchased Water Services	$ 1,437,313	$ 1,466,059	$ 1,495,381	$ 1,525,288	$ 1,555,794	$ 1,586,910	$ 1,618,648	$ 1,651,021	$ 1,684,041	$ 1,717,722	$ 1,752,077	$ 1,787,118	$ 1,822,861	$ 1,859,318	$ 1,896,504
19	Contracted Services	1,900,876	1,938,894	1,977,672	2,017,225	2,057,570	2,098,721	2,140,695	2,183,509	2,227,179	2,271,723	2,317,158	2,363,501	2,410,771	2,458,986	2,508,166
20	Repairs & Maintenance	363,054	370,315	377,722	385,276	392,982	400,841	408,858	417,035	425,376	433,884	442,561	451,412	460,441	469,649	479,042
21	Professional Fees	308,473	314,643	320,936	327,354	333,901	340,579	347,391	354,339	361,426	368,654	376,027	383,548	391,219	399,043	407,024
22	Depreciation & Amortization	1,496,403	1,526,331	1,556,857	1,587,994	1,619,754	1,652,149	1,685,192	1,718,896	1,753,274	1,788,340	1,824,106	1,860,588	1,897,800	1,935,756	1,974,471
23	Purchased Sewer Services	197,507	201,457	205,486	209,596	213,787	218,063	222,424	226,873	231,410	236,039	240,759	245,575	250,486	255,496	260,606
24	Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	Solid Waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	Utilities	9,410	9,598	9,790	9,986	10,186	10,390	10,597	10,809	11,026	11,246	11,471	11,700	11,934	12,173	12,417
27	Purchased Services	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	Capital Outlay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	Payments to Master ("Connection Charges")	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	Lease	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	Purchase of Capacity	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
32	Renewals & Replacements	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
33	Salaries and Benefits	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
34	Surface Water Fee	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
35	Groundwater Reduction Fees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36		$ 5,713,036	$ 5,827,297	$ 5,943,843	$ 6,062,720	$ 6,183,974	$ 6,307,654	$ 6,433,807	$ 6,562,483	$ 6,693,732	$ 6,827,607	$ 6,964,159	$ 7,103,442	$ 7,245,511	$ 7,390,421	$ 7,538,230
37																
38	**Net Income before Debt Service**	$ (432,318)	$ (465,732)	$ (499,814)	$ (534,578)	$ (570,037)	$ (606,206)	$ (643,097)	$ (680,727)	$ (719,109)	$ (758,259)	$ (798,192)	$ (838,923)	$ (880,469)	$ (922,846)	$ (966,071)
39																
40																
41	Capital Improvement Plan - Water															
42	Cost															
43	Principal	$ 32,373	$ 34,011	$ 35,733	$ 37,542	$ 39,443	$ 41,440	$ 43,538	$ 45,742	$ 48,057	$ 50,490	$ 53,046	$ 55,732	$ 58,553	$ 61,517	$ 64,632
44	Interest	34,693	33,054	31,332	29,523	27,623	25,626	23,528	21,324	19,008	16,575	14,019	11,334	8,512	5,548	2,434
45	Total	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065
46																
47	Capital Improvement Plan - Wastewater															
48	Cost															
49	Principal	$ 128,328	$ 134,825	$ 141,650	$ 148,821	$ 156,355	$ 164,271	$ 172,587	$ 181,324	$ 190,504	$ 200,148	$ 210,280	$ 220,926	$ 232,110	$ 243,861	$ 256,206
50	Interest	206,594	200,098	193,272	186,101	178,567	170,652	162,335	153,598	144,419	134,774	124,642	113,996	102,812	91,061	78,716
51	Total	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922
52																
53	**Total Debt Service**	$ 401,988	$ 401,988	$ 401,988	$ 401,988	$ 401,988	$ 401,988	$ 401,988	$ 401,988	$ 401,988	$ 401,988	$ 401,988	$ 401,988	$ 401,988	$ 401,988	$ 401,988
54																
55	**Net Income after Debt Service**	$ (834,306)	$ (867,720)	$ (901,802)	$ (936,566)	$ (972,025)	$ (1,008,193)	$ (1,045,085)	$ (1,082,715)	$ (1,121,097)	$ (1,160,246)	$ (1,200,179)	$ (1,240,911)	$ (1,282,457)	$ (1,324,834)	$ (1,368,058)
56																
57	**Net Present Value (at 5% discount rate)**															
58																

City of Missouri City
Scenario 1.1: Riverstone MUDs

Schedule 1
Asset Acquisition
Scenario 1.1

Line No.		Year 16 2035	Year 17 2036	Year 18 2037	Year 19 2038	Year 20 2039	Year 21 2040	Year 22 2041	Year 23 2042	Year 24 2043	Year 25 2044	Year 26 2045	Year 27 2046	Year 28 2047	Year 29 2048	Year 30 2049
59	MUD Revenues															
60	Other Revenues	$ 736,453	$ 751,182	$ 766,206	$ 781,530	$ 797,161	$ 813,104	$ 829,366	$ 845,953	$ 862,872	$ 880,130	$ 897,732	$ 915,687	$ 934,001	$ 952,681	$ 971,734
61	Other Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
62	Revenue Total	$ 736,453	$ 751,182	$ 766,206	$ 781,530	$ 797,161	$ 813,104	$ 829,366	$ 845,953	$ 862,872	$ 880,130	$ 897,732	$ 915,687	$ 934,001	$ 952,681	$ 971,734
63																
64	MUD Expenses															
65	Administrative Expenses	$ 103,906	$ 105,984	$ 108,104	$ 110,266	$ 112,471	$ 114,721	$ 117,015	$ 119,356	$ 121,743	$ 124,177	$ 126,661	$ 129,194	$ 131,778	$ 134,414	$ 137,102
66	Other	472,317	481,763	491,398	501,226	511,251	521,476	531,905	542,543	553,394	564,462	575,751	587,266	599,012	610,992	623,212
67	Capital Outlay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
68	Lease	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
69	Transfers for Debt Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
70	Salaries and Benefits	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
68	Expense Total	$ 576,223	$ 587,747	$ 599,502	$ 611,492	$ 623,722	$ 636,196	$ 648,920	$ 661,899	$ 675,137	$ 688,639	$ 702,412	$ 716,460	$ 730,790	$ 745,405	$ 760,314
71																
72	Debt Service Schedule															
73	Principal	$ 2,800,000	$ 1,525,000	$ 1,585,000	$ 1,650,000	$ 1,260,000	$ 530,000	$ 550,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
74	Interest	339,591	253,106	191,263	126,600	68,400	32,600	11,000	-	-	-	-	-	-	-	-
75	Total	$ 3,139,591	$ 1,778,106	$ 1,776,263	$ 1,776,600	$ 1,328,400	$ 562,600	$ 561,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
76																
77	Expense and Debt Total	$ 3,715,814	$ 2,365,853	$ 2,375,765	$ 2,388,092	$ 1,952,122	$ 1,198,796	$ 1,209,920	$ 661,899	$ 675,137	$ 688,639	$ 702,412	$ 716,460	$ 730,790	$ 745,405	$ 760,314
78																
79	Net Income before Property Tax	$ (2,979,361)	$ (1,614,671)	$ (1,609,559)	$ (1,606,562)	$ (1,154,961)	$ (385,693)	$ (380,555)	$ 184,054	$ 187,735	$ 191,490	$ 195,320	$ 199,226	$ 203,211	$ 207,275	$ 211,421
80																
81	Property Tax	$ 6,092,091	$ 6,213,933	$ 6,338,211	$ 6,464,975	$ 6,594,275	$ 6,726,160	$ 6,860,684	$ 6,997,897	$ 7,137,855	$ 7,280,612	$ 7,426,225	$ 7,574,749	$ 7,726,244	$ 7,880,769	$ 8,038,384
82																
83	Net Property Tax Revenue After Debt & Expenses	$ 3,112,730	$ 4,599,262	$ 4,728,652	$ 4,858,413	$ 5,439,313	$ 6,340,468	$ 6,480,129	$ 7,181,952	$ 7,325,591	$ 7,472,103	$ 7,621,545	$ 7,773,975	$ 7,929,455	$ 8,088,044	$ 8,249,805
84																
85	Net Benefit to the City of Missouri City	$ 1,238,379	$ 1,238,379	$ 1,238,379	$ 1,238,379	$ 1,238,379	$ 1,238,379	$ 1,238,379	$ 1,238,379	$ 1,238,379	$ 1,238,379	$ 1,238,379	$ 1,238,379	$ 1,238,379	$ 1,238,379	$ 1,238,379

City of Missouri City
Scenario 1.2: Sienna Plantation MUD #1

Schedule 1
Asset Acquisition
Scenario 1.2

Line No.		Actual	Adjustments	Test Year		Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	Year 11 2030	Year 12 2031	Year 13 2032	Year 14 2033	Year 15 2034
1	**Revenues**																			
2	Water Service	$ 3,552,204	$ -	$ 3,552,204	B	$ 3,623,248	$ 3,771,257	$ 3,929,933	$ 4,100,363	$ 4,283,758	$ 4,481,471	$ 4,639,201	$ 4,805,732	$ 4,981,711	$ 5,167,839	$ 5,364,875	$ 5,475,678	$ 5,588,852	$ 5,704,449	$ 5,822,526
3	Property Tax	19,869,681	-	19,869,681	C	6,027,259	6,027,259	6,027,259	6,027,259	6,027,259	6,027,259	6,027,259	6,027,259	6,027,259	6,027,259	6,027,259	6,027,259	6,027,259	6,027,259	6,027,259
4	Wastewater Service	3,960,423	-	3,960,423	B	4,039,631	4,207,753	4,387,844	4,581,106	4,788,877	5,012,649	5,185,491	5,367,896	5,560,569	5,764,273	5,979,832	6,099,428	6,221,417	6,345,845	6,472,762
5	Garbage Service	-	-	-	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	Other Revenues	5,619,727	-	5,619,727	R Q	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Tap Connection and Inspection Fees	792,530	-	792,530	I	475,573	485,084	494,786	504,682	514,775	525,071	242,277	247,123	252,065	257,107	262,249	-	-	-	-
8	Contracted Wastewater Fees	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	Groundwater Reduction Fees	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Participant Billings	3,114,298	-	3,114,298	B S	3,176,584	3,284,252	3,395,569	3,510,659	3,629,650	3,752,674	3,876,480	4,004,370	4,136,480	4,272,948	4,413,919	4,607,408	4,809,380	5,020,205	5,240,272
11	Surface Water Fees	6,424,894	(2,746,424)	3,678,470	B N	3,752,039	3,879,212	4,010,695	4,146,634	4,287,181	4,432,492	4,578,725	4,729,784	4,885,826	5,047,016	5,213,524	5,442,065	5,680,625	5,929,642	6,189,576
12	Other Tax	1,097,660	-	1,097,660	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	Water Impact Fee	-	-	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	Wastewater Impact Fee	-	-	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15		$ 44,431,417	$ (2,746,424)	$ 41,684,993		$ 21,094,335	$ 21,654,817	$ 22,246,086	$ 22,870,703	$ 23,531,501	$ 24,231,616	$ 24,549,434	$ 25,182,164	$ 25,843,911	$ 26,536,442	$ 27,261,657	$ 27,651,840	$ 28,327,533	$ 29,027,401	$ 29,752,395
16																				
17	**Operating Expenses**																			
18	Purchased Water Services	$ -	$ -	$ -		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
19	Contracted Services	3,363,116	(182,025)	3,181,091	F O	3,226,317	3,311,080	3,398,472	3,488,597	3,479,169	3,572,337	3,657,133	3,744,179	3,833,544	3,801,978	3,892,936	3,980,837	4,070,817	4,162,927	4,257,221
20	Repairs & Maintenance	2,506,414	-	2,506,414	L	2,556,542	2,632,150	2,710,493	2,791,698	2,875,899	2,963,239	3,043,633	3,126,492	3,211,903	3,299,957	3,390,749	3,478,455	3,568,549	3,661,101	3,756,180
21	Professional Fees	1,008,980	-	1,008,980	A	1,029,160	1,049,743	1,070,738	1,092,152	1,113,995	1,136,275	1,159,001	1,182,181	1,205,824	1,229,941	1,254,540	1,279,631	1,305,223	1,331,328	1,357,954
22	Depreciation & Amortization	5,934,083	-	5,934,083	L K	6,052,765	6,194,696	6,340,055	6,488,929	6,641,405	6,797,573	6,942,352	7,090,261	7,241,369	7,395,745	7,553,461	7,722,991	7,896,500	8,074,087	8,255,854
23	Purchased Sewer Services	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	Other	4,133,464	182,025	4,315,489	R O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	Solid Waste	-	-	-	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	Utilities	280,928	-	280,928	B	286,547	296,907	307,708	318,975	330,735	343,020	355,006	367,452	380,378	393,806	407,760	424,837	442,646	461,220	480,592
27	Purchased Services	19,292	-	19,292	L	19,678	20,208	20,753	21,312	21,886	22,476	23,071	23,683	24,310	24,954	25,616	26,433	27,277	28,147	29,046
28	Capital Outlay	3,732,396	(3,732,396)	-	K M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	Payments to SP1 ("Connection Charges")	2,663,468	-	2,663,468	B S	2,716,737	2,797,350	2,881,654	2,969,931	3,062,493	3,159,683	3,237,667	3,318,455	3,402,207	3,489,097	3,579,310	3,650,896	3,723,914	3,798,392	3,874,360
30	Lease	514,560	-	514,560	P	524,851	535,348	546,055	-	-	-	-	-	-	-	-	-	-	-	-
31	Purchase of Capacity	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
32	Renewals & Replacements	317,902	(317,902)	-	K	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
33	Salaries and Benefits	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
34	Surface Water Fee	6,160,705	(2,883,902)	3,276,803	B N	3,342,339	3,455,625	3,572,751	3,693,846	3,819,046	3,948,490	4,078,756	4,213,320	4,352,323	4,495,912	4,644,238	4,847,824	5,060,335	5,282,161	5,513,711
35	Groundwater Reduction Fees	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36		$ 30,635,308	$ (6,934,200)	$ 23,701,108		$ 19,754,935	$ 20,293,107	$ 20,848,678	$ 20,865,440	$ 21,344,630	$ 21,943,092	$ 22,496,619	$ 23,066,021	$ 23,651,858	$ 24,131,390	$ 24,748,609	$ 25,411,903	$ 26,095,262	$ 26,799,365	$ 27,524,919
37																				
38	**Net Income before Debt Service**	$ 13,796,109	$ 4,187,776	$ 17,983,885		$ 1,339,400	$ 1,361,711	$ 1,397,408	$ 2,005,262	$ 2,186,871	$ 2,288,524	$ 2,052,815	$ 2,116,143	$ 2,192,053	$ 2,405,052	$ 2,513,048	$ 2,239,936	$ 2,232,271	$ 2,228,036	$ 2,227,476
39																				
40																				
41	Capital Improvement Plan - Water																			
42	Cost	$ 14,131,901			G															
43	Principal					$ 214,642	$ 225,508	$ 236,924	$ 248,918	$ 261,520	$ 274,759	$ 288,669	$ 303,283	$ 318,637	$ 334,768	$ 351,715	$ 369,521	$ 388,228	$ 407,882	$ 428,531
44	Interest					718,077	707,211	695,794	683,800	671,199	657,959	644,050	629,436	614,082	597,951	581,003	563,198	544,491	524,837	504,188
45	Total					$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719
46																				
47	Capital Improvement Plan - Wastewater																			
48	Cost	$ 15,518,623			H															
49	Principal					$ 23,570	$ 24,764	$ 26,017	$ 27,334	$ 181,926	$ 191,136	$ 200,812	$ 210,978	$ 221,659	$ 291,806	$ 306,579	$ 322,099	$ 338,406	$ 355,537	$ 373,536
50	Interest					78,854	77,661	76,407	75,090	586,257	577,047	567,371	557,205	546,524	732,437	717,665	702,144	685,838	668,706	650,707
51	Total					$ 102,424	$ 102,424	$ 102,424	$ 102,424	$ 768,183	$ 768,183	$ 768,183	$ 768,183	$ 768,183	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243
52																				
53	**Total Debt Service**					$ 1,035,143	$ 1,035,143	$ 1,035,143	$ 1,035,143	$ 1,700,901	$ 1,700,901	$ 1,700,901	$ 1,700,901	$ 1,700,901	$ 1,956,962	$ 1,956,962	$ 1,956,962	$ 1,956,962	$ 1,956,962	$ 1,956,962
54																				
55	**Net Income after Debt Service**					$ 304,257	$ 326,568	$ 362,265	$ 970,119	$ 485,970	$ 587,623	$ 351,914	$ 415,242	$ 491,152	$ 448,090	$ 556,086	$ 282,974	$ 275,309	$ 271,074	$ 270,514
56																				
57	**Net Present Value (at 5% discount rate)**	$6,178,851																		
58																				

City of Missouri City
Scenario 1.2: Sienna Plantation MUD #1

Schedule 1
Asset Acquisition
Scenario 1.2

Line No.		Actual	Adjustments	Test Year		Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	Year 11 2030	Year 12 2031	Year 13 2032	Year 14 2033	Year 15 2034
59	MUD Revenues																			
60	Other Revenues	$ 5,619,727	$ -	$ 5,619,727	L Q	$ 5,732,122	$ 5,912,975	$ 6,100,959	$ 6,296,482	$ 6,499,988	$ 6,711,960	$ 6,904,190	$ 7,102,986	$ 7,308,636	$ 7,521,447	$ 7,741,742	$ 7,987,627	$ 8,242,421	$ 8,506,476	$ 8,780,162
61	Other Tax	1,097,660	-	1,097,660	A	1,119,613	1,142,005	1,164,846	1,188,142	1,211,905	1,236,143	1,260,866	1,286,084	1,311,805	1,338,041	1,364,802	1,392,098	1,419,940	1,448,339	1,477,306
62	Revenue Total	$ 6,717,387	$ -	$ 6,717,387		$ 6,851,735	$ 7,054,980	$ 7,265,804	$ 7,484,624	$ 7,711,893	$ 7,948,103	$ 8,165,056	$ 8,389,069	$ 8,620,442	$ 8,859,489	$ 9,106,545	$ 9,379,725	$ 9,662,361	$ 9,954,815	$ 10,257,468
63																				
64	MUD Expenses				J															
65	Administrative Expenses	$ 437,021	$ -	$ 437,021	A	$ 445,761	$ 454,677	$ 463,770	$ 473,046	$ 482,506	$ 492,157	$ 502,000	$ 512,040	$ 522,281	$ 532,726	$ 543,381	$ 554,248	$ 565,333	$ 576,640	$ 588,173
66	Other	4,133,464	182,025	4,315,489	A O	4,401,799	4,489,835	4,579,631	4,671,224	4,764,649	4,859,942	4,957,140	5,056,283	5,157,409	5,260,557	5,365,768	5,473,084	5,582,545	5,694,196	5,808,080
67	Capital Outlay	3,732,396	(3,732,396)	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
68	Transfers for Debt Service	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
69	Salaries and Benefits	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
70	Expense Total	$ 8,302,881	$ (3,550,371)	$ 4,752,510		$ 4,847,560	$ 4,944,511	$ 5,043,402	$ 5,144,270	$ 5,247,155	$ 5,352,098	$ 5,459,140	$ 5,568,323	$ 5,679,689	$ 5,793,283	$ 5,909,149	$ 6,027,332	$ 6,147,878	$ 6,270,836	$ 6,396,253
71																				
72	Debt Service Schedule																			
73	Principal				E	$ 9,020,000	$ 9,500,000	$ 9,865,000	$ 10,215,000	$ 10,615,000	$ 11,060,000	$ 11,540,000	$ 9,805,000	$ 10,200,000	$ 10,740,000	$ 11,035,000	$ 10,850,000	$ 11,380,000	$ 8,575,000	$ 8,735,000
74	Interest				E	7,223,990	6,956,522	6,687,912	6,398,620	6,077,002	5,745,527	5,396,212	5,034,211	4,721,402	4,381,977	4,024,935	3,601,129	3,163,358	2,701,646	2,380,887
75	Total					$ 16,243,990	$ 16,456,522	$ 16,552,912	$ 16,613,620	$ 16,692,002	$ 16,805,527	$ 16,936,212	$ 14,839,211	$ 14,921,402	$ 15,121,977	$ 15,059,935	$ 14,451,129	$ 14,543,358	$ 11,276,646	$ 11,115,887
76																				
77	Expense and Debt Total					$ 21,091,550	$ 21,401,033	$ 21,596,314	$ 21,757,890	$ 21,939,157	$ 22,157,625	$ 22,395,352	$ 20,407,534	$ 20,601,091	$ 20,915,260	$ 20,969,084	$ 20,478,461	$ 20,691,236	$ 17,547,482	$ 17,512,140
78																				
79	Net Income before Property Tax					$ (14,239,815)	$ (14,346,053)	$ (14,330,509)	$ (14,273,265)	$ (14,227,264)	$ (14,209,522)	$ (14,230,296)	$ (12,018,465)	$ (11,980,650)	$ (12,055,772)	$ (11,862,539)	$ (11,098,736)	$ (11,028,876)	$ (7,592,667)	$ (7,254,672)
80																				
81	Property Tax	$ 19,869,681	$ -	$ 19,869,681	A	$ 20,267,075	$ 20,672,416	$ 21,085,864	$ 21,507,582	$ 21,937,733	$ 22,376,488	$ 22,824,018	$ 23,280,498	$ 23,746,108	$ 24,221,030	$ 24,705,451	$ 25,199,560	$ 25,703,551	$ 26,217,622	$ 26,741,975
82																				
83	Net Property Tax Revenue After Debt & Expenses					$ 6,027,259	$ 6,326,363	$ 6,755,355	$ 7,234,316	$ 7,710,470	$ 8,166,966	$ 8,593,722	$ 11,262,034	$ 11,765,458	$ 12,165,259	$ 12,842,912	$ 14,100,824	$ 14,674,675	$ 18,624,955	$ 19,487,303
84																				
85	Net Benefit to the City of Missouri City				C	$ 6,027,259	$ 6,027,259	$ 6,027,259	$ 6,027,259	$ 6,027,259	$ 6,027,259	$ 6,027,259	$ 6,027,259	$ 6,027,259	$ 6,027,259	$ 6,027,259	$ 6,027,259	$ 6,027,259	$ 6,027,259	$ 6,027,259

Notes:

A Annual increases in forecast based on inflation only

B Annual increases in forecast based on inflation and customer growth

C Net property tax revenue for the benefit of the City of Missouri City is based on one of two equivalent concepts:
1) The MUDs will pass along any property tax revenue not needed for debt service, administration, or other services retained by the MUDs in year 1 of the forecast and will continue to pass along this dollar amount each year for the remainder of the forecast; OR
2) The MUDs will decrease property taxes in year 1 of the forecast by an amount equal to the amount identified in 1) and the City of Missouri City will be able to increase rates for these customers by an equal dollar amount.

D The City does not charge its impact fees to the MUDs

E Forecast of existing principal and interest based on debt service schedule for existing debt for each utility

F Annual increases in forecast based on 50% inflation plus 50% inflation and customer growth combined, except Sienna Plantation #1 costs, which are assumed to increase with inflation and customer growth but also account for the wastewater O&M savings projection from eHT report based on an assumed 60/40 split in Contracted Services between water and sewer, respectively.

G Based on the applicable water capital projects in the 2011 eHT report (Table 4-20) updated to today's dollars; does not include any capital costs for the new transmission lines (which are complete) or the new raw water treatment plant (which is already out for bid)

H Based on Option 5 (without WC&ID #2) in the 2018 eHT report (Table 5-1) allocated to the MUDs based on total buildout connection counts

I Assumes inspection fees are negligible and tap fee revenue will increase with inflation and end at buildout

J Developer reimbursements, if any, would remain the obligation of the MUDs

K Assumes depreciation will fully fund capital needs for renewal and replacements

L Annual increases in forecast based on 50% inflation plus 50% inflation and customer growth combined

M Adjusted to take out one-time capital contribution expenses

N Sienna Plantation 1 collects the surface water fees from each participant MUD and then pays the City of Missouri City; Thus, the adjustments are to keep from double counting these revenues and expenses (once in Sienna Plantation 1 and again in the financials of each participating MUD)

O Move the cost of Law Enforcement Services from Contracted Services to Other to keep this expense with the MUD

P This lease expense is associated with three operating leases for a temporary wastewater treatment plant, all of which are month to month, and are assumed to be ended in FY 2023

Q The adjustment to Other Revenues reflects the removal of the lease payments to Sienna Plantation MUD #1, consistent with the removal of the expense (footnote P)

R Assumed to say with the MUD

S It is important to note that Participant Billings and Payments to SP1 ("Connection Charges") reflect duplications in this summary. For example, the revenue listed as Participant Billings for Sienna Plantation MUD #1 comes from revenue that is captured within Water Service and Wastewater Service for the participant MUDs (i.e., it is counted twice). The same is true for expenses (i.e., the expense of Payments to SP1 made by the participant MUDs is recovering the expenses also listed in other line item expenses for Sienna Plantation MUD #1). Because both the revenues and expense are included, the net amount is appropriate.

City of Missouri City
Scenario 1.2: Sienna Plantation MUD #1

Line No.		Year 16 2035	Year 17 2036	Year 18 2037	Year 19 2038	Year 20 2039	Year 21 2040	Year 22 2041	Year 23 2042	Year 24 2043	Year 25 2044	Year 26 2045	Year 27 2046	Year 28 2047	Year 29 2048	Year 30 2049
1	**Revenues**															
2	Water Service	$ 5,943,138	$ 6,065,883	$ 6,191,243	$ 6,319,277	$ 6,450,045	$ 6,583,610	$ 6,719,300	$ 6,857,856	$ 6,999,343	$ 7,143,823	$ 7,291,364	$ 7,442,033	$ 7,595,899	$ 7,753,034	$ 7,913,509
3	Property Tax	6,027,259	6,027,259	6,027,259	6,027,259	6,027,259	6,027,259	6,027,259	6,027,259	6,027,259	6,027,259	6,027,259	6,027,259	6,027,259	6,027,259	6,027,259
4	Wastewater Service	6,602,217	6,734,262	6,868,947	7,006,326	7,146,452	7,289,382	7,435,169	7,583,873	7,735,550	7,890,261	8,048,066	8,209,028	8,373,208	8,540,672	8,711,486
5	Garbage Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	Other Revenues	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Tap Connection and Inspection Fees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	Contracted Wastewater Fees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	Groundwater Reduction Fees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Participant Billings	5,469,986	5,695,873	5,931,088	6,176,016	6,431,059	6,696,634	6,951,135	7,215,309	7,489,522	7,774,157	8,069,609	8,376,290	8,694,625	9,025,059	9,368,051
11	Surface Water Fees	6,460,904	6,727,711	7,005,537	7,294,835	7,596,080	7,909,766	8,210,371	8,522,401	8,846,290	9,182,488	9,531,463	9,893,700	10,269,704	10,659,998	11,065,124
12	Other Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	Water Impact Fee	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	Wastewater Impact Fee	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15		$ 30,503,505	$ 31,250,988	$ 32,024,073	$ 32,823,713	$ 33,650,896	$ 34,506,650	$ 35,343,235	$ 36,206,699	$ 37,097,964	$ 38,017,988	$ 38,967,761	$ 39,948,309	$ 40,960,695	$ 42,006,022	$ 43,085,429
16																
17	**Operating Expenses**															
18	Purchased Water Services	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
19	Contracted Services	4,353,753	4,451,326	4,551,172	4,653,348	4,757,908	4,864,912	4,972,532	5,082,604	5,195,185	5,310,335	5,428,114	5,548,584	5,671,809	5,797,854	5,926,786
20	Repairs & Maintenance	3,853,859	3,951,730	4,052,195	4,155,327	4,261,199	4,369,885	4,477,727	4,588,319	4,701,733	4,818,043	4,937,325	5,059,657	5,185,121	5,313,797	5,445,771
21	Professional Fees	1,385,113	1,412,816	1,441,072	1,469,893	1,499,291	1,529,277	1,559,863	1,591,060	1,622,881	1,655,339	1,688,445	1,722,214	1,756,659	1,791,792	1,827,628
22	Depreciation & Amortization	8,441,904	8,630,040	8,822,530	9,019,480	9,220,997	9,427,192	9,634,710	9,846,928	10,063,957	10,285,910	10,512,900	10,745,048	10,982,473	11,225,300	11,473,656
23	Purchased Sewer Services	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	Solid Waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	Utilities	500,796	520,690	541,390	562,928	585,340	608,660	631,057	654,291	678,393	703,396	729,333	756,240	784,153	813,111	843,152
27	Purchased Services	29,973	30,892	31,838	32,814	33,820	34,856	35,867	36,907	37,978	39,079	40,213	41,379	42,579	43,814	45,085
28	Capital Outlay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	Payments to SP1 ("Connection Charges")	3,951,847	4,030,884	4,111,502	4,193,732	4,277,607	4,363,159	4,450,422	4,539,430	4,630,219	4,722,823	4,817,280	4,913,625	5,011,898	5,112,136	5,214,379
30	Lease	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	Purchase of Capacity	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
32	Renewals & Replacements	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
33	Salaries and Benefits	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
34	Surface Water Fee	5,755,411	5,993,085	6,240,574	6,498,282	6,766,634	7,046,066	7,313,848	7,591,806	7,880,328	8,179,815	8,490,684	8,813,367	9,148,313	9,495,989	9,856,879
35	Groundwater Reduction Fees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36		$ 28,272,656	$ 29,021,462	$ 29,792,274	$ 30,585,805	$ 31,402,795	$ 32,244,008	$ 33,076,026	$ 33,931,346	$ 34,810,674	$ 35,714,739	$ 36,644,294	$ 37,600,115	$ 38,583,005	$ 39,593,793	$ 40,633,334
37																
38	**Net Income before Debt Service**	$ 2,230,849	$ 2,229,526	$ 2,231,799	$ 2,237,908	$ 2,248,101	$ 2,262,642	$ 2,267,209	$ 2,275,352	$ 2,287,290	$ 2,303,249	$ 2,323,467	$ 2,348,194	$ 2,377,690	$ 2,412,228	$ 2,452,094
39																
40																
41	Capital Improvement Plan - Water															
42	Cost															
43	Principal	$ 450,225	$ 473,018	$ 496,964	$ 522,123	$ 548,556	$ 576,326	$ 605,503	$ 636,156	$ 668,362	$ 702,197	$ 737,746	$ 775,095	$ 814,334	$ 855,559	$ 898,872
44	Interest	482,493	459,701	435,754	410,595	384,163	356,392	327,216	296,562	264,357	230,521	194,972	157,624	118,385	77,159	33,846
45	Total	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719
46																
47	Capital Improvement Plan - Wastewater															
48	Cost															
49	Principal	$ 392,447	$ 412,314	$ 433,188	$ 455,118	$ 478,158	$ 502,365	$ 527,797	$ 554,517	$ 582,589	$ 612,083	$ 643,070	$ 675,625	$ 709,828	$ 745,764	$ 783,518
50	Interest	631,797	611,929	591,056	569,126	546,085	521,879	496,446	469,727	441,654	412,161	381,174	348,619	314,415	278,480	240,726
51	Total	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243
52																
53	**Total Debt Service**	$ 1,956,962	$ 1,956,962	$ 1,956,962	$ 1,956,962	$ 1,956,962	$ 1,956,962	$ 1,956,962	$ 1,956,962	$ 1,956,962	$ 1,956,962	$ 1,956,962	$ 1,956,962	$ 1,956,962	$ 1,956,962	$ 1,956,962
54																
55	**Net Income after Debt Service**	$ 273,887	$ 272,564	$ 274,837	$ 280,946	$ 291,139	$ 305,680	$ 310,247	$ 318,390	$ 330,328	$ 346,287	$ 366,505	$ 391,232	$ 420,728	$ 455,266	$ 495,132
56																
57	**Net Present Value (at 5% discount rate)**															
58																

City of Missouri City
Scenario 1.2: Sienna Plantation MUD #1

Schedule 1
Asset Acquisition
Scenario 1.2

Line No.		Year 16 2035	Year 17 2036	Year 18 2037	Year 19 2038	Year 20 2039	Year 21 2040	Year 22 2041	Year 23 2042	Year 24 2043	Year 25 2044	Year 26 2045	Year 27 2046	Year 28 2047	Year 29 2048	Year 30 2049
59	MUD Revenues															
60	Other Revenues	$ 9,063,861	$ 9,345,946	$ 9,637,835	$ 9,939,898	$ 10,252,515	$ 10,576,085	$ 10,891,947	$ 11,218,091	$ 11,554,875	$ 11,902,666	$ 12,261,848	$ 12,632,818	$ 13,015,985	$ 13,411,775	$ 13,820,630
61	Other Tax	1,506,852	1,536,989	1,567,729	1,599,083	1,631,065	1,663,686	1,696,960	1,730,899	1,765,517	1,800,828	1,836,844	1,873,581	1,911,053	1,949,274	1,988,259
62	Revenue Total	$ 10,570,713	$ 10,882,935	$ 11,205,564	$ 11,538,981	$ 11,883,580	$ 12,239,771	$ 12,588,907	$ 12,948,990	$ 13,320,392	$ 13,703,494	$ 14,098,692	$ 14,506,399	$ 14,927,037	$ 15,361,049	$ 15,808,889
63																
64	MUD Expenses															
65	Administrative Expenses	$ 599,936	$ 611,935	$ 624,174	$ 636,657	$ 649,390	$ 662,378	$ 675,626	$ 689,138	$ 702,921	$ 716,979	$ 731,319	$ 745,945	$ 760,864	$ 776,081	$ 791,603
66	Other	5,924,242	6,042,726	6,163,581	6,286,853	6,412,590	6,540,841	6,671,658	6,805,091	6,941,193	7,080,017	7,221,617	7,366,050	7,513,371	7,663,638	7,816,911
67	Capital Outlay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
68	Transfers for Debt Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
69	Salaries and Benefits	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
70	Expense Total	$ 6,524,178	$ 6,654,661	$ 6,787,755	$ 6,923,510	$ 7,061,980	$ 7,203,219	$ 7,347,284	$ 7,494,230	$ 7,644,114	$ 7,796,996	$ 7,952,936	$ 8,111,995	$ 8,274,235	$ 8,439,720	$ 8,608,514
71																
72	Debt Service Schedule															
73	Principal	$ 9,115,000	$ 9,265,000	$ 9,655,000	$ 8,740,000	$ 9,110,000	$ 5,800,000	$ 2,195,000	$ 1,305,000	$ 1,160,000	$ 1,185,000	$ 830,000	$ 850,000	$ 875,000	$ 645,000	$ 665,000
74	Interest	2,051,980	1,709,344	1,361,925	1,019,480	697,183	363,069	228,270	173,048	138,420	109,869	85,245	64,622	43,361	24,557	8,279
75	Total	$ 11,166,980	$ 10,974,344	$ 11,016,925	$ 9,759,480	$ 9,807,183	$ 6,163,069	$ 2,423,270	$ 1,478,048	$ 1,298,420	$ 1,294,869	$ 915,245	$ 914,622	$ 918,361	$ 669,557	$ 673,279
76																
77	Expense and Debt Total	$ 17,691,158	$ 17,629,005	$ 17,804,680	$ 16,682,990	$ 16,869,163	$ 13,366,288	$ 9,770,554	$ 8,972,278	$ 8,942,534	$ 9,091,865	$ 8,868,181	$ 9,026,617	$ 9,192,596	$ 9,109,277	$ 9,281,793
78																
79	Net Income before Property Tax	$ (7,120,445)	$ (6,746,071)	$ (6,599,115)	$ (5,144,009)	$ (4,985,583)	$ (1,126,517)	$ 2,818,353	$ 3,976,713	$ 4,377,858	$ 4,611,628	$ 5,230,511	$ 5,479,782	$ 5,734,441	$ 6,251,772	$ 6,527,096
80																
81	Property Tax	$ 27,276,814	$ 27,822,350	$ 28,378,797	$ 28,946,373	$ 29,525,301	$ 30,115,807	$ 30,718,123	$ 31,332,485	$ 31,959,135	$ 32,598,318	$ 33,250,284	$ 33,915,290	$ 34,593,596	$ 35,285,468	$ 35,991,177
82																
83	Net Property Tax Revenue After Debt & Expenses	$ 20,156,369	$ 21,076,280	$ 21,779,682	$ 23,802,365	$ 24,539,718	$ 28,989,290	$ 33,536,476	$ 35,309,198	$ 36,336,993	$ 37,209,946	$ 38,480,795	$ 39,395,071	$ 40,328,037	$ 41,537,240	$ 42,518,273
84																
85	Net Benefit to the City of Missouri City	$ 6,027,259	$ 6,027,259	$ 6,027,259	$ 6,027,259	$ 6,027,259	$ 6,027,259	$ 6,027,259	$ 6,027,259	$ 6,027,259	$ 6,027,259	$ 6,027,259	$ 6,027,259	$ 6,027,259	$ 6,027,259	$ 6,027,259

City of Missouri City
Scenario 1.3: Sienna Plantation MUD #5

Schedule 1
Asset Acquisition
Scenario 1.3

Line No.		Actual	Adjustments	Test Year			Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	Year 11 2030	Year 12 2031	Year 13 2032	Year 14 2033	Year 15 2034
1	**Revenues**																				
2	Water Service	$ 353,914	$ -	$ 353,914	B		$ 360,992	$ 428,114	$ 507,715	$ 602,117	$ 714,072	$ 846,844	$ 939,620	$ 1,042,561	$ 1,156,779	$ 1,283,510	$ 1,424,126	$ 1,540,421	$ 1,666,213	$ 1,802,277	$ 1,949,453
3	Property Tax	2,403,182	-	2,403,182	C		163,875	163,875	163,875	163,875	163,875	163,875	163,875	163,875	163,875	163,875	163,875	163,875	163,875	163,875	163,875
4	Wastewater Service	362,137	-	362,137	B		369,380	438,061	519,512	616,107	730,664	866,520	961,452	1,066,784	1,183,656	1,313,332	1,457,215	1,576,212	1,704,927	1,844,152	1,994,747
5	Garbage Service	-	-	-	N		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	Other Revenues	304,050	-	304,050	N		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Tap Connection and Inspection Fees	378,723	-	378,723	I		386,297	394,023	401,904	409,942	418,141	426,504	435,034	443,734	452,609	461,661	470,894	480,312	489,919	499,717	509,711
8	Contracted Wastewater Fees	-	-	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	Groundwater Reduction Fees	-	-	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Participant Billings	1,047,753	-	1,047,753	B P		1,068,708	1,267,419	1,503,077	1,782,553	2,113,993	2,507,059	2,781,721	3,086,474	3,424,614	3,799,799	4,216,088	4,560,377	4,932,780	5,335,595	5,771,303
11	Surface Water Fees	300,699	-	300,699	B		306,713	363,742	431,374	511,582	606,704	719,511	798,338	885,800	982,844	1,090,520	1,209,993	1,308,802	1,415,679	1,531,285	1,656,330
12	Other Tax	-	-	-	N		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	Water Impact Fee	-	-	-	D		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	Wastewater Impact Fee	-	-	-	D		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	Developer Advance	-	-	-	Q		1,267,401	1,351,339	1,435,402	1,183,883	1,192,577	1,252,734	1,292,987	1,329,863	1,362,482	1,286,204	1,300,417	1,313,691	1,322,468	1,326,092	1,323,842
16	Incremental Property Tax for New Debt (captial)	-	-	-	R		162,516	162,516	162,516	162,516	832,360	832,360	832,360	832,360	832,360	1,089,992	1,089,992	1,089,992	1,089,992	1,089,992	1,089,992
17		$ 5,150,458	$ -	$ 5,150,458			$ 4,085,882	$ 4,569,088	$ 5,125,375	$ 5,432,575	$ 6,772,385	$ 7,615,406	$ 8,205,386	$ 8,851,451	$ 9,559,219	$ 10,488,895	$ 11,332,600	$ 12,033,682	$ 12,785,853	$ 13,592,985	$ 14,459,254
18																					
19	**Operating Expenses**																				
20	Purchased Water Services	$ -	$ -	$ -			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
21	Contracted Services	503,312	-	503,312	M		502,333	554,057	611,107	674,031	679,453	749,415	797,960	849,650	904,688	859,663	915,350	961,878	1,010,771	1,062,148	1,116,138
22	Repairs & Maintenance	280,027	-	280,027	L		285,627	315,038	347,476	383,255	422,718	466,245	496,447	528,606	562,847	599,307	638,129	670,566	704,651	740,468	778,107
23	Professional Fees	303,319	-	303,319	A		309,385	315,573	321,885	328,322	334,889	341,586	348,418	355,387	362,494	369,744	377,139	384,682	392,375	400,223	408,227
24	Depreciation & Amortization	907,920	-	907,920	L K		926,078	1,021,435	1,126,610	1,242,614	1,370,563	1,511,687	1,609,611	1,713,878	1,824,899	1,943,112	2,068,982	2,174,149	2,284,662	2,400,792	2,522,825
25	Purchased Sewer Services	-	-	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	Other	296,381	-	296,381	N		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	Solid Waste	-	-	-	N		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	Utilities	28,406	-	28,406	B		28,974	34,361	40,750	48,327	57,313	67,970	75,416	83,678	92,846	103,018	114,304	123,638	133,734	144,655	156,468
29	Purchased Services	5,694	-	5,694	L		5,808	6,406	7,066	7,794	8,596	9,481	10,095	10,749	11,446	12,187	12,977	13,636	14,329	15,058	15,823
30	Capital Outlay	-	-	-	K		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	Payments to Master ("Connection Charges")	1,219,139	-	1,219,139	B P		1,243,522	1,474,737	1,748,943	2,074,133	2,459,789	2,917,151	3,236,741	3,591,343	3,984,795	4,421,351	4,905,734	5,306,339	5,739,659	6,208,364	6,715,343
32	Lease	308,750	-	308,750	F		314,925	321,224	327,648	-	-	-	-	-	-	-	-	-	-	-	-
33	Purchase of Capacity	-	-	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
34	Renewals & Replacements	-	-	-	K		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
35	Salaries and Benefits	2,076	-	2,076	A		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36	Surface Water Fee	300,699	-	300,699	B		306,713	363,742	431,374	511,582	606,704	719,511	798,338	885,800	982,844	1,090,520	1,209,993	1,308,802	1,415,679	1,531,285	1,656,330
37	Groundwater Reduction Fees	-	-	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
38		$ 4,155,724	$ -	$ 4,155,724			$ 3,923,366	$ 4,406,572	$ 4,962,859	$ 5,270,059	$ 5,940,025	$ 6,783,046	$ 7,373,026	$ 8,019,091	$ 8,726,860	$ 9,398,902	$ 10,242,607	$ 10,943,690	$ 11,695,861	$ 12,502,993	$ 13,369,262
39																					
40	**Net Income before Debt Service**	$ 994,734	$ -	$ 994,734			$ 162,516	$ 162,516	$ 162,516	$ 162,516	$ 832,360	$ 832,360	$ 832,360	$ 832,360	$ 832,360	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992
41																					
42																					
43	Capital Improvement Plan - Water																				
44	Cost	$ 900,937			G																
45	Principal						$ 13,684	$ 14,377	$ 15,104	$ 15,869	$ 16,672	$ 17,516	$ 18,403	$ 19,335	$ 20,314	$ 21,342	$ 22,423	$ 23,558	$ 24,750	$ 26,003	$ 27,320
46	Interest						45,779	45,086	44,358	43,594	42,790	41,946	41,059	40,128	39,149	38,121	37,040	35,905	34,712	33,459	32,143
47	Total						$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463
48																					
49	Capital Improvement Plan - Wastewater																				
50	Cost	$ 15,613,867			H																
51	Principal						$ 23,715	$ 24,916	$ 26,177	$ 27,502	$ 183,042	$ 192,309	$ 202,044	$ 212,273	$ 223,019	$ 293,597	$ 308,460	$ 324,076	$ 340,482	$ 357,719	$ 375,829
52	Interest						79,338	78,137	76,876	75,551	589,855	580,589	570,853	560,625	549,878	736,933	722,069	706,454	690,047	672,810	654,701
53	Total						$ 103,053	$ 103,053	$ 103,053	$ 103,053	$ 772,897	$ 772,897	$ 772,897	$ 772,897	$ 772,897	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530
54																					
55	**Total Debt Service**						$ 162,516	$ 162,516	$ 162,516	$ 162,516	$ 832,360	$ 832,360	$ 832,360	$ 832,360	$ 832,360	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992
56																					
57	**Net Income after Debt Service**						$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
58																					
59	**Net Present Value (at 5% discount rate)**	$0																			
60																					

City of Missouri City
Scenario 1.3: Sienna Plantation MUD #5

Line No.		Actual	Adjustments	Test Year		Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	Year 11 2030	Year 12 2031	Year 13 2032	Year 14 2033	Year 15 2034
61	MUD Revenues																			
62	Other Revenues	$ 304,050	$ -	$ 304,050	L	$ 310,131	$ 367,796	$ 436,182	$ 517,284	$ 613,465	$ 727,530	$ 807,235	$ 895,672	$ 993,798	$ 1,102,674	$ 1,223,478	$ 1,323,388	$ 1,431,457	$ 1,548,350	$ 1,674,790
63	Other Tax	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
64	Revenue Total	$ 304,050	$ -	$ 304,050		$ 310,131	$ 367,796	$ 436,182	$ 517,284	$ 613,465	$ 727,530	$ 807,235	$ 895,672	$ 993,798	$ 1,102,674	$ 1,223,478	$ 1,323,388	$ 1,431,457	$ 1,548,350	$ 1,674,790
65																				
66	MUD Expenses				J															
67	Administrative Expenses	$ 75,006	$ -	$ 75,006	A	$ 76,506	$ 78,036	$ 79,597	$ 81,188	$ 82,812	$ 84,468	$ 86,158	$ 87,881	$ 89,639	$ 91,431	$ 93,260	$ 95,125	$ 97,028	$ 98,968	$ 100,948
68	Other	296,381	-	296,381	A	302,309	308,355	314,522	320,813	327,229	333,773	340,449	347,258	354,203	361,287	368,513	375,883	383,401	391,069	398,890
69	Capital Outlay	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
70	Transfers for Debt Service	547,313	(547,313)	-	O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
71	Salaries and Benefits	2,076	-	2,076	A	2,118	2,160	2,203	2,247	2,292	2,338	2,385	2,433	2,481	2,531	2,582	2,633	2,686	2,740	2,794
72	Expense Total	$ 920,776	$ (547,313)	$ 373,463		$ 380,932	$ 388,551	$ 396,322	$ 404,248	$ 412,333	$ 420,580	$ 428,992	$ 437,571	$ 446,323	$ 455,249	$ 464,354	$ 473,641	$ 483,114	$ 492,777	$ 502,632
73																				
74	Debt Service Schedule																			
75	Principal				E	$ 1,015,000	$ 1,045,000	$ 1,090,000	$ 1,130,000	$ 1,180,000	$ 1,220,000	$ 1,270,000	$ 1,320,000	$ 1,370,000	$ 1,425,000	$ 1,480,000	$ 1,540,000	$ 1,595,000	$ 1,655,000	$ 1,720,000
76	Interest				E	1,201,570	1,173,824	1,143,537	1,110,407	1,075,319	1,038,224	1,001,352	965,943	929,057	888,661	845,044	798,037	747,754	694,553	637,911
77	Total					$ 2,216,570	$ 2,218,824	$ 2,233,537	$ 2,240,407	$ 2,255,319	$ 2,258,224	$ 2,271,352	$ 2,285,943	$ 2,299,057	$ 2,313,661	$ 2,325,044	$ 2,338,037	$ 2,342,754	$ 2,349,553	$ 2,357,911
78																				
79	Expense and Debt Total					$ 2,597,502	$ 2,607,375	$ 2,629,859	$ 2,644,655	$ 2,667,652	$ 2,678,804	$ 2,700,344	$ 2,723,514	$ 2,745,380	$ 2,768,910	$ 2,789,398	$ 2,811,678	$ 2,825,868	$ 2,842,330	$ 2,860,543
80																				
81	Net Income before Property Tax					$ (2,287,371)	$ (2,239,579)	$ (2,193,677)	$ (2,127,372)	$ (2,054,187)	$ (1,951,274)	$ (1,893,109)	$ (1,827,842)	$ (1,751,582)	$ (1,666,237)	$ (1,565,921)	$ (1,488,291)	$ (1,394,412)	$ (1,293,979)	$ (1,185,753)
82																				
83	Property Tax	$ 2,403,182	$ -	$ 2,403,182	A	$ 2,451,246	$ 2,500,271	$ 2,550,276	$ 2,601,281	$ 2,653,307	$ 2,706,373	$ 2,760,501	$ 2,815,711	$ 2,872,025	$ 2,929,465	$ 2,988,055	$ 3,047,816	$ 3,108,772	$ 3,170,948	$ 3,234,367
84																				
85	Net Property Tax Revenue After Debt & Expenses					$ 163,875	$ 260,691	$ 356,599	$ 473,910	$ 599,120	$ 755,099	$ 867,392	$ 987,868	$ 1,120,443	$ 1,263,229	$ 1,422,134	$ 1,559,525	$ 1,714,361	$ 1,876,968	$ 2,048,613
86																				
87	Net Benefit to the City of Missouri City				C	$ 163,875	$ 163,875	$ 163,875	$ 163,875	$ 163,875	$ 163,875	$ 163,875	$ 163,875	$ 163,875	$ 163,875	$ 163,875	$ 163,875	$ 163,875	$ 163,875	$ 163,875

Notes:

A Annual increases in forecast based on inflation only

B Annual increases in forecast based on inflation and customer growth

C Net property tax revenue for the benefit of the City of Missouri City is based on one of two equivalent concepts:
1) The MUDs will pass along any property tax revenue not needed for debt service, administration, or other services retained by the MUDs in year 1 of the forecast and will continue to pass along this dollar amount each year for the remainder of the forecast; OR
2) The MUDs will decrease property taxes in year 1 of the forecast by an amount equal to the amount identified in 1) and the City of Missouri City will be able to increase rates for these customers by an equal dollar amount.

D The City does not charge its impact fees to the MUDs

E Forecast of existing principal and interest based on debt service schedule for existing debt for each utility

F This lease expense is associated with an operating lease agreement for a wastewater treatment plant, which is assumed to end by FY 2023

G Based on the applicable water capital projects in the 2011 eHT report (Table 4-20) updated to today's dollars; does not include any capital costs for the new transmission lines (which are complete) or the new raw water treatment plant (which is already out for bid)

H Based on Option 5 (without WC&ID #2) in the 2018 eHT report (Table 5-1) allocated to the MUDs based on total buildout connection counts

I Assumes inspection fees are negligible and tap fee revenue will increase with inflation and end at buildout

J Developer reimbursements, if any, would remain the obligation of the MUDs

K Assumes depreciation will fully fund capital needs for renewal and replacements

L Annual increases in forecast based on 50% inflation plus 50% inflation and customer growth combined

M Annual increases in forecast based on 50% inflation plus 50% inflation and customer growth combined, but also account for the wastewater O&M savings projection from eHT report based on an assumed 60/40 split in Contracted Services between water and sewer, respectively.

N Assumed to say with the MUD

O This reflects a transfer from Sienna Plantation MUD #4 to Sienna Plantation MUD #5 for debt service. However, since the total debt service is already accounted for under Sienna Plantation MUD #5, the portion paid for by Sienna Plantation MUD #4 via this transfer was removed from the analysis to avoid double-counting this expense.

P It is important to note that Participant Billings and Payments to Master ("Connection Charges") reflect duplications in this summary. For example, the revenue listed as Participant Billings for Sienna Plantation MUD #5 comes from revenue that is captured within Water Service and Wastewater Service for the participant MUDs (i.e., it is counted twice). The same is true for expenses (i.e., the expense of Payments to Master made by the participant MUDs is recovering the expenses also listed in other line item expenses for Sienna Plantation MUD #5). Because both the revenues and expense are included, the net amount is appropriate.

Q Sienna Plantation MUD #5 has agreements with Sienna Plantation MUD #4, 6 and 7 for them to pay their allocated share of all expenses and Sienna Plantation MUD #5 has an agreement with the developer (Toll-GTIS Property Owner) to make contributions to fund any operating shortfalls. This developer advance will be repaid in the future from cash or new debt issues. Furthermore, the MUDs in this scenario are only just beginning to be built out and, therefore, their revenues are understated as compared to what they should be in the future. Thus, the developer advances formulaically eliminate any operating shortfall in this scenario.

R In addition to paying all existing debt service, this analysis assumes the MUDs will voluntarily pay the debt service on any new debt issues needed to fund capital improvements for water and wastewater or, alternatively, issue debt to pay the capital costs and repay the debt.

City of Missouri City
Scenario 1.3: Sienna Plantation MUD #5

Line No.		Year 16 2035	Year 17 2036	Year 18 2037	Year 19 2038	Year 20 2039	Year 21 2040	Year 22 2041	Year 23 2042	Year 24 2043	Year 25 2044	Year 26 2045	Year 27 2046	Year 28 2047	Year 29 2048	Year 30 2049
1	**Revenues**															
2	Water Service	$ 2,108,646	$ 2,250,138	$ 2,401,124	$ 2,562,241	$ 2,734,170	$ 2,917,635	$ 3,241,677	$ 3,601,707	$ 4,001,724	$ 4,446,168	$ 4,834,830	$ 4,931,527	$ 5,030,157	$ 5,130,760	$ 5,233,376
3	Property Tax	163,875	163,875	163,875	163,875	163,875	163,875	163,875	163,875	163,875	163,875	163,875	163,875	163,875	163,875	163,875
4	Wastewater Service	2,157,640	2,302,419	2,456,913	2,621,774	2,797,697	2,985,425	3,316,996	3,685,392	4,094,703	4,549,473	4,947,166	5,046,109	5,147,031	5,249,972	5,354,971
5	Garbage Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	Other Revenues	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Tap Connection and Inspection Fees	519,906	530,304	540,910	551,728	562,762	574,018	585,498	597,208	609,152	621,335	633,762	-	-	-	-
8	Contracted Wastewater Fees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	Groundwater Reduction Fees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Participant Billings	6,242,592	6,661,475	7,108,465	7,585,449	8,094,439	8,637,582	9,596,899	10,662,761	11,847,000	13,162,765	14,313,389	14,599,656	14,891,650	15,189,483	15,493,272
11	Surface Water Fees	1,791,588	1,911,805	2,040,088	2,176,980	2,323,057	2,478,936	2,754,254	3,060,150	3,400,020	3,777,637	4,107,859	4,190,016	4,273,817	4,359,293	4,446,479
12	Other Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	Water Impact Fee	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	Wastewater Impact Fee	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	Developer Advance	1,314,920	1,309,321	1,298,666	1,282,410	1,259,962	1,230,682	1,133,491	1,008,513	851,539	657,818	487,503	1,146,968	1,173,185	1,199,926	1,227,202
16	Incremental Property Tax for New Debt (captial)	1,089,992	1,089,992	1,089,992	1,089,992	1,089,992	1,089,992	1,089,992	1,089,992	1,089,992	1,089,992	1,089,992	1,089,992	1,089,992	1,089,992	1,089,992
17		$ 15,389,159	$ 16,219,329	$ 17,100,034	$ 18,034,449	$ 19,025,954	$ 20,078,144	$ 21,882,681	$ 23,869,598	$ 26,058,006	$ 28,469,065	$ 30,578,375	$ 31,168,143	$ 31,769,706	$ 32,383,300	$ 33,009,167
18																
19	**Operating Expenses**															
20	Purchased Water Services	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
21	Contracted Services	1,172,872	1,223,951	1,277,254	1,332,879	1,390,926	1,451,502	1,546,621	1,647,974	1,755,968	1,871,039	1,971,528	2,010,959	2,051,178	2,092,201	2,134,045
22	Repairs & Maintenance	817,658	853,267	890,427	929,206	969,673	1,011,903	1,078,214	1,148,872	1,224,159	1,304,380	1,374,435	1,401,924	1,429,962	1,458,561	1,487,733
23	Professional Fees	416,392	424,720	433,214	441,879	450,716	459,730	468,925	478,304	487,870	497,627	507,580	517,731	528,086	538,647	549,420
24	Depreciation & Amortization	2,651,061	2,766,516	2,886,999	3,012,729	3,143,934	3,280,854	3,495,854	3,724,942	3,969,044	4,229,141	4,456,278	4,545,403	4,636,312	4,729,038	4,823,619
25	Purchased Sewer Services	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	Solid Waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	Utilities	169,245	180,602	192,720	205,652	219,451	234,177	260,185	289,082	321,188	356,860	388,055	395,816	403,733	411,807	420,044
29	Purchased Services	16,627	17,352	18,107	18,896	19,719	20,577	21,926	23,363	24,894	26,525	27,950	28,509	29,079	29,660	30,254
30	Capital Outlay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	Payments to Master ("Connection Charges")	7,263,723	7,751,125	8,271,231	8,826,237	9,418,485	10,050,473	11,166,710	12,406,920	13,784,871	15,315,862	16,654,699	16,987,793	17,327,548	17,674,099	18,027,581
32	Lease	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
33	Purchase of Capacity	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
34	Renewals & Replacements	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
35	Salaries and Benefits	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36	Surface Water Fee	1,791,588	1,911,805	2,040,088	2,176,980	2,323,057	2,478,936	2,754,254	3,060,150	3,400,020	3,777,637	4,107,859	4,190,016	4,273,817	4,359,293	4,446,479
37	Groundwater Reduction Fees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
38		$ 14,299,166	$ 15,129,336	$ 16,010,042	$ 16,944,457	$ 17,935,962	$ 18,988,152	$ 20,792,689	$ 22,779,605	$ 24,968,013	$ 27,379,072	$ 29,488,383	$ 30,078,151	$ 30,679,714	$ 31,293,308	$ 31,919,174
39																
40	**Net Income before Debt Service**	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992
41																
42																
43	Capital Improvement Plan - Water															
44	Cost															
45	Principal	$ 28,703	$ 30,156	$ 31,682	$ 33,286	$ 34,972	$ 36,742	$ 38,602	$ 40,556	$ 42,609	$ 44,766	$ 47,033	$ 49,414	$ 51,915	$ 54,544	$ 57,305
46	Interest	30,760	29,307	27,780	26,176	24,491	22,721	20,861	18,906	16,853	14,696	12,430	10,049	7,547	4,919	2,158
47	Total	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463
48																
49	Capital Improvement Plan - Wastewater															
50	Cost															
51	Principal	$ 394,855	$ 414,845	$ 435,846	$ 457,911	$ 481,093	$ 505,448	$ 531,036	$ 557,920	$ 586,165	$ 615,839	$ 647,016	$ 679,772	$ 714,185	$ 750,341	$ 788,327
52	Interest	635,674	615,685	594,683	572,619	549,437	525,082	499,493	472,610	444,365	414,690	383,513	350,758	316,345	280,189	242,203
53	Total	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530
54																
55	**Total Debt Service**	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992	$ 1,089,992
56																
57	**Net Income after Debt Service**	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
58																
59	**Net Present Value (at 5% discount rate)**															
60																

City of Missouri City
Scenario 1.3: Sienna Plantation MUD #5

Schedule 1
Asset Acquisition
Scenario 1.3

Line No.		Year 16 2035	Year 17 2036	Year 18 2037	Year 19 2038	Year 20 2039	Year 21 2040	Year 22 2041	Year 23 2042	Year 24 2043	Year 25 2044	Year 26 2045	Year 27 2046	Year 28 2047	Year 29 2048	Year 30 2049
61	MUD Revenues															
62	Other Revenues	$ 1,811,554	$ 1,933,111	$ 2,062,824	$ 2,201,242	$ 2,348,947	$ 2,506,563	$ 2,784,950	$ 3,094,255	$ 3,437,912	$ 3,819,738	$ 4,153,640	$ 4,236,713	$ 4,321,447	$ 4,407,876	$ 4,496,034
63	Other Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
64	Revenue Total	$ 1,811,554	$ 1,933,111	$ 2,062,824	$ 2,201,242	$ 2,348,947	$ 2,506,563	$ 2,784,950	$ 3,094,255	$ 3,437,912	$ 3,819,738	$ 4,153,640	$ 4,236,713	$ 4,321,447	$ 4,407,876	$ 4,496,034
65																
66	MUD Expenses															
67	Administrative Expenses	$ 102,967	$ 105,026	$ 107,126	$ 109,269	$ 111,454	$ 113,683	$ 115,957	$ 118,276	$ 120,642	$ 123,055	$ 125,516	$ 128,026	$ 130,587	$ 133,198	$ 135,862
68	Other	406,868	415,005	423,305	431,771	440,407	449,215	458,199	467,363	476,711	486,245	495,970	505,889	516,007	526,327	536,854
69	Capital Outlay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
70	Transfers for Debt Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
71	Salaries and Benefits	2,850	2,907	2,965	3,025	3,085	3,147	3,210	3,274	3,340	3,406	3,474	3,544	3,615	3,687	3,761
72	Expense Total	$ 512,685	$ 522,938	$ 533,397	$ 544,065	$ 554,946	$ 566,045	$ 577,366	$ 588,914	$ 600,692	$ 612,706	$ 624,960	$ 637,459	$ 650,208	$ 663,212	$ 676,477
73																
74	Debt Service Schedule															
75	Principal	$ 1,790,000	$ 1,860,000	$ 1,935,000	$ 2,005,000	$ 2,090,000	$ 2,170,000	$ 2,255,000	$ 2,260,000	$ 1,025,000	$ -	$ -	$ -	$ -	$ -	$ -
76	Interest	578,169	515,018	448,278	378,164	304,659	227,273	145,933	63,092	18,950	-	-	-	-	-	-
77	Total	$ 2,368,169	$ 2,375,018	$ 2,383,278	$ 2,383,164	$ 2,394,659	$ 2,397,273	$ 2,400,933	$ 2,323,092	$ 1,043,950	$ -	$ -	$ -	$ -	$ -	$ -
78																
79	Expense and Debt Total	$ 2,880,854	$ 2,897,956	$ 2,916,675	$ 2,927,229	$ 2,949,605	$ 2,963,318	$ 2,978,299	$ 2,912,006	$ 1,644,642	$ 612,706	$ 624,960	$ 637,459	$ 650,208	$ 663,212	$ 676,477
80																
81	Net Income before Property Tax	$ (1,069,299)	$ (964,845)	$ (853,851)	$ (725,988)	$ (600,659)	$ (456,756)	$ (193,350)	$ 182,249	$ 1,793,271	$ 3,207,032	$ 3,528,680	$ 3,599,254	$ 3,671,239	$ 3,744,664	$ 3,819,557
82																
83	Property Tax	$ 3,299,054	$ 3,365,035	$ 3,432,336	$ 3,500,982	$ 3,571,002	$ 3,642,422	$ 3,715,271	$ 3,789,576	$ 3,865,367	$ 3,942,675	$ 4,021,528	$ 4,101,959	$ 4,183,998	$ 4,267,678	$ 4,353,032
84																
85	Net Property Tax Revenue After Debt & Expenses	$ 2,229,755	$ 2,400,190	$ 2,578,485	$ 2,774,995	$ 2,970,343	$ 3,185,666	$ 3,521,921	$ 3,971,825	$ 5,658,638	$ 7,149,707	$ 7,550,209	$ 7,701,213	$ 7,855,237	$ 8,012,342	$ 8,172,589
86																
87	Net Benefit to the City of Missouri City	$ 163,875	$ 163,875	$ 163,875	$ 163,875	$ 163,875	$ 163,875	$ 163,875	$ 163,875	$ 163,875	$ 163,875	$ 163,875	$ 163,875	$ 163,875	$ 163,875	$ 163,875

City of Missouri City
Scenario 1.1: Riverstone MUDs

Schedule 2
Annexation
Scenario 1.1

Line No.		Actual	Adjustments	Test Year		Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	Year 11 2030	Year 12 2031	Year 13 2032	Year 14 2033	Year 15 2034	Year 16 2035	Year 17 2036	Year 18 2037
1	**Revenues**																						
2	Water Service	$ 577,132	$ -	$ 577,132	B	$ 588,675	$ 605,446	$ 622,761	$ 640,637	$ 659,096	$ 678,157	$ 691,720	$ 705,555	$ 719,666	$ 734,059	$ 748,740	$ 763,715	$ 778,989	$ 794,569	$ 810,461	$ 826,670	$ 843,203	$ 860,067
3	Property Tax	4,437,758	-	4,437,758	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	Wastewater Service	1,531,797	-	1,531,797	B	1,562,433	1,608,720	1,656,556	1,705,998	1,757,104	1,809,936	1,846,135	1,883,058	1,920,719	1,959,133	1,998,316	2,038,282	2,079,048	2,120,629	2,163,041	2,206,302	2,250,428	2,295,437
5	Garbage Service	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	Other Revenues	510,755	-	510,755	B	520,970	536,519	552,592	569,208	586,386	604,148	616,231	628,556	641,127	653,949	667,028	680,369	693,976	707,856	722,013	736,453	751,182	766,206
7	Tap Connection and Inspection Fees	113,435	-	113,435	I	74,873	76,371	77,898	79,456	81,045	82,666	-	-	-	-	-	-	-	-	-	-	-	-
8	Contracted Wastewater Fees	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	Groundwater Reduction Fees	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Participant Billings	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	Surface Water Fees	706,060	-	706,060	B	720,181	740,413	761,290	782,836	805,075	828,032	844,593	861,485	878,714	896,289	914,214	932,499	951,149	970,172	989,575	1,009,367	1,029,554	1,050,145
12	Other Tax	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	Water Impact Fee	-	-	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	Wastewater Impact Fee	-	-	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15		$ 7,876,937	$ -	$ 7,876,937		$ 3,467,132	$ 3,567,469	$ 3,671,097	$ 3,778,135	$ 3,888,706	$ 4,002,940	$ 3,998,679	$ 4,078,653	$ 4,160,226	$ 4,243,430	$ 4,328,299	$ 4,414,865	$ 4,503,162	$ 4,593,225	$ 4,685,090	$ 4,778,792	$ 4,874,367	$ 4,971,855
16																							
17	**Operating Expenses**																						
18	Purchased Water Services	$ 1,025,021	$ -	$ 1,025,021	L	$ 1,045,521	$ 1,070,911	$ 1,096,946	$ 1,123,644	$ 1,151,021	$ 1,179,097	$ 1,202,679	$ 1,226,733	$ 1,251,268	$ 1,276,293	$ 1,301,819	$ 1,327,855	$ 1,354,412	$ 1,381,500	$ 1,409,130	$ 1,437,313	$ 1,466,059	$ 1,495,381
19	Contracted Services	1,347,733	-	1,347,733	L	1,374,688	1,409,711	1,445,665	1,482,577	1,520,473	1,559,381	1,590,568	1,622,380	1,654,827	1,687,924	1,721,682	1,756,116	1,791,238	1,827,063	1,863,604	1,900,876	1,938,894	1,977,672
20	Repairs & Maintenance	255,415	-	255,415	L	260,523	267,578	274,830	282,286	289,951	297,831	303,788	309,863	316,061	322,382	328,829	335,406	342,114	348,956	355,936	363,054	370,315	377,722
21	Professional Fees	224,706	-	224,706	A	229,200	233,784	238,460	243,229	248,094	253,055	258,117	263,279	268,544	273,915	279,394	284,982	290,681	296,495	302,425	308,473	314,643	320,936
22	Depreciation & Amortization	1,063,233	-	1,063,233	L K	1,084,498	1,111,651	1,139,516	1,168,111	1,197,456	1,227,571	1,252,123	1,277,165	1,302,708	1,328,763	1,355,338	1,382,445	1,410,094	1,438,295	1,467,061	1,496,403	1,526,331	1,556,857
23	Purchased Sewer Services	304,271	-	304,271	E	293,663	300,898	308,321	315,935	250,130	256,321	261,447	266,676	272,009	175,380	178,888	182,466	186,115	189,837	193,634	197,507	201,457	205,486
24	Other	344,057	-	344,057	A	350,938	357,957	365,116	372,418	379,867	387,464	395,213	403,118	411,180	419,404	427,792	436,347	445,074	453,976	463,055	472,317	481,763	491,398
25	Solid Waste	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	Utilities	6,178	-	6,178	B	6,302	6,563	6,835	7,118	7,413	7,720	7,874	8,032	8,192	8,356	8,523	8,694	8,867	9,045	9,226	9,410	9,598	9,790
27	Purchased Services	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	Surface Water Fee	-	-	-	J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29		$ 4,570,614	$ -	$ 4,570,614		$ 4,645,333	$ 4,759,053	$ 4,875,688	$ 4,995,317	$ 5,044,404	$ 5,168,440	$ 5,271,809	$ 5,377,245	$ 5,484,790	$ 5,492,416	$ 5,602,264	$ 5,714,310	$ 5,828,596	$ 5,945,168	$ 6,064,071	$ 6,185,353	$ 6,309,060	$ 6,435,241
30																							
31	**Net Income before Debt Service**	$ 3,306,323	$ -	$ 3,306,323		$ (1,178,201)	$ (1,191,584)	$ (1,204,591)	$ (1,217,182)	$ (1,155,698)	$ (1,165,500)	$ (1,273,130)	$ (1,298,592)	$ (1,324,564)	$ (1,248,986)	$ (1,273,966)	$ (1,299,445)	$ (1,325,434)	$ (1,351,943)	$ (1,378,981)	$ (1,406,561)	$ (1,434,692)	$ (1,463,386)

Line No.		Actual	Adjustments	Test Year		Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	Year 11 2030	Year 12 2031	Year 13 2032	Year 14 2033	Year 15 2034	Year 16 2035	Year 17 2036	Year 18 2037
32																							
33																							
34	Capital Improvement Plan - Water																						
35	Cost	$ 1,016,128			F																		
36	Principal					$ 15,433	$ 16,215	$ 17,036	$ 17,898	$ 18,804	$ 19,756	$ 20,756	$ 21,807	$ 22,911	$ 24,071	$ 25,289	$ 26,570	$ 27,915	$ 29,328	$ 30,813	$ 32,373	$ 34,011	$ 35,733
37	Interest					51,632	50,851	50,030	49,167	48,261	47,309	46,309	45,258	44,154	42,995	41,776	40,496	39,151	37,737	36,253	34,693	33,054	31,332
38	Total					$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065
39																							
40	Capital Improvement Plan - Wastewater																						
41	Cost	$ 5,074,507			G																		
42	Principal					$ 7,707	$ 8,098	$ 8,508	$ 8,938	$ 59,489	$ 62,500	$ 65,664	$ 68,989	$ 72,481	$ 95,419	$ 100,250	$ 105,325	$ 110,657	$ 116,259	$ 122,144	$ 128,328	$ 134,825	$ 141,650
43	Interest					25,785	25,395	24,985	24,554	191,703	188,691	185,527	182,203	178,710	239,503	234,673	229,597	224,265	218,663	212,778	206,594	200,098	193,272
44	Total					$ 33,492	$ 33,492	$ 33,492	$ 33,492	$ 251,192	$ 251,192	$ 251,192	$ 251,192	$ 251,192	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922
45																							
46	Defease Existing MUD Debt and Developer Reimbursement Obligations																						
47	Cost	$ 45,034,070			H																		
48	Principal					$ 683,997	$ 718,625	$ 755,005	$ 793,227	$ 833,384	$ 875,574	$ 919,900	$ 966,470	$ 1,015,398	$ 1,066,802	$ 1,120,809	$ 1,177,550	$ 1,237,164	$ 1,299,795	$ 1,365,597	$ 1,434,730	$ 1,507,364	$ 1,583,674
49	Interest					2,288,293	2,253,666	2,217,285	2,179,063	2,138,906	2,096,716	2,052,390	2,005,820	1,956,893	1,905,488	1,851,481	1,794,740	1,735,127	1,672,495	1,606,693	1,537,560	1,464,927	1,388,616
50	Total					$ 2,972,290	$ 2,972,290	$ 2,972,290	$ 2,972,290	$ 2,972,290	$ 2,972,290	$ 2,972,290	$ 2,972,290	$ 2,972,290	$ 2,972,290	$ 2,972,290	$ 2,972,290	$ 2,972,290	$ 2,972,290	$ 2,972,290	$ 2,972,290	$ 2,972,290	$ 2,972,290
51																							
52	Total Debt Service					$ 3,072,848	$ 3,072,848	$ 3,072,848	$ 3,072,848	$ 3,290,547	$ 3,290,547	$ 3,290,547	$ 3,290,547	$ 3,290,547	$ 3,374,278	$ 3,374,278	$ 3,374,278	$ 3,374,278	$ 3,374,278	$ 3,374,278	$ 3,374,278	$ 3,374,278	$ 3,374,278
53																							
54	**Net Income after Debt Service**					$ (4,251,049)	$ (4,264,432)	$ (4,277,439)	$ (4,290,030)	$ (4,446,245)	$ (4,456,048)	$ (4,563,677)	$ (4,589,140)	$ (4,615,112)	$ (4,623,264)	$ (4,648,244)	$ (4,673,723)	$ (4,699,712)	$ (4,726,220)	$ (4,753,259)	$ (4,780,839)	$ (4,808,970)	$ (4,837,664)
55																							
56	**Net Present Value (at 5% discount rate)**	($71,398,108)																					

Notes:

A Annual increases in forecast based on inflation only

B Annual increases in forecast based on inflation and customer growth

C There will no longer be MUD property taxes under this option

D The City does not charge its impact fees to the MUDs

E Wastewater O&M expense reflects payments to the City of Missouri City and is forecasted based on inflation less savings projection from eHT report

F Based on the applicable water capital projects in the 2011 eHT report (Table 4-20) updated to today's dollars; does not include any capital costs for the new transmission lines (which are complete) or the new raw water treatment plant (which is already out for bid)

G Based on Option 5 (without WC&ID #2) in the 2018 eHT report (Table 5-1) allocated to the MUDs based on total buildout connection counts

H Based on total principal outstanding on all existing MUD debt plus all existing developer reimbursement obligations

I Assumes inspection fees are negligible and tap fee revenue will increase with inflation and end at buildout

J It is assumed that the expense of paying the City of Missouri City for surface water is contained within one of the expenses listed (e.g., Purchased Water Services) given that it is not separately listed as an expense in the financial statements.

K Assumes depreciation will fully fund capital needs for renewal and replacements

L Annual increases in forecast based on 50% inflation plus 50% inflation and customer growth combined

City of Missouri City
Scenario 1.1: Riverstone MUDs

Line No.		Year 19 2038	Year 20 2039	Year 21 2040	Year 22 2041	Year 23 2042	Year 24 2043	Year 25 2044	Year 26 2045	Year 27 2046	Year 28 2047	Year 29 2048	Year 30 2049
1	**Revenues**												
2	Water Service	$ 877,269	$ 894,814	$ 912,710	$ 930,964	$ 949,584	$ 968,575	$ 987,947	$ 1,007,706	$ 1,027,860	$ 1,048,417	$ 1,069,385	$ 1,090,773
3	Property Tax	-	-	-	-	-	-	-	-	-	-	-	-
4	Wastewater Service	2,341,346	2,388,173	2,435,936	2,484,655	2,534,348	2,585,035	2,636,735	2,689,470	2,743,260	2,798,125	2,854,087	2,911,169
5	Garbage Service	-	-	-	-	-	-	-	-	-	-	-	-
6	Other Revenues	781,530	797,161	813,104	829,366	845,953	862,872	880,130	897,732	915,687	934,001	952,681	971,734
7	Tap Connection and Inspection Fees	-	-	-	-	-	-	-	-	-	-	-	-
8	Contracted Wastewater Fees	-	-	-	-	-	-	-	-	-	-	-	-
9	Groundwater Reduction Fees	-	-	-	-	-	-	-	-	-	-	-	-
10	Participant Billings	-	-	-	-	-	-	-	-	-	-	-	-
11	Surface Water Fees	1,071,148	1,092,571	1,114,422	1,136,711	1,159,445	1,182,634	1,206,287	1,230,412	1,255,020	1,280,121	1,305,723	1,331,838
12	Other Tax	-	-	-	-	-	-	-	-	-	-	-	-
13	Water Impact Fee	-	-	-	-	-	-	-	-	-	-	-	-
14	Wastewater Impact Fee	-	-	-	-	-	-	-	-	-	-	-	-
15		$ 5,071,292	$ 5,172,718	$ 5,276,172	$ 5,381,696	$ 5,489,329	$ 5,599,116	$ 5,711,098	$ 5,825,320	$ 5,941,827	$ 6,060,663	$ 6,181,877	$ 6,305,514
16													
17	**Operating Expenses**												
18	Purchased Water Services	$ 1,525,288	$ 1,555,794	$ 1,586,910	$ 1,618,648	$ 1,651,021	$ 1,684,041	$ 1,717,722	$ 1,752,077	$ 1,787,118	$ 1,822,861	$ 1,859,318	$ 1,896,504
19	Contracted Services	2,017,225	2,057,570	2,098,721	2,140,695	2,183,509	2,227,179	2,271,723	2,317,158	2,363,501	2,410,771	2,458,986	2,508,166
20	Repairs & Maintenance	385,276	392,982	400,841	408,858	417,035	425,376	433,884	442,561	451,412	460,441	469,649	479,042
21	Professional Fees	327,354	333,901	340,579	347,391	354,339	361,426	368,654	376,027	383,548	391,219	399,043	407,024
22	Depreciation & Amortization	1,587,994	1,619,754	1,652,149	1,685,192	1,718,896	1,753,274	1,788,340	1,824,106	1,860,588	1,897,800	1,935,756	1,974,471
23	Purchased Sewer Services	209,596	213,787	218,063	222,424	226,873	231,410	236,039	240,759	245,575	250,486	255,496	260,606
24	Other	501,226	511,251	521,476	531,905	542,543	553,394	564,462	575,751	587,266	599,012	610,992	623,212
25	Solid Waste	-	-	-	-	-	-	-	-	-	-	-	-
26	Utilities	9,986	10,186	10,390	10,597	10,809	11,026	11,246	11,471	11,700	11,934	12,173	12,417
27	Purchased Services	-	-	-	-	-	-	-	-	-	-	-	-
28	Surface Water Fee	-	-	-	-	-	-	-	-	-	-	-	-
29		$ 6,563,946	$ 6,695,225	$ 6,829,129	$ 6,965,712	$ 7,105,026	$ 7,247,126	$ 7,392,069	$ 7,539,910	$ 7,690,709	$ 7,844,523	$ 8,001,413	$ 8,161,441
30													
31	**Net Income before Debt Service**	$ (1,492,654)	$ (1,522,507)	$ (1,552,957)	$ (1,584,016)	$ (1,615,696)	$ (1,648,010)	$ (1,680,971)	$ (1,714,590)	$ (1,748,882)	$ (1,783,859)	$ (1,819,537)	$ (1,855,927)

City of Missouri City
Scenario 1.1: Riverstone MUDs

Line No.		Year 19 2038	Year 20 2039	Year 21 2040	Year 22 2041	Year 23 2042	Year 24 2043	Year 25 2044	Year 26 2045	Year 27 2046	Year 28 2047	Year 29 2048	Year 30 2049
32													
33													
34	Capital Improvement Plan - Water												
35	Cost												
36	Principal	$ 37,542	$ 39,443	$ 41,440	$ 43,538	$ 45,742	$ 48,057	$ 50,490	$ 53,046	$ 55,732	$ 58,553	$ 61,517	$ 64,632
37	Interest	29,523	27,623	25,626	23,528	21,324	19,008	16,575	14,019	11,334	8,512	5,548	2,434
38	Total	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065	$ 67,065
39													
40	Capital Improvement Plan - Wastewater												
41	Cost												
42	Principal	$ 148,821	$ 156,355	$ 164,271	$ 172,587	$ 181,324	$ 190,504	$ 200,148	$ 210,280	$ 220,926	$ 232,110	$ 243,861	$ 256,206
43	Interest	186,101	178,567	170,652	162,335	153,598	144,419	134,774	124,642	113,996	102,812	91,061	78,716
44	Total	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922	$ 334,922
45													
46	Defease Existing MUD Debt and Develc												
47	Cost												
48	Principal	$ 1,663,847	$ 1,748,080	$ 1,836,576	$ 1,929,553	$ 2,027,237	$ 2,129,865	$ 2,237,690	$ 2,350,973	$ 2,469,991	$ 2,595,034	$ 2,726,408	$ 2,864,432
49	Interest	1,308,443	1,224,211	1,135,714	1,042,737	945,054	842,425	734,601	621,318	502,300	377,256	245,883	107,858
50	Total	$ 2,972,290	$ 2,972,290	$ 2,972,290	$ 2,972,290	$ 2,972,290	$ 2,972,290	$ 2,972,290	$ 2,972,290	$ 2,972,290	$ 2,972,290	$ 2,972,290	$ 2,972,290
51													
52	Total Debt Service	$ 3,374,278	$ 3,374,278	$ 3,374,278	$ 3,374,278	$ 3,374,278	$ 3,374,278	$ 3,374,278	$ 3,374,278	$ 3,374,278	$ 3,374,278	$ 3,374,278	$ 3,374,278
53													
54	**Net Income after Debt Service**	$ (4,866,932)	$ (4,896,785)	$ (4,927,235)	$ (4,958,294)	$ (4,989,974)	$ (5,022,288)	$ (5,055,249)	$ (5,088,868)	$ (5,123,160)	$ (5,158,137)	$ (5,193,815)	$ (5,230,205)

City of Missouri City
Scenario 1.2: Sienna Plantation MUD #1

Schedule 2
Annexation
Scenario 1.2

Line No.		Actual	Adjustments	Test Year		Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	Year 11 2030	Year 12 2031	Year 13 2032	Year 14 2033	Year 15 2034	Year 16 2035	Year 17 2036	Year 18 2037
1	**Revenues**																						
2	Water Service	$ 3,552,204	$ -	$ 3,552,204	B	$ 3,623,248	$ 3,771,257	$ 3,929,933	$ 4,100,363	$ 4,283,758	$ 4,481,471	$ 4,639,201	$ 4,805,732	$ 4,981,711	$ 5,167,839	$ 5,364,875	$ 5,475,678	$ 5,588,852	$ 5,704,449	$ 5,822,526	$ 5,943,138	$ 6,065,883	$ 6,191,243
3	Property Tax	19,869,681	-	19,869,681	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	Wastewater Service	3,960,423	-	3,960,423	B	4,039,631	4,207,753	4,387,844	4,581,106	4,788,877	5,012,649	5,185,491	5,367,896	5,560,569	5,764,273	5,979,832	6,099,428	6,221,417	6,345,845	6,472,762	6,602,217	6,734,262	6,868,947
5	Garbage Service	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	Other Revenues	5,619,727	-	5,619,727	B J	5,732,122	5,912,975	6,100,959	6,296,482	6,499,988	6,711,960	6,904,190	7,102,986	7,308,636	7,521,447	7,741,742	7,987,627	8,242,421	8,506,476	8,780,162	9,063,861	9,345,946	9,637,835
7	Tap Connection and Inspection Fees	792,530	-	792,530	I	475,573	485,084	494,786	504,682	514,775	525,071	242,277	247,123	252,065	257,107	262,249	-	-	-	-	-	-	-
8	Contracted Wastewater Fees	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	Groundwater Reduction Fees	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Participant Billings	3,114,298	-	3,114,298	B Q	3,176,584	3,284,252	3,395,569	3,510,659	3,629,650	3,752,674	3,876,480	4,004,370	4,136,480	4,272,948	4,413,919	4,607,408	4,809,380	5,020,205	5,240,272	5,469,986	5,695,873	5,931,088
11	Surface Water Fees	6,424,894	(2,746,424)	3,678,470	B N	3,752,039	3,879,212	4,010,695	4,146,634	4,287,181	4,432,492	4,578,725	4,729,784	4,885,826	5,047,016	5,213,524	5,442,065	5,680,625	5,929,642	6,189,576	6,460,904	6,727,711	7,005,537
12	Other Tax	1,097,660	-	1,097,660	A	1,119,613	1,142,005	1,164,846	1,188,142	1,211,905	1,236,143	1,260,866	1,286,084	1,311,805	1,338,041	1,364,802	1,392,098	1,419,940	1,448,339	1,477,306	1,506,852	1,536,989	1,567,729
13	Water Impact Fee	-	-	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	Wastewater Impact Fee	-	-	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15		$ 44,431,417	$ (2,746,424)	$ 41,684,993		$ 21,918,811	$ 22,682,539	$ 23,484,631	$ 24,328,068	$ 25,216,135	$ 26,152,461	$ 26,687,231	$ 27,543,974	$ 28,437,093	$ 29,368,672	$ 30,340,943	$ 31,004,306	$ 31,962,634	$ 32,954,957	$ 33,982,603	$ 35,046,958	$ 36,106,663	$ 37,202,378
16																							
17	**Operating Expenses**																						
18	Purchased Water Services	$ -	$ -	$ -		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
19	Contracted Services	3,363,116	(182,025)	3,181,091	E O	3,226,317	3,311,080	3,398,472	3,488,597	3,479,169	3,572,337	3,657,133	3,744,179	3,833,544	3,801,978	3,892,936	3,980,837	4,070,817	4,162,927	4,257,221	4,353,753	4,451,326	4,551,172
20	Repairs & Maintenance	2,506,414	-	2,506,414	L	2,556,542	2,632,150	2,710,493	2,791,698	2,875,899	2,963,239	3,043,633	3,126,492	3,211,903	3,299,957	3,390,749	3,478,455	3,568,549	3,661,101	3,756,180	3,853,859	3,951,730	4,052,195
21	Professional Fees	1,008,980	-	1,008,980	A	1,029,160	1,049,743	1,070,738	1,092,152	1,113,995	1,136,275	1,159,001	1,182,181	1,205,824	1,229,941	1,254,540	1,279,631	1,305,223	1,331,328	1,357,954	1,385,113	1,412,816	1,441,072
22	Depreciation & Amortization	5,934,083	-	5,934,083	L K	6,052,765	6,194,696	6,340,055	6,488,929	6,641,405	6,797,573	6,942,352	7,090,261	7,241,369	7,395,745	7,553,461	7,722,991	7,896,500	8,074,087	8,255,854	8,441,904	8,630,040	8,822,530
23	Purchased Sewer Services	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	Other	4,133,464	182,025	4,315,489	A O	4,401,799	4,489,835	4,579,631	4,671,224	4,764,649	4,859,942	4,957,140	5,056,283	5,157,409	5,260,557	5,365,768	5,473,084	5,582,545	5,694,196	5,808,080	5,924,242	6,042,726	6,163,581
25	Solid Waste	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	Utilities	280,928	-	280,928	B	286,547	296,907	307,708	318,975	330,735	343,020	355,006	367,452	380,378	393,806	407,760	424,837	442,646	461,220	480,592	500,796	520,690	541,390
27	Purchased Services	19,292	-	19,292	L	19,678	20,208	20,753	21,312	21,886	22,476	23,071	23,683	24,310	24,954	25,616	26,433	27,277	28,147	29,046	29,973	30,892	31,838
28	Capital Outlay	3,732,396	(3,732,396)	-	K M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	Payments to SP1 ("Connection Charges")	2,663,468	-	2,663,468	B Q	2,716,737	2,797,350	2,881,654	2,969,931	3,062,493	3,159,683	3,237,667	3,318,455	3,402,207	3,489,097	3,579,310	3,650,896	3,723,914	3,798,392	3,874,360	3,951,847	4,030,884	4,111,502
30	Lease	514,560	-	514,560	P	524,851	535,348	546,055	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	Purchase of Capacity	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
32	Renewals & Replacements	317,902	(317,902)	-	K	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
33	Salaries and Benefits	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
34	Surface Water Fee	6,160,705	(2,883,902)	3,276,803	B N	3,342,339	3,455,625	3,572,751	3,693,846	3,819,046	3,948,490	4,078,756	4,213,320	4,352,323	4,495,912	4,644,238	4,847,824	5,060,335	5,282,161	5,513,711	5,755,411	5,993,085	6,240,574
35		$ 30,635,308	$ (6,934,200)	$ 23,701,108		$ 24,156,734	$ 24,782,941	$ 25,428,309	$ 25,536,664	$ 26,109,278	$ 26,803,034	$ 27,453,760	$ 28,122,305	$ 28,809,267	$ 29,391,947	$ 30,114,377	$ 30,884,987	$ 31,677,807	$ 32,493,561	$ 33,332,999	$ 34,196,898	$ 35,064,189	$ 35,955,855
36																							
37	**Net Income before Debt Service**	$ 13,796,109	$ 4,187,776	$ 17,983,885		$ (2,237,924)	$ (2,100,403)	$ (1,943,678)	$ (1,208,597)	$ (893,143)	$ (650,573)	$ (766,528)	$ (578,330)	$ (372,174)	$ (23,275)	$ 226,565	$ 119,319	$ 284,828	$ 461,396	$ 649,604	$ 850,061	$ 1,042,475	$ 1,246,524

City of Missouri City
Scenario 1.2: Sienna Plantation MUD #1

Schedule 2
Annexation
Scenario 1.2

Line No.		Actual	Adjustments	Test Year		Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	Year 11 2030	Year 12 2031	Year 13 2032	Year 14 2033	Year 15 2034	Year 16 2035	Year 17 2036	Year 18 2037
38																							
39																							
40	Capital Improvement Plan - Water																						
41	Cost	$ 14,131,901			F																		
42	Principal					$ 214,642	$ 225,508	$ 236,924	$ 248,918	$ 261,520	$ 274,759	$ 288,669	$ 303,283	$ 318,637	$ 334,768	$ 351,715	$ 369,521	$ 388,228	$ 407,882	$ 428,531	$ 450,225	$ 473,018	$ 496,964
43	Interest					718,077	707,211	695,794	683,800	671,199	657,959	644,050	629,436	614,082	597,951	581,003	563,198	544,491	524,837	504,188	482,493	459,701	435,754
44	Total					$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719
45																							
46	Capital Improvement Plan - Wastewater																						
47	Cost	$ 15,518,623			G																		
48	Principal					$ 23,570	$ 24,764	$ 26,017	$ 27,334	$ 181,926	$ 191,136	$ 200,812	$ 210,978	$ 221,659	$ 291,806	$ 306,579	$ 322,099	$ 338,406	$ 355,537	$ 373,536	$ 392,447	$ 412,314	$ 433,188
49	Interest					78,854	77,661	76,407	75,090	586,257	577,047	567,371	557,205	546,524	732,437	717,665	702,144	685,838	668,706	650,707	631,797	611,929	591,056
50	Total					$ 102,424	$ 102,424	$ 102,424	$ 102,424	$ 768,183	$ 768,183	$ 768,183	$ 768,183	$ 768,183	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243
51																							
52	Defease Existing MUD Debt and Developer Reimbursement Obligations																						
53	Cost	$ 243,236,111			H																		
54	Principal					$ 3,694,377	$ 3,881,405	$ 4,077,901	$ 4,284,345	$ 4,501,240	$ 4,729,115	$ 4,968,526	$ 5,220,058	$ 5,484,323	$ 5,761,967	$ 6,053,667	$ 6,360,134	$ 6,682,115	$ 7,020,397	$ 7,375,805	$ 7,749,205	$ 8,141,509	$ 8,553,673
55	Interest					12,359,432	12,172,404	11,975,908	11,769,464	11,552,569	11,324,694	11,085,283	10,833,751	10,569,486	10,291,842	10,000,142	9,693,675	9,371,694	9,033,412	8,678,004	8,304,604	7,912,300	7,500,136
56	Total					$ 16,053,809	$ 16,053,809	$ 16,053,809	$ 16,053,809	$ 16,053,809	$ 16,053,809	$ 16,053,809	$ 16,053,809	$ 16,053,809	$ 16,053,809	$ 16,053,809	$ 16,053,809	$ 16,053,809	$ 16,053,809	$ 16,053,809	$ 16,053,809	$ 16,053,809	$ 16,053,809
57																							
58	Total Debt Service					$ 17,088,952	$ 17,088,952	$ 17,088,952	$ 17,088,952	$ 17,754,710	$ 17,754,710	$ 17,754,710	$ 17,754,710	$ 17,754,710	$ 18,010,771	$ 18,010,771	$ 18,010,771	$ 18,010,771	$ 18,010,771	$ 18,010,771	$ 18,010,771	$ 18,010,771	$ 18,010,771
59																							
60	**Net Income after Debt Service**					$ (19,326,876)	$ (19,189,355)	$ (19,032,630)	$ (18,297,549)	$ (18,647,853)	$ (18,405,284)	$ (18,521,238)	$ (18,333,040)	$ (18,126,884)	$ (18,034,046)	$ (17,784,206)	$ (17,891,452)	$ (17,725,943)	$ (17,549,375)	$ (17,361,167)	$ (17,160,710)	$ (16,968,296)	$ (16,764,247)
61																							
62	**Net Present Value (at 5% discount rate)**	($269,621,643)																					

Notes:

A Annual increases in forecast based on inflation only

B Annual increases in forecast based on inflation and customer growth

C There will no longer be MUD property taxes under this option

D The City does not charge its impact fees to the MUDs

E Annual increases in forecast based on 50% inflation plus 50% inflation and customer growth combined, except Sienna Plantation #1 costs, which are assumed to increase with inflation and customer growth but also account for the wastewater O&M savings projection from eHT report based on an assumed 60/40 split in Contracted Services between water and sewer, respectively.

F Based on the applicable water capital projects in the 2011 eHT report (Table 4-20) updated to today's dollars; does not include any capital costs for the new transmission lines (which are complete) or the new raw water treatment plant (which is already out for bid)

G Based on Option 5 (without WC&ID #2) in the 2018 eHT report (Table 5-1) allocated to the MUDs based on total buildout connection counts

H Based on total principal outstanding on all existing MUD debt plus all existing developer reimbursement obligations

I Assumes inspection fees are negligible and tap fee revenue will increase with inflation and end at buildout

J The adjustment to Other Revenues reflects the removal of the lease payments to Sienna Plantation MUD #1, consistent with the removal of the expense (footnote P)

K Assumes depreciation will fully fund capital needs for renewal and replacements

L Annual increases in forecast based on 50% inflation plus 50% inflation and customer growth combined

M Adjusted to take out one-time capital contribution expenses

N Sienna Plantation 1 collects the surface water fees from each participant MUD and then pays the City of Missouri City; Thus, the adjustments are to keep from double counting these revenues and expenses (once in Sienna Plantation 1 and again in the financials of each participating MUD)

O Move the cost of Law Enforcement Services from Contracted Services to Other to keep this expense with the MUD

P This lease expense is associated with three operating leases for a temporary wastewater treatment plant, all of which are month to month, and are assumed to be ended in FY 2023

Q It is important to note that Participant Billings and Payments to SP1 ("Connection Charges") reflect duplications in this summary. For example, the revenue listed as Participant Billings for Sienna Plantation MUD #1 comes from revenue that is captured within Water Service and Wastewater Service for the participant MUDs (i.e., it is counted twice). The same is true for expenses (i.e., the expense of Payments to SP1 made by the participant MUDs is recovering the expenses also listed in other line item expenses for Sienna Plantation MUD #1). Because both the revenues and expense are included, the net amount is appropriate.

City of Missouri City
Scenario 1.2: Sienna Plantation MUD #1

Line No.		Year 19 2038	Year 20 2039	Year 21 2040	Year 22 2041	Year 23 2042	Year 24 2043	Year 25 2044	Year 26 2045	Year 27 2046	Year 28 2047	Year 29 2048	Year 30 2049
1	**Revenues**												
2	Water Service	$ 6,319,277	$ 6,450,045	$ 6,583,610	$ 6,719,300	$ 6,857,856	$ 6,999,343	$ 7,143,823	$ 7,291,364	$ 7,442,033	$ 7,595,899	$ 7,753,034	$ 7,913,509
3	Property Tax	-	-	-	-	-	-	-	-	-	-	-	-
4	Wastewater Service	7,006,326	7,146,452	7,289,382	7,435,169	7,583,873	7,735,550	7,890,261	8,048,066	8,209,028	8,373,208	8,540,672	8,711,486
5	Garbage Service	-	-	-	-	-	-	-	-	-	-	-	-
6	Other Revenues	9,939,898	10,252,515	10,576,085	10,891,947	11,218,091	11,554,875	11,902,666	12,261,848	12,632,818	13,015,985	13,411,775	13,820,630
7	Tap Connection and Inspection Fees	-	-	-	-	-	-	-	-	-	-	-	-
8	Contracted Wastewater Fees	-	-	-	-	-	-	-	-	-	-	-	-
9	Groundwater Reduction Fees	-	-	-	-	-	-	-	-	-	-	-	-
10	Participant Billings	6,176,016	6,431,059	6,696,634	6,951,135	7,215,309	7,489,522	7,774,157	8,069,609	8,376,290	8,694,625	9,025,059	9,368,051
11	Surface Water Fees	7,294,835	7,596,080	7,909,766	8,210,371	8,522,401	8,846,290	9,182,488	9,531,463	9,893,700	10,269,704	10,659,998	11,065,124
12	Other Tax	1,599,083	1,631,065	1,663,686	1,696,960	1,730,899	1,765,517	1,800,828	1,836,844	1,873,581	1,911,053	1,949,274	1,988,259
13	Water Impact Fee	-	-	-	-	-	-	-	-	-	-	-	-
14	Wastewater Impact Fee	-	-	-	-	-	-	-	-	-	-	-	-
15		$ 38,335,435	$ 39,507,217	$ 40,719,162	$ 41,904,883	$ 43,128,430	$ 44,391,097	$ 45,694,223	$ 47,039,194	$ 48,427,448	$ 49,860,473	$ 51,339,811	$ 52,867,059
16													
17	**Operating Expenses**												
18	Purchased Water Services	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
19	Contracted Services	4,653,348	4,757,908	4,864,912	4,972,532	5,082,604	5,195,185	5,310,335	5,428,114	5,548,584	5,671,809	5,797,854	5,926,786
20	Repairs & Maintenance	4,155,327	4,261,199	4,369,885	4,477,727	4,588,319	4,701,733	4,818,043	4,937,325	5,059,657	5,185,121	5,313,797	5,445,771
21	Professional Fees	1,469,893	1,499,291	1,529,277	1,559,863	1,591,060	1,622,881	1,655,339	1,688,445	1,722,214	1,756,659	1,791,792	1,827,628
22	Depreciation & Amortization	9,019,480	9,220,997	9,427,192	9,634,710	9,846,928	10,063,957	10,285,910	10,512,900	10,745,048	10,982,473	11,225,300	11,473,656
23	Purchased Sewer Services	-	-	-	-	-	-	-	-	-	-	-	-
24	Other	6,286,853	6,412,590	6,540,841	6,671,658	6,805,091	6,941,193	7,080,017	7,221,617	7,366,050	7,513,371	7,663,638	7,816,911
25	Solid Waste	-	-	-	-	-	-	-	-	-	-	-	-
26	Utilities	562,928	585,340	608,660	631,057	654,291	678,393	703,396	729,333	756,240	784,153	813,111	843,152
27	Purchased Services	32,814	33,820	34,856	35,867	36,907	37,978	39,079	40,213	41,379	42,579	43,814	45,085
28	Capital Outlay	-	-	-	-	-	-	-	-	-	-	-	-
29	Payments to SP1 ("Connection Charges")	4,193,732	4,277,607	4,363,159	4,450,422	4,539,430	4,630,219	4,722,823	4,817,280	4,913,625	5,011,898	5,112,136	5,214,379
30	Lease	-	-	-	-	-	-	-	-	-	-	-	-
31	Purchase of Capacity	-	-	-	-	-	-	-	-	-	-	-	-
32	Renewals & Replacements	-	-	-	-	-	-	-	-	-	-	-	-
33	Salaries and Benefits	-	-	-	-	-	-	-	-	-	-	-	-
34	Surface Water Fee	6,498,282	6,766,634	7,046,066	7,313,848	7,591,806	7,880,328	8,179,815	8,490,684	8,813,367	9,148,313	9,495,989	9,856,879
35		$ 36,872,658	$ 37,815,385	$ 38,784,849	$ 39,747,684	$ 40,736,438	$ 41,751,867	$ 42,794,756	$ 43,865,911	$ 44,966,165	$ 46,096,376	$ 47,257,431	$ 48,450,245
36													
37	**Net Income before Debt Service**	$ 1,462,777	$ 1,691,832	$ 1,934,313	$ 2,157,198	$ 2,391,992	$ 2,639,229	$ 2,899,466	$ 3,173,283	$ 3,461,284	$ 3,764,097	$ 4,082,380	$ 4,416,813

City of Missouri City
Scenario 1.2: Sienna Plantation MUD #1

Line No.		Year 19 2038	Year 20 2039	Year 21 2040	Year 22 2041	Year 23 2042	Year 24 2043	Year 25 2044	Year 26 2045	Year 27 2046	Year 28 2047	Year 29 2048	Year 30 2049
38													
39													
40	Capital Improvement Plan - Water												
41	Cost												
42	Principal	$ 522,123	$ 548,556	$ 576,326	$ 605,503	$ 636,156	$ 668,362	$ 702,197	$ 737,746	$ 775,095	$ 814,334	$ 855,559	$ 898,872
43	Interest	410,595	384,163	356,392	327,216	296,562	264,357	230,521	194,972	157,624	118,385	77,159	33,846
44	Total	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719	$ 932,719
45													
46	Capital Improvement Plan - Wastewater												
47	Cost												
48	Principal	$ 455,118	$ 478,158	$ 502,365	$ 527,797	$ 554,517	$ 582,589	$ 612,083	$ 643,070	$ 675,625	$ 709,828	$ 745,764	$ 783,518
49	Interest	569,126	546,085	521,879	496,446	469,727	441,654	412,161	381,174	348,619	314,415	278,480	240,726
50	Total	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243	$ 1,024,243
51													
52	Defease Existing MUD Debt and Develc												
53	Cost												
54	Principal	$ 8,986,702	$ 9,441,654	$ 9,919,638	$ 10,421,819	$ 10,949,424	$ 11,503,739	$ 12,086,115	$ 12,697,975	$ 13,340,810	$ 14,016,189	$ 14,725,758	$ 15,471,250
55	Interest	7,067,107	6,612,155	6,134,171	5,631,990	5,104,385	4,550,070	3,967,694	3,355,834	2,712,999	2,037,620	1,328,051	582,559
56	Total	$ 16,053,809	$ 16,053,809	$ 16,053,809	$ 16,053,809	$ 16,053,809	$ 16,053,809	$ 16,053,809	$ 16,053,809	$ 16,053,809	$ 16,053,809	$ 16,053,809	$ 16,053,809
57													
58	Total Debt Service	$ 18,010,771	$ 18,010,771	$ 18,010,771	$ 18,010,771	$ 18,010,771	$ 18,010,771	$ 18,010,771	$ 18,010,771	$ 18,010,771	$ 18,010,771	$ 18,010,771	$ 18,010,771
59													
60	**Net Income after Debt Service**	$ (16,547,994)	$ (16,318,939)	$ (16,076,458)	$ (15,853,573)	$ (15,618,779)	$ (15,371,542)	$ (15,111,305)	$ (14,837,488)	$ (14,549,487)	$ (14,246,674)	$ (13,928,391)	$ (13,593,958)

City of Missouri City
Scenario 1.3: Sienna Plantation MUD #5

Schedule 2
Annexation
Scenario 1.3

Line No.		Actual	Adjustments	Test Year		Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	Year 11 2030	Year 12 2031	Year 13 2032	Year 14 2033	Year 15 2034	Year 16 2035	Year 17 2036	Year 18 2037
1	**Revenues**																						
2	Water Service	$ 353,914	$ -	$ 353,914	B	$ 360,992	$ 428,114	$ 507,715	$ 602,117	$ 714,072	$ 846,844	$ 939,620	$ 1,042,561	$ 1,156,779	$ 1,283,510	$ 1,424,126	$ 1,540,421	$ 1,666,213	$ 1,802,277	$ 1,949,453	$ 2,108,646	$ 2,250,138	$ 2,401,124
3	Property Tax	2,403,182	-	2,403,182	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	Wastewater Service	362,137	-	362,137	B	369,380	438,061	519,512	616,107	730,664	866,520	961,452	1,066,784	1,183,656	1,313,332	1,457,215	1,576,212	1,704,927	1,844,152	1,994,747	2,157,640	2,302,419	2,456,913
5	Garbage Service	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	Other Revenues	304,050	-	304,050	B	310,131	367,796	436,182	517,284	613,465	727,530	807,235	895,672	993,798	1,102,674	1,223,478	1,323,388	1,431,457	1,548,350	1,674,790	1,811,554	1,933,111	2,062,824
7	Tap Connection and Inspection Fees	378,723	-	378,723	I	386,297	394,023	401,904	409,942	418,141	426,504	435,034	443,734	452,609	461,661	470,894	480,312	489,919	499,717	509,711	519,906	530,304	540,910
8	Contracted Wastewater Fees	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	Groundwater Reduction Fees	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Participant Billings	1,047,753	-	1,047,753	B N	1,068,708	1,267,419	1,503,077	1,782,553	2,113,993	2,507,059	2,781,721	3,086,474	3,424,614	3,799,799	4,216,088	4,560,377	4,932,780	5,335,595	5,771,303	6,242,592	6,661,475	7,108,465
11	Surface Water Fees	300,699	-	300,699	B	306,713	363,742	431,374	511,582	606,704	719,511	798,338	885,800	982,844	1,090,520	1,209,993	1,308,802	1,415,679	1,531,285	1,656,330	1,791,588	1,911,805	2,040,088
12	Other Tax	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	Water Impact Fee	-	-	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	Wastewater Impact Fee	-	-	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15		$ 5,150,458	$ -	$ 5,150,458		$ 2,802,222	$ 3,259,154	$ 3,799,764	$ 4,439,585	$ 5,197,038	$ 6,093,968	$ 6,723,400	$ 7,421,025	$ 8,194,300	$ 9,051,497	$ 10,001,794	$ 10,789,512	$ 11,640,975	$ 12,561,377	$ 13,556,335	$ 14,631,926	$ 15,589,252	$ 16,610,325
16																							
17	**Operating Expenses**																						
18	Purchased Water Services	$ -	$ -	$ -		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
19	Contracted Services	503,312	-	503,312	J	502,333	554,057	611,107	674,031	679,453	749,415	797,960	849,650	904,688	859,663	915,350	961,878	1,010,771	1,062,148	1,116,138	1,172,872	1,223,951	1,277,254
20	Repairs & Maintenance	280,027	-	280,027	L	285,627	315,038	347,476	383,255	422,718	466,245	496,447	528,606	562,847	599,307	638,129	670,566	704,651	740,468	778,107	817,658	853,267	890,427
21	Professional Fees	303,319	-	303,319	A	309,385	315,573	321,885	328,322	334,889	341,586	348,418	355,387	362,494	369,744	377,139	384,682	392,375	400,223	408,227	416,392	424,720	433,214
22	Depreciation & Amortization	907,920	-	907,920	L K	926,078	1,021,435	1,126,610	1,242,614	1,370,563	1,511,687	1,609,611	1,713,878	1,824,899	1,943,112	2,068,982	2,174,149	2,284,662	2,400,792	2,522,825	2,651,061	2,766,516	2,886,999
23	Purchased Sewer Services	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	Other	296,381	-	296,381	A	302,309	308,355	314,522	320,813	327,229	333,773	340,449	347,258	354,203	361,287	368,513	375,883	383,401	391,069	398,890	406,868	415,005	423,305
25	Solid Waste	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	Utilities	28,406	-	28,406	B	28,974	34,361	40,750	48,327	57,313	67,970	75,416	83,678	92,846	103,018	114,304	123,638	133,734	144,655	156,468	169,245	180,602	192,720
27	Purchased Services	5,694	-	5,694	L	5,808	6,406	7,066	7,794	8,596	9,481	10,095	10,749	11,446	12,187	12,977	13,636	14,329	15,058	15,823	16,627	17,352	18,107
28	Capital Outlay	-	-	-	K	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	Payments to Master ("Connection Charges")	1,219,139	-	1,219,139	B N	1,243,522	1,474,737	1,748,943	2,074,133	2,459,789	2,917,151	3,236,741	3,591,343	3,984,795	4,421,351	4,905,734	5,306,339	5,739,659	6,208,364	6,715,343	7,263,723	7,751,125	8,271,231
30	Lease	308,750	-	308,750	E	314,925	321,224	327,648	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	Purchase of Capacity	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
32	Renewals & Replacements	-	-	-	K	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
33	Salaries and Benefits	2,076	-	2,076	A	2,118	2,160	2,203	2,247	2,292	2,338	2,385	2,433	2,481	2,531	2,582	2,633	2,686	2,740	2,794	2,850	2,907	2,965
34	Surface Water Fee	300,699	-	300,699	B	306,713	363,742	431,374	511,582	606,704	719,511	798,338	885,800	982,844	1,090,520	1,209,993	1,308,802	1,415,679	1,531,285	1,656,330	1,791,588	1,911,805	2,040,088
35	Groundwater Reduction Fees	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36	Transfers for Debt Service	547,313	(547,313)	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
37		$ 4,703,037	$ (547,313)	$ 4,155,724		$ 4,227,793	$ 4,717,087	$ 5,279,584	$ 5,593,119	$ 6,269,546	$ 7,119,158	$ 7,715,860	$ 8,368,782	$ 9,083,544	$ 9,762,720	$ 10,613,702	$ 11,322,206	$ 12,081,947	$ 12,896,801	$ 13,770,946	$ 14,708,884	$ 15,547,249	$ 16,436,312
38																							
39	**Net Income before Debt Service**	$ 447,421	$ 547,313	$ 994,734		$ (1,425,571)	$ (1,457,933)	$ (1,479,820)	$ (1,153,534)	$ (1,072,508)	$ (1,025,190)	$ (992,460)	$ (947,756)	$ (889,243)	$ (711,223)	$ (611,908)	$ (532,694)	$ (440,972)	$ (335,425)	$ (214,611)	$ (76,958)	$ 42,003	$ 174,013
40																							

City of Missouri City
Scenario 1.3: Sienna Plantation MUD #5

Schedule 2
Annexation
Scenario 1.3

Line No.		Actual	Adjustments	Test Year		Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	Year 11 2030	Year 12 2031	Year 13 2032	Year 14 2033	Year 15 2034	Year 16 2035	Year 17 2036	Year 18 2037
41																							
42	Capital Improvement Plan - Water																						
43	Cost	$ 900,937			F																		
44	Principal					$ 13,684	$ 14,377	$ 15,104	$ 15,869	$ 16,672	$ 17,516	$ 18,403	$ 19,335	$ 20,314	$ 21,342	$ 22,423	$ 23,558	$ 24,750	$ 26,003	$ 27,320	$ 28,703	$ 30,156	$ 31,682
45	Interest					45,779	45,086	44,358	43,594	42,790	41,946	41,059	40,128	39,149	38,121	37,040	35,905	34,712	33,459	32,143	30,760	29,307	27,780
46	Total					$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463
47																							
48	Capital Improvement Plan - Wastewater																						
49	Cost	$ 15,613,867			G																		
50	Principal					$ 23,715	$ 24,916	$ 26,177	$ 27,502	$ 183,042	$ 192,309	$ 202,044	$ 212,273	$ 223,019	$ 293,597	$ 308,460	$ 324,076	$ 340,482	$ 357,719	$ 375,829	$ 394,855	$ 414,845	$ 435,846
51	Interest					79,338	78,137	76,876	75,551	589,855	580,589	570,853	560,625	549,878	736,933	722,069	706,454	690,047	672,810	654,701	635,674	615,685	594,683
52	Total					$ 103,053	$ 103,053	$ 103,053	$ 103,053	$ 772,897	$ 772,897	$ 772,897	$ 772,897	$ 772,897	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530
53																							
54	Defease Existing MUD Debt and Developer Reimbursement Obligations																						
55	Cost	$ 76,340,286			H																		
56	Principal					$ 1,159,490	$ 1,218,189	$ 1,279,860	$ 1,344,653	$ 1,412,726	$ 1,484,245	$ 1,559,385	$ 1,638,329	$ 1,721,269	$ 1,808,408	$ 1,899,959	$ 1,996,144	$ 2,097,199	$ 2,203,370	$ 2,314,916	$ 2,432,108	$ 2,555,234	$ 2,684,592
57	Interest					3,879,040	3,820,341	3,758,670	3,693,877	3,625,804	3,554,285	3,479,145	3,400,201	3,317,261	3,230,121	3,138,571	3,042,385	2,941,330	2,835,160	2,723,614	2,606,421	2,483,296	2,353,937
58	Total					$ 5,038,530	$ 5,038,530	$ 5,038,530	$ 5,038,530	$ 5,038,530	$ 5,038,530	$ 5,038,530	$ 5,038,530	$ 5,038,530	$ 5,038,530	$ 5,038,530	$ 5,038,530	$ 5,038,530	$ 5,038,530	$ 5,038,530	$ 5,038,530	$ 5,038,530	$ 5,038,530
59																							
60	Total Debt Service					$ 5,201,045	$ 5,201,045	$ 5,201,045	$ 5,201,045	$ 5,870,890	$ 5,870,890	$ 5,870,890	$ 5,870,890	$ 5,870,890	$ 6,128,522	$ 6,128,522	$ 6,128,522	$ 6,128,522	$ 6,128,522	$ 6,128,522	$ 6,128,522	$ 6,128,522	$ 6,128,522
61																							
62	**Net Income after Debt Service**					$ (6,626,616)	$ (6,658,979)	$ (6,680,866)	$ (6,354,579)	$ (6,943,397)	$ (6,896,079)	$ (6,863,350)	$ (6,818,646)	$ (6,760,133)	$ (6,839,745)	$ (6,740,430)	$ (6,661,216)	$ (6,569,494)	$ (6,463,947)	$ (6,343,133)	$ (6,205,481)	$ (6,086,519)	$ (5,954,509)
63																							
64	**Net Present Value (at 5% discount rate)**	($93,942,989)																					

Notes:

A Annual increases in forecast based on inflation only

B Annual increases in forecast based on inflation and customer growth

C There will no longer be MUD property taxes under this option

D The City does not charge its impact fees to the MUDs

E This lease expense is associated with an operating lease agreement for a wastewater treatment plant, which is assumed to end by FY 2023

F Based on the applicable water capital projects in the 2011 eHT report (Table 4-20) updated to today's dollars; does not include any capital costs for the new transmission lines (which are complete) or the new raw water treatment plant (which is already out for bid)

G Based on Option 5 (without WC&ID #2) in the 2018 eHT report (Table 5-1) allocated to the MUDs based on total buildout connection counts

H Based on total principal outstanding on all existing MUD debt plus all existing developer reimbursement obligations

I Assumes inspection fees are negligible and tap fee revenue will increase with inflation and end at buildout

J Annual increases in forecast based on 50% inflation plus 50% inflation and customer growth combined, but also account for the wastewater O&M savings projection from eHT report based on an assumed 60/40 split in Contracted Services between water and sewer, respectively.

K Assumes depreciation will fully fund capital needs for renewal and replacements

L Annual increases in forecast based on 50% inflation plus 50% inflation and customer growth combined

M This reflects a transfer from Sienna Plantation MUD #4 to Sienna Plantation MUD #5 for debt service. However, since the total debt service is already accounted for under Sienna Plantation MUD #5, the portion paid for by Sienna Plantation MUD #4 via this transfer was removed from the analysis to avoid double-counting this expense.

N It is important to note that Participant Billings and Payments to Master ("Connection Charges") reflect duplications in this summary. For example, the revenue listed as Participant Billings for Sienna Plantation MUD #5 comes from revenue that is captured within Water Service and Wastewater Service for the participant MUDs (i.e., it is counted twice). The same is true for expenses (i.e., the expense of Payments to Master made by the participant MUDs is recovering the expenses also listed in other line item expenses for Sienna Plantation MUD #5). Because both the revenues and expense are included, the net amount is appropriate.

City of Missouri City
Scenario 1.3: Sienna Plantation MUD #5

Schedule 2
Annexation
Scenario 1.3

Line No.		Year 19 2038	Year 20 2039	Year 21 2040	Year 22 2041	Year 23 2042	Year 24 2043	Year 25 2044	Year 26 2045	Year 27 2046	Year 28 2047	Year 29 2048	Year 30 2049
1	**Revenues**												
2	Water Service	$ 2,562,241	$ 2,734,170	$ 2,917,635	$ 3,241,677	$ 3,601,707	$ 4,001,724	$ 4,446,168	$ 4,834,830	$ 4,931,527	$ 5,030,157	$ 5,130,760	$ 5,233,376
3	Property Tax	-	-	-	-	-	-	-	-	-	-	-	-
4	Wastewater Service	2,621,774	2,797,697	2,985,425	3,316,996	3,685,392	4,094,703	4,549,473	4,947,166	5,046,109	5,147,031	5,249,972	5,354,971
5	Garbage Service	-	-	-	-	-	-	-	-	-	-	-	-
6	Other Revenues	2,201,242	2,348,947	2,506,563	2,784,950	3,094,255	3,437,912	3,819,738	4,153,640	4,236,713	4,321,447	4,407,876	4,496,034
7	Tap Connection and Inspection Fees	551,728	562,762	574,018	585,498	597,208	609,152	621,335	633,762	-	-	-	-
8	Contracted Wastewater Fees	-	-	-	-	-	-	-	-	-	-	-	-
9	Groundwater Reduction Fees	-	-	-	-	-	-	-	-	-	-	-	-
10	Participant Billings	7,585,449	8,094,439	8,637,582	9,596,899	10,662,761	11,847,000	13,162,765	14,313,389	14,599,656	14,891,650	15,189,483	15,493,272
11	Surface Water Fees	2,176,980	2,323,057	2,478,936	2,754,254	3,060,150	3,400,020	3,777,637	4,107,859	4,190,016	4,273,817	4,359,293	4,446,479
12	Other Tax	-	-	-	-	-	-	-	-	-	-	-	-
13	Water Impact Fee	-	-	-	-	-	-	-	-	-	-	-	-
14	Wastewater Impact Fee	-	-	-	-	-	-	-	-	-	-	-	-
15		$ 17,699,414	$ 18,861,072	$ 20,100,158	$ 22,280,273	$ 24,701,473	$ 27,390,512	$ 30,377,117	$ 32,990,646	$ 33,004,021	$ 33,664,102	$ 34,337,384	$ 35,024,132
16													
17	**Operating Expenses**												
18	Purchased Water Services	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
19	Contracted Services	1,332,879	1,390,926	1,451,502	1,546,621	1,647,974	1,755,968	1,871,039	1,971,528	2,010,959	2,051,178	2,092,201	2,134,045
20	Repairs & Maintenance	929,206	969,673	1,011,903	1,078,214	1,148,872	1,224,159	1,304,380	1,374,435	1,401,924	1,429,962	1,458,561	1,487,733
21	Professional Fees	441,879	450,716	459,730	468,925	478,304	487,870	497,627	507,580	517,731	528,086	538,647	549,420
22	Depreciation & Amortization	3,012,729	3,143,934	3,280,854	3,495,854	3,724,942	3,969,044	4,229,141	4,456,278	4,545,403	4,636,312	4,729,038	4,823,619
23	Purchased Sewer Services	-	-	-	-	-	-	-	-	-	-	-	-
24	Other	431,771	440,407	449,215	458,199	467,363	476,711	486,245	495,970	505,889	516,007	526,327	536,854
25	Solid Waste	-	-	-	-	-	-	-	-	-	-	-	-
26	Utilities	205,652	219,451	234,177	260,185	289,082	321,188	356,860	388,055	395,816	403,733	411,807	420,044
27	Purchased Services	18,896	19,719	20,577	21,926	23,363	24,894	26,525	27,950	28,509	29,079	29,660	30,254
28	Capital Outlay	-	-	-	-	-	-	-	-	-	-	-	-
29	Payments to Master ("Connection Charges")	8,826,237	9,418,485	10,050,473	11,166,710	12,406,920	13,784,871	15,315,862	16,654,699	16,987,793	17,327,548	17,674,099	18,027,581
30	Lease	-	-	-	-	-	-	-	-	-	-	-	-
31	Purchase of Capacity	-	-	-	-	-	-	-	-	-	-	-	-
32	Renewals & Replacements	-	-	-	-	-	-	-	-	-	-	-	-
33	Salaries and Benefits	3,025	3,085	3,147	3,210	3,274	3,340	3,406	3,474	3,544	3,615	3,687	3,761
34	Surface Water Fee	2,176,980	2,323,057	2,478,936	2,754,254	3,060,150	3,400,020	3,777,637	4,107,859	4,190,016	4,273,817	4,359,293	4,446,479
35	Groundwater Reduction Fees	-	-	-	-	-	-	-	-	-	-	-	-
36	Transfers for Debt Service	-	-	-	-	-	-	-	-	-	-	-	-
37		$ 17,379,253	$ 18,379,454	$ 19,440,514	$ 21,254,098	$ 23,250,243	$ 25,448,063	$ 27,868,723	$ 29,987,827	$ 30,587,584	$ 31,199,335	$ 31,823,322	$ 32,459,789
38													
39	**Net Income before Debt Service**	$ 320,161	$ 481,618	$ 659,644	$ 1,026,175	$ 1,451,230	$ 1,942,449	$ 2,508,394	$ 3,002,818	$ 2,416,438	$ 2,464,766	$ 2,514,062	$ 2,564,343
40													

City of Missouri City
Scenario 1.3: Sienna Plantation MUD #5

Line No.		Year 19 2038	Year 20 2039	Year 21 2040	Year 22 2041	Year 23 2042	Year 24 2043	Year 25 2044	Year 26 2045	Year 27 2046	Year 28 2047	Year 29 2048	Year 30 2049
41													
42	Capital Improvement Plan - Water												
43	Cost												
44	Principal	$ 33,286	$ 34,972	$ 36,742	$ 38,602	$ 40,556	$ 42,609	$ 44,766	$ 47,033	$ 49,414	$ 51,915	$ 54,544	$ 57,305
45	Interest	26,176	24,491	22,721	20,861	18,906	16,853	14,696	12,430	10,049	7,547	4,919	2,158
46	Total	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463	$ 59,463
47													
48	Capital Improvement Plan - Wastewater												
49	Cost												
50	Principal	$ 457,911	$ 481,093	$ 505,448	$ 531,036	$ 557,920	$ 586,165	$ 615,839	$ 647,016	$ 679,772	$ 714,185	$ 750,341	$ 788,327
51	Interest	572,619	549,437	525,082	499,493	472,610	444,365	414,690	383,513	350,758	316,345	280,189	242,203
52	Total	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530	$ 1,030,530
53													
54	Defease Existing MUD Debt and Develo												
55	Cost												
56	Principal	$ 2,820,500	$ 2,963,288	$ 3,113,304	$ 3,270,915	$ 3,436,505	$ 3,610,478	$ 3,793,259	$ 3,985,292	$ 4,187,048	$ 4,399,017	$ 4,621,717	$ 4,855,692
57	Interest	2,218,030	2,075,242	1,925,226	1,767,615	1,602,024	1,428,051	1,245,271	1,053,237	851,482	639,512	416,812	182,838
58	Total	$ 5,038,530	$ 5,038,530	$ 5,038,530	$ 5,038,530	$ 5,038,530	$ 5,038,530	$ 5,038,530	$ 5,038,530	$ 5,038,530	$ 5,038,530	$ 5,038,530	$ 5,038,530
59													
60	Total Debt Service	$ 6,128,522	$ 6,128,522	$ 6,128,522	$ 6,128,522	$ 6,128,522	$ 6,128,522	$ 6,128,522	$ 6,128,522	$ 6,128,522	$ 6,128,522	$ 6,128,522	$ 6,128,522
61													
62	**Net Income after Debt Service**	$ (5,808,362)	$ (5,646,904)	$ (5,468,878)	$ (5,102,347)	$ (4,677,292)	$ (4,186,073)	$ (3,620,128)	$ (3,125,704)	$ (3,712,084)	$ (3,663,756)	$ (3,614,460)	$ (3,564,179)

Schedule 3
Allocation of Water Captial Projects

No.	Project	Connections at Build Out [2]	Estimated Capital Cost (2011 dollars) [1]	Impact on Scenario
1	Interconnection Project		$ 607,000	
	Allocation [3]			
	First Colony MUD #9	3,300	**$ 516,263**	**3**
	Fort Bend County MUD #115	580	**$ 90,737**	**3**
		3,880	$ 607,000	
2	Interconnection Project		$ 799,000	
	Allocation [3]			
	Mustang Bayou WTP System [8]	5,106	$ 592,376	4
	Sienna Plantation MUD #2	1,781	**$ 206,624**	**1.2**
		6,887	$ 799,000	
3	Interconnection Project		$ 683,500	
	Allocation [3]			
	Mustang Bayou WTP System [8]	5,106	$ 452,066	4
	Sienna Plantation MUD #3	2,614	**$ 231,434**	**1.2**
		7,720	$ 683,500	
4	Interconnection Project		$ 458,000	
	Allocation [3]			
	Sienna Plantation MUD #1 [4]	9,939	**$ 228,299**	**1.2**
	Sienna Plantation MUD #5 [4]	10,000	**$ 229,701**	**1.3**
		19,939	$ 458,000	
5	Interconnection Project		$ 927,500	
	Allocation [3]			
	Sienna Plantation System (MUD #1) [5]	9,939	**$ 444,540**	**1.2**
	Sienna Plantation System (MUD #5) [5]	10,000	**$ 447,268**	**1.3**
	Palmer Plantation MUD #1	798	**$ 35,692**	**3**
		20,737	$ 927,500	
6	Interconnection Project		$ 154,000	
	Allocation [3]			
	Silver Ridge Development [7]	1,122	$ 15,621	(none)
	Sienna Plantation MUD #1 [4]	9,939	**$ 138,379**	**1.2**
		11,061	$ 154,000	
7	Interconnection Project		$ 579,000	
	Allocation [3]			
	Fort Bend County MUD #149	1,700	**$ 84,569**	**1.1**
	Sienna Plantation MUD #1 [4]	9,939	**$ 494,431**	**1.2**
		11,639	$ 579,000	

No.	Project	Connections at Build Out [2]	Estimated Capital Cost (2011 dollars) [1]	Impact on Scenario
8	Interconnection Project		$ 298,000	
	Allocation [3]			
	Mustang Bayou WTP System [8]	5,106	$ 220,392	4
	Palmer Plantation [6]	1,798	**$ 77,608**	**3**
		6,904	$ 298,000	
9	Interconnection Project		$ 289,000	
	Allocation [3]			
	Mustang Bayou WTP System [8]	5,106	$ 153,392	4
	Quail Valley Utility District	4,514	**$ 135,608**	**3**
		9,620	$ 289,000	
10	Elevated Storage Project		$ 4,602,000	
	Sienna Plantation MUD #1		**$ 4,602,000**	**1.2**
11	Elevated Storage Project		$ 1,947,000	
	Allocation [3]			
	Mustang Bayou WTP System [8]	5,106	$ 660,776	4
	Sienna Plantation MUD #1 [4]	9,939	**$ 1,286,224**	**1.2**
		15,045	$ 1,947,000	
12	Elevated Storage Project		$ 6,372,000	
	Allocation [3]			
	Fort Bend County MUD #149	1,700	**$ 814,956**	**1.1**
	Sienna Plantation MUD #1 [4]	9,939	**$ 4,764,618**	**1.2**
	Ft. Bend County MUD #46	1,073	**$ 514,381**	**3**
	Ft. Bend County MUD #115	580	**$ 278,044**	**3**
		13,292	$ 6,372,000	
13	Elevated Storage Project		$ 3,717,000	
	Allocation [3]			
	Palmer Plantation MUD #2	1,000	**$ 443,927**	**3**
	Palmer Plantation MUD #1	798	**$ 354,254**	**3**
	Ft. Bend County MUD #49	396	**$ 175,795**	**3**
	Ft. Bend County MUD #46	1,073	**$ 476,334**	**3**
	Mustang Bayou WTP System [8]	5,106	$ 2,266,691	4
		8,373	$ 3,717,000	
14	Elevated Storage Project		$ 3,717,000	
	Thunderbird Utility District		**$ 3,717,000**	**3**

Schedule 3
Allocation of Water Captial Projects

No.	Project	Connections at Build Out [2]	Estimated Capital Cost (2011 dollars) [1]	Impact on Scenario
15	Elevated Storage Project		$ 1,947,000	
	Harris County WCID - Fondren Road		**$ 1,947,000**	**2**

Footnotes:

[1] Source: eHT 2011 Regional Water & Wastewater Planning Study, Table 4-20 (Page 4-16)

[2] Source: eHT 2018 Regional Water & Wastewater Planning Study, dated January 2019, Table 2-1 (Page 2-4)

[3] Based on build out connection count

[4] Connection count includes subservient MUDs

[5] Sienna Plantation System is assumed to include all the Sienna Plantation MUDs

[6] Assumes Palmer Plantation is composed of Palmer Plantation MUD #1 and Palmer Plantation MUD #2

[7] Silver Ridge Development build out provided by City staff

[8] Connection count for Mustang Bayou WTP System from revised growth projection provided by City staff

Appendix H
NewGen Report on Scenario 2: Harris County MUDs

NewGen Strategies & Solutions
3420 Executive Center Drive
Suite 165
Austin, TX 78731
Phone: (512) 479-7900

Memorandum

To: Greenberg Traurig, P.A.

From: Dave Yanke, President – Environmental Practice, NewGen
Grant Rabon, Executive Consultant, NewGen

Date: July 30, 2019

Re: **Missouri City Feasibility Analysis Regarding Regionalization of Water/Wastewater Utility Providers for the City and the City's Extra Territorial Jurisdiction (Study): Financial Feasibility – Scenario 2: Harris County MUDs**

Background

Greenberg Traurig, P.A., retained NewGen Strategies & Solutions, LLC (NewGen) to provide a financial feasibility analysis related to the Study, including evaluating several Study consolidation scenarios as directed by City staff regarding the potential consolidation of several municipal utility districts (MUDs) located in and/or near the City of Missouri City (City) with the City's existing water/wastewater utility systems. In establishing the scenarios to analyze, Newgen with input from City staff identified geographically, technically, and developmentally related MUDs to be considered as natural groupings for consolidation.

As part of the Harris County MUDs scenario analysis, NewGen evaluated the forecasted customer growth, revenue, capital costs, debt service, and operations and maintenance (O&M) costs over a 30-year period (FY 2020 – FY 2049) to evaluate the financial impact that a consolidation may have on the City.

Methodology

For the Harris County MUDs scenario, NewGen studied the following MUDs:

- Harris County MUD #122
- Harris County WC&ID - Fondren Road
- Southwest Harris County MUD #1

The financial audits for each MUD were used to develop a test year for the utilities. A test year reflects expected recurring revenue and expense line items, including existing debt service. The most recent financial audits available to NewGen were used. The test year was then used to develop a 30-year forecast. Table 1 shows the revenue and expense categories used for the 30-year forecast, as applicable.

Table 1
Revenue and Expense Categories

Revenues	Expenses
Contracted Wastewater Fees	Administrative Expenses
Garbage Service[1]	Capital Outlay
Groundwater Reduction Fees[2]	Connection Fees
Other Revenues[2]	**Contracted Services**[1]
Other Tax	**Depreciation & Amortization**[1]
Participant Billings[2]	Groundwater Reduction Fees
Property Tax	Lease
Surface Water Fees[2]	Other
Tap Connection and Inspection Fees	Professional Fees
Wastewater Service[2]	Purchase of Capacity
Water Service[2]	**Purchased Services**[1]
Water Impact Fee	**Purchased Sewer Services**[1]
Wastewater Impact Fee	**Purchased Water Services**[1]
	Renewals & Replacements
	Repairs & Maintenance[1]
	Salaries and Benefits
	Solid Waste
	Surface Water Fee[2]
	Utilities[2]
	Payments to Master ("Connection Charges")[2]

1. Annual growth in forecast based on 50% inflation plus 50% inflation and customer growth combined
2. Annual growth in forecast based on inflation and customer growth

All categories were forecasted to increase at 2% per year to reflect inflation, except the bolded categories, which were forecasted based on a combination of inflation and customer growth (as identified in the footnotes of Table 1). For customer growth, NewGen utilized the growth projections from the 2018 Regional Water & Wastewater Planning Study Update (2018 eHT Study) prepared by Enprotec/Hibbs & Todd, Inc. (eHT) for the Study, which were validated by City staff. Table 2 shows the connection projections for the Harris County MUDs in this scenario. Note that NewGen did not independently verify the eHT projections, and any material change in actual customer growth (compared with the projections) could have a material impact on the financial analyses.

Table 2
Connection Projections [1]

MUD	Current	2020	2025	2030	2035	2040	Build Out
Harris County MUD #122	409	437	507	577	647	713	714
Harris County WC&ID – Fondren RD	1,021	1,022	1,025	1,028	1,031	1,034	1,566
Southwest Harris County MUD #1	528	591	749	906	1,064	1,064	1,315
Total Connections	1,958	2,050	2,281	2,511	2,742	2,811	3,595

1. Source: 2018 Regional Water & Wastewater Planning Study Update by eHT

NewGen developed its scenario analysis based on two potential consolidation implementation structures – 1) dissolution of each MUD and assumption by the City of each MUD's assets (including both water/wastewater assets and all other assets of the MUD) and liabilities (including MUD debt and all operating expense obligations); and 2) voluntary transfer by each MUD of its water/wastewater utility assets to the City, with each MUD continuing in existence.

Asset Acquisition

In the asset acquisition option, the MUDs would continue to exist to provide non-utility services (parks, roads, etc.), and to service outstanding water/wastewater debt. In this option, the MUD would continue to levy and collect at current levels the MUD property taxes to fund its administrative costs, remaining operating expenses, and existing debt service, which would not be assumed by the City but would be retired by the MUDs in the ordinary course of business. The scenario assumes that the City would continue the existing MUD utility rates in place, with annual adjustments for inflation, and would not raise rates to fund the acquisition. The scenario also assumes that the MUD will continue to collect the water/wastewater operating expenses imbedded in the MUDs property tax levy and transfer those funds to the City for the same purpose. For purposes of our financial analyses, we have assumed that the amount the MUD collects from property taxes in excess of its administrative costs, non-utility operating expenses, and debt service is equal to the portion of water/wastewater utility operating expenses currently used in addition to revenues from utility rates to fund its water/wastewater utility service (i.e., the subsidy). This available property tax portion for funding water/wastewater utility operating costs would be transferred annually to the City to pay the water/wastewater operating costs not covered by rate revenues (mirroring the existing funding mechanism of the MUDs).[1]

MUD Dissolution

In the MUD dissolution option, since all of the Harris County MUDs are within the City's municipal boundaries already, the City would dissolve the MUDs, which would cause the MUDs to cease to exist as governmental entities. By law, upon dissolution of the MUDs, the City would obtain title to all of the MUDs' assets and assume all the MUDs' expenses, debts and other obligations. The City would not assume the MUDs' ability to levy a MUD property tax to fund the expenses, debts and other assumed obligations, and would have to identify other funding sources within the City to pay such assumed

[1] Alternatively, for the purposes of this analysis, the assumption could equally be that the City would be able to increase utility revenues equal to the subsidy in the first year of the forecast. However, factoring in political considerations, NewGen believes that option is less likely.

obligations. Since most MUDs are using property tax revenue to pay water/wastewater utility debt, and to supplement utility rate revenues to pay operating expenses, the loss of MUD property tax revenue support has a very negative effect on the financial feasibility of this option. Under this option, the former MUD water/wastewater customers would face a lower overall tax burden as the MUD property tax expired, but the City would have to either substantially raise the former MUD customers' water/wastewater utility rates, or allocate general City tax revenues to subsidize the cost of water/wastewater utility service to the former MUD customers. In addition, the existing debt of each MUD would have to be paid off by the City via a new debt issuance by the City, with the City funding the debt service either through increased water/wastewater utility rates or City general fund revenues. Note: The City could not assume the MUDs' existing debt as the debt is secured by MUD property taxes, which the City would have no recourse to. Finally, under this option, the City would have to assume the provision of all other governmental services being provided by the MUDs in addition to water/wastewater services, again without recourse to the MUDs property tax levies currently funding operation of those services.

Capital Plans

Upon acquisition of the MUDs water/wastewater facilities under both options, the City would assume the continuing obligation to maintain, upgrade, expand and replace the water/wastewater utility system infrastructure acquired, as conveyed in a Capital Improvement Plan (CIP). Based on input from eHT, the water/wastewater CIP were assumed to be the same in both the MUD dissolution and asset acquisition options.

The relevant water CIP projects were taken from Table 4-20 of the 2011 Regional Water and Wastewater Planning Study (2011 eHT Study) developed by eHT. Since the CIP project costs in the 2011 eHT Study were not in current dollars, NewGen increased the costs taken from the 2011 eHT Study by either approximately 3.6%[2] per year for interconnection projects or approximately 1.3%[3] per year for elevated storage tank projects. While the 2011 eHT Study lists 15 different water interconnection and storage projects, for this analysis NewGen focused on the projects directly related to the Harris County MUDs. In this case, NewGen identified only one relevant water project and then inflated the costs to 2019 dollars, as seen in Table 3. The water capital costs are assumed to be incurred in the first year of the forecast.

For wastewater CIP projects, per input from eHT and City staff, the most cost-effective means of providing wastewater service to the area would be to consolidate down to two master regional wastewater treatment plants (WWTPs) as seen in Option 5 in Table 5-1 in the 2018 eHT Study. Since the costs for this project cannot be pinpointed to each individual MUD, the costs were allocated based on the total build out size of each participant, as found in the 2018 eHT Study. The wastewater project cost shown in Table 3 represents the pro-rata share allocated to the Harris County MUDs.

Since there are no projected revenues identified currently to fund the CIP, we have assumed the City would fund the CIP with the issuance of new debt. The timing of debt incurred to fund the wastewater CIP is assumed to be 10% of the total in year 1 of the forecast, 65% in year 5, and the remaining 25% in

[2] Based on the annualized change in the Handy Whitman Index cost for water mains (NARUC 331) within the South Central region of the country between January 2011 and January 2018

[3] Based on the annualized change in the Handy Whitman Index cost for elevated steel tanks (NARUC 330) within the South Central region of the country between January 2011 and January 2018

year 10. It is assumed that all capital projects will be debt funded over a 30-year term with a 5% interest rate and a 2% issuance fee.

Table 3
Capital Projects

Utility	Project Description	Project Cost
Water	New EST at Harris County WC&ID – Fondren Road GWTP No. 2	$2,158,731 [1]
Wastewater	Consolidation into two master regional WWTPs (without WC&ID #2)	$5,613,185 [2]

1. Costs have been inflated to 2019 dollars using an appropriate inflation factor
2. Project cost reflects pro-rata share of the overall project cost based on build out connection counts of all participants in the project

Implementation of the wastewater CIP presents opportunities for O&M cost savings. By modernizing and consolidating facilities, eHT estimates that the overall wastewater O&M cost should decrease by approximately 54%[4] when compared to the status quo. Similar to the capital spending, the O&M savings are assumed to be phased in over time. The cost savings were applied to the Purchased Wastewater Services line item in the financial forecast. The timing for the utility debt issuances and the O&M savings is shown in Table 4.

Table 4
Capital Project Debt and Savings Schedule

	Debt Issuance [1]		O&M [2]	
Year	Capital Debt %	Cumulative %	O&M Savings %	Cumulative %
2020	10%	10%	10%	10%
2024	65%	75%	40%	50%
2029	25%	100%	50%	100%

1. 10% of debt is issued in 2020, 65% of debt in 2024, and 25% in 2029 based on input from eHT
2. 10% of the 54% total O&M savings is realized in 2020, an additional 40% in 2024, and the final 50% in 2029 based on input from eHT

It is assumed that the depreciation (a non-cash item) included within the cash flow forecast will sufficiently fund any necessary capital renewals and replacements. It is also assumed that the CIP projects identified in Table 3 and the O&M savings discussed in the 2018 eHT report are realized as forecasted.

Analysis

Methodology

NewGen's analysis for both options will focus on changes in revenue, operating expenses, and debt service expenses. Table 5 summarizes several of the key differences between an asset acquisition and a dissolution of the Harris County MUDs.

[4] Per Table 5-1 in the 2018 eHT Study

Table 5
Relevant Components for Each Option

Asset Acquisition	Dissolution
Revenues	Revenues
• Water Service	• Water Service
• Property Tax Support [1, 2]	• No Property Taxes
• Wastewater Service	• Wastewater Service
• Tap Connection & Inspection Fees	• Garbage Service (if any)
	• Other Revenues
	• Tap Connection & Inspection Fees
Operating Expenses	Operating Expenses
• Treated the same, except excludes "Other" operating expenses (e.g., solid waste), which remain with the MUD	• Treated the same, except includes "Other" operating expenses (e.g., solid waste)
Debt Service	Debt Service
• Debt Service for new capital projects	• Debt Service for new capital projects
	• Plus MUD Debt defeasance costs

1. MUD Property Tax Revenue + Revenues for services retained by the MUD – MUD Debt Service – Expenses for services retained by the MUD = Portion of Tax Revenue Assigned to the City
   Example: Property Tax Revenue in 2020 = $1,615,851; Other MUD revenue for services in 2020 = $310,692;
   MUD Expenses for services in 2020 = $400,708; MUD Debt Service in 2020 = $791,725
   City Tax Revenue Portion = $1,615,851 + $310,692 – $400,708 – $791,725 = $734,110
2. Amount City receives in 2020 is constant throughout the 30-year forecast.

Asset Acquisition

In the asset acquisition option, one key assumption involves the continuation of property tax revenue collected by the MUD to offset water/wastewater operating costs, which will then be transferred to the City by the MUDs to supplement water/wastewater utility rate revenues. Table 6 shows the cash flow in the asset acquisition option. Schedule 1 shows a detailed breakdown of the cash flow.

As shown in Table 6, the acquired MUDs are forecasted to be self-supporting.

Table 6
Cash Flow Analysis – Asset Acquisition

Categories	2020	2025	2030	2035	2040	2045	2049
Revenues[1]	$2,784,181	$3,246,875	$3,781,306	$4,400,280	$4,855,305	$5,591,748	$6,153,088
Expenses[2]	2,426,457	2,754,935	3,095,661	3,559,371	3,986,616	4,507,959	4,932,950
Net Income before Debt Service	$357,724	$491,940	$685,645	$840,910	$868,689	$1,083,789	$1,220,138
Debt Service[3]	179,526	420,335	512,954	512,954	512,954	512,954	512,954
Net Income after Debt Service	$178,198	$71,606	$172,691	$327,956	$355,735	$570,835	$707,184

1. Includes the share of property taxes assumed to be transferred to the City by the MUDs
2. Includes operating expenses except debt service
3. Debt service on debt to be issued by the City to fund the CIP

Dissolution

One of the key differences between the MUDs dissolution option and the asset acquisition option is the need for the City to repay existing MUD debt. This amounts to approximately $4.9 million of debt principal to be repaid for the three Harris County MUDs. The defeasance will be facilitated by a new debt issue with the same term, rate, and issuance fees assumptions as the issuances for capital projects.

Table 7
Cash Flow Analysis – Dissolution

Categories	2020	2025	2030	2035	2040	2045	2049
Revenues[1]	$2,360,762	$2,872,664	$3,463,029	$4,145,710	$4,657,031	$5,468,765	$6,090,845
Expenses[2]	2,773,343	3,137,925	3,518,513	4,026,233	4,502,070	5,077,062	5,548,965
Net Income before Debt Service	($412,581)	($265,261)	($55,484)	$119,477	$154,961	$391,703	$541,880
Debt Service[3]	504,580	745,389	838,008	838,008	838,008	838,008	838,008
Net Income after Debt Service	($917,161)	($1,010,650)	($893,492)	($718,531)	($683,047)	($446,305)	($296,128)

1. Includes no property taxes
2. Includes operating expenses except debt service
3. Debt service on debt to be issued by the City to repay the MUDs' outstanding debt and fund the CIP

A second key difference between the MUDs dissolution option and the asset acquisition option is the loss of MUD property tax revenues to fund water/wastewater operating expenses. Table 7 shows a cash flow analysis for the dissolution option. Schedule 2 shows a detailed breakdown of the cash flow.

As shown in Table 7, the dissolution option initially results in significant operating losses even before any capital or debt service is considered. This is primarily due to the loss of property tax revenues. Thus, dissolution is not forecasted to be self-supporting.

Net Present Value Analysis

NewGen developed a net present value (NPV) analysis that calculates the payback, if any, from each option over a 30-year period based on the net income after debt service and operating expenses. The NPV analysis takes into account the relative timing of CIP and O&M expenditures and the impact they have on cash flow. If the NPV is negative, it indicates the existing water/wastewater utility revenues (even with customer growth and adjustments to rates for inflation) are not sufficient to keep the City from having to financially support the MUDs water/wastewater expenses from utility rate increases and/or general City revenues. In calculating the NPV analysis, NewGen utilized a 5% discount rate.

Table 8 summarizes the NPV for each option over the FY 2020 – FY 2049 timeframe. An asset acquisition would result in a positive NPV of approximately $3.9 million, which could be used to upgrade utility systems, reduce the need for general fund support, or reduce assumed future rate increases. Dissolution would result in a negative NPV of approximately $12.4 million. For the dissolution option to break-even (on an NPV basis) the City would need to increase water/wastewater utility rate revenue or general fund subsidy by approximately $800,000 per year over the 30-year forecast.

Table 8
Net Present Value Analysis

Option	NPV [1]	
Asset Acquisition	$ 3,942,434	favorable
Dissolution	($12,393,853)	unfavorable

1. Based on a 5% discount rate

Findings

Based on NewGen's financial analysis, we make the following findings as part of the Study for consideration by the City:

1. **An asset acquisition from the Harris County MUDs represents a viable financial transaction that is forecasted to avoid increases in utility rates or general fund subsidy**. The NPV of this option is positive, meaning there is not forecasted to be a financial impact on the current MUDs water/wastewater customers or subsidy cost to the City of pursuing this option for this scenario. The main concern with an asset acquisition is the necessity of negotiating a voluntary acquisition transaction with the MUDs' Boards in accordance with the transaction assumptions/parameters identified above. Absent the revenue sharing parameters between the MUDs and the City, which underlie this analysis, **this option would be negatively impacted and the NPV would be approximately negative $7.3 million.**
2. **A dissolution of the Harris County MUDs does not represent a viable financial transaction as it would require increases in utility rates or general fund subsidies due to the negative NPV**. The requirement to repay all of the MUDs' existing debt, and the inability to supplement utility rate

revenues via MUDs' continuing property tax revenues, means that the City would require significant utility rate increases and/or subsidies from the City's general funds under the assumptions identified above.

City of Missouri City
Scenario 2: Harris County MUDs

Schedule 1
Asset Acquisition

Line No.		Actual	Adjustments	Test Year		Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	Year 11 2030	Year 12 2031	Year 13 2032	Year 14 2033	Year 15 2034	Year 16 2035
1	**Revenues**																				
2	Water Service	$ 1,117,520	$ -	$ 1,117,520	B	$ 1,139,870	$ 1,187,227	$ 1,237,080	$ 1,289,580	$ 1,344,886	$ 1,403,169	$ 1,458,552	$ 1,516,546	$ 1,577,287	$ 1,640,918	$ 1,707,592	$ 1,772,265	$ 1,839,751	$ 1,910,184	$ 1,983,703	$ 2,060,454
3	Property Tax	1,584,168	-	1,584,168	C	734,110	734,110	734,110	734,110	734,110	734,110	734,110	734,110	734,110	734,110	734,110	734,110	734,110	734,110	734,110	734,110
4	Wastewater Service	827,688	-	827,688	B	844,242	878,846	915,285	953,672	994,126	1,036,773	1,077,225	1,119,590	1,163,969	1,210,468	1,259,200	1,306,431	1,355,721	1,407,167	1,460,872	1,516,945
5	Garbage Service	162,225	-	162,225	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	Other Revenues	142,375	-	142,375	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Tap Connection and Inspection Fees	64,665	-	64,665	I	65,958	67,277	68,623	69,995	71,395	72,823	74,280	75,765	77,281	78,826	80,403	82,011	83,651	85,324	87,031	88,771
8	Water Impact Fee	-	-	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	Wastewater Impact Fee	-	-	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10		$ 3,898,641	$ -	$ 3,898,641		$ 2,784,181	$ 2,867,460	$ 2,955,099	$ 3,047,358	$ 3,144,518	$ 3,246,875	$ 3,344,167	$ 3,446,012	$ 3,552,647	$ 3,664,324	$ 3,781,306	$ 3,894,817	$ 4,013,233	$ 4,136,785	$ 4,265,716	$ 4,400,280
11																					
12	**Operating Expenses**																				
13	Purchased Water Services	$ 686,530	$ -	$ 686,530	L	$ 700,261	$ 718,211	$ 736,685	$ 755,701	$ 775,275	$ 795,427	$ 815,297	$ 835,712	$ 856,690	$ 878,247	$ 900,401	$ 922,483	$ 945,149	$ 968,414	$ 992,297	$ 1,016,813
14	Contracted Services	380,880	-	380,880	L	388,498	401,295	414,552	428,287	442,517	457,261	471,479	486,167	501,343	517,023	533,224	549,113	565,498	582,397	599,825	617,800
15	Repairs & Maintenance	338,581	-	338,581	L	345,353	358,889	372,964	387,598	402,814	418,635	433,703	449,317	465,498	482,266	499,642	516,531	533,993	552,048	570,717	590,021
16	Professional Fees	286,453	-	286,453	A	292,182	298,026	303,986	310,066	316,267	322,593	329,044	335,625	342,338	349,185	356,168	363,292	370,558	377,969	385,528	393,239
17	Depreciation & Amortization	247,505	-	247,505	L K	252,455	262,322	272,581	283,246	294,333	305,861	316,846	328,229	340,024	352,246	364,911	377,224	389,955	403,118	416,727	430,798
18	Purchased Sewer Services	245,893	-	245,893	F	237,320	242,358	247,508	252,773	199,455	203,706	208,010	212,407	216,901	140,009	142,976	145,986	149,062	152,204	155,414	158,694
19	Other	177,470	-	177,470	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	Solid Waste	162,614	-	162,614	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	Utilities	158,443	-	158,443	B	161,612	167,407	173,477	179,837	186,505	193,498	200,218	207,227	214,540	222,171	230,137	237,922	246,020	254,444	263,209	272,331
22	Purchased Services	47,821	-	47,821	L	48,777	50,489	52,260	54,093	55,991	57,955	59,873	61,855	63,903	66,018	68,203	70,357	72,579	74,872	77,236	79,676
23		$ 2,732,190	$ -	$ 2,732,190		$ 2,426,457	$ 2,498,997	$ 2,574,013	$ 2,651,600	$ 2,673,156	$ 2,754,935	$ 2,834,470	$ 2,916,541	$ 3,001,237	$ 3,007,164	$ 3,095,661	$ 3,182,908	$ 3,272,813	$ 3,365,465	$ 3,460,953	$ 3,559,371
24																					
25	**Net Income before Debt Service**	$ 1,166,451	$ -	$ 1,166,451		$ 357,724	$ 368,463	$ 381,085	$ 395,758	$ 471,362	$ 491,940	$ 509,697	$ 529,471	$ 551,411	$ 657,159	$ 685,645	$ 711,910	$ 740,420	$ 771,320	$ 804,763	$ 840,910
26																					
27																					
28	Capital Improvement Plan - Water																				
29	Cost	$ 2,158,731			G																
30	Principal					$ 32,788	$ 34,448	$ 36,192	$ 38,024	$ 39,949	$ 41,971	$ 44,096	$ 46,328	$ 48,674	$ 51,138	$ 53,727	$ 56,446	$ 59,304	$ 62,306	$ 65,461	$ 68,775
31	Interest					109,690	108,031	106,287	104,454	102,530	100,507	98,382	96,150	93,805	91,341	88,752	86,032	83,174	80,172	77,018	73,704
32	Total					$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478
33																					
34	Capital Improvement Plan - Wastewater																				
35	Cost	$ 5,613,185			H																
36	Principal					$ 8,526	$ 8,957	$ 9,411	$ 9,887	$ 65,804	$ 69,135	$ 72,635	$ 76,312	$ 80,175	$ 105,548	$ 110,891	$ 116,505	$ 122,403	$ 128,600	$ 135,111	$ 141,950
37	Interest					28,522	28,090	27,637	27,161	212,053	208,722	205,222	201,545	197,681	264,927	259,584	253,970	248,072	241,875	235,365	228,525
38	Total					$ 37,048	$ 37,048	$ 37,048	$ 37,048	$ 277,857	$ 277,857	$ 277,857	$ 277,857	$ 277,857	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475
39																					
40	**Net Income after Debt Service**					$ 178,198	$ 188,937	$ 201,559	$ 216,232	$ 51,027	$ 71,606	$ 89,362	$ 109,136	$ 131,076	$ 144,206	$ 172,691	$ 198,956	$ 227,466	$ 258,366	$ 291,809	$ 327,956
41																					
42	**Net Present Value (at 5% discount rate)**	$3,942,434																			
43																					

Line No.		Actual	Adjustments	Test Year		Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	Year 11 2030	Year 12 2031	Year 13 2032	Year 14 2033	Year 15 2034	Year 16 2035
44	MUD Revenues																				
45	Garbage Service	162,225	-	162,225	L	165,470	168,827	172,253	175,749	179,316	182,954	186,667	190,455	194,320	198,263	202,286	206,391	210,579	214,852	219,211	223,660
46	Other Revenues	142,375	-	142,375	B	145,223	150,949	156,967	163,293	169,946	176,945	183,623	190,606	197,910	205,551	213,547	221,324	229,430	237,881	246,692	255,881
47	Revenue Total	$ 304,600	$ -	$ 304,600		$ 310,692	$ 319,776	$ 329,220	$ 339,042	$ 349,261	$ 359,899	$ 370,290	$ 381,061	$ 392,230	$ 403,814	$ 415,833	$ 427,715	$ 440,009	$ 452,733	$ 465,903	$ 479,540
48																					
49	MUD Expenses				J																
50	Administrative Expenses	$ 52,767	$ -	$ 52,767	A	$ 53,822	$ 54,899	$ 55,997	$ 57,117	$ 58,259	$ 59,424	$ 60,613	$ 61,825	$ 63,061	$ 64,323	$ 65,609	$ 66,921	$ 68,260	$ 69,625	$ 71,017	$ 72,438
51	Other	177,470	-	177,470	A	181,019	184,640	188,333	192,099	195,941	199,860	203,857	207,934	212,093	216,335	220,662	225,075	229,576	234,168	238,851	243,628
52	Solid Waste	162,614	-	162,614	A	165,866	169,184	172,567	176,019	179,539	183,130	186,792	190,528	194,339	198,226	202,190	206,234	210,359	214,566	218,857	223,234
53	Expense Total	$ 392,851	-	$ 392,851		$ 400,708	$ 408,722	$ 416,897	$ 425,235	$ 433,739	$ 442,414	$ 451,262	$ 460,288	$ 469,493	$ 478,883	$ 488,461	$ 498,230	$ 508,195	$ 518,359	$ 528,726	$ 539,300
54																					
55	Debt Service Schedule																				
56	Principal				E	$ 625,000	$ 385,000	$ 400,000	$ 425,000	$ 450,000	$ 475,000	$ 500,000	$ 520,000	$ 320,000	$ 335,000	$ 360,000	$ 130,000	$ -	$ -	$ -	$ -
57	Interest				E	166,725	149,899	136,460	121,924	105,662	87,962	69,261	49,656	34,314	23,254	11,372	2,600	-	-	-	-
58	Total					$ 791,725	$ 534,899	$ 536,460	$ 546,924	$ 555,662	$ 562,962	$ 569,261	$ 569,656	$ 354,314	$ 358,254	$ 371,372	$ 132,600	$ -	$ -	$ -	$ -
59																					
60	Expense and Debt Total					$ 1,192,433	$ 943,621	$ 953,356	$ 972,158	$ 989,401	$ 1,005,376	$ 1,020,523	$ 1,029,943	$ 823,807	$ 837,137	$ 859,833	$ 630,830	$ 508,195	$ 518,359	$ 528,726	$ 539,300
61																					
62	Net Income before Property Tax					$ (881,741)	$ (623,845)	$ (624,136)	$ (633,116)	$ (640,140)	$ (645,477)	$ (650,233)	$ (648,883)	$ (431,578)	$ (433,323)	$ (443,999)	$ (203,115)	$ (68,186)	$ (65,626)	$ (62,822)	$ (59,760)
63																					
64	Property Tax	$ 1,584,168	$ -	$ 1,584,168	A	$ 1,615,851	$ 1,648,168	$ 1,681,132	$ 1,714,754	$ 1,749,049	$ 1,784,030	$ 1,819,711	$ 1,856,105	$ 1,893,227	$ 1,931,092	$ 1,969,714	$ 2,009,108	$ 2,049,290	$ 2,090,276	$ 2,132,082	$ 2,174,723
65																					
66	Net Property Tax Revenue After Debt & Expenses					$ 734,110	$ 1,024,323	$ 1,056,996	$ 1,081,638	$ 1,108,910	$ 1,138,554	$ 1,169,478	$ 1,207,223	$ 1,461,650	$ 1,497,769	$ 1,525,714	$ 1,805,993	$ 1,981,105	$ 2,024,650	$ 2,069,259	$ 2,114,963
67																					
68	Net Benefit to the City of Missouri City				C	$ 734,110	$ 734,110	$ 734,110	$ 734,110	$ 734,110	$ 734,110	$ 734,110	$ 734,110	$ 734,110	$ 734,110	$ 734,110	$ 734,110	$ 734,110	$ 734,110	$ 734,110	$ 734,110

Notes:

A Annual increases in forecast based on inflation only

B Annual increases in forecast based on inflation and customer growth

C Net property tax revenue for the benefit of the City of Missouri City is based on one of two equivalent concepts:
1) The MUDs will pass along any property tax revenue not needed for debt service, administration, or other services retained by the MUDs in year 1 of the forecast and will continue to pass along this dollar amount each year for the remainder of the forecast; OR
2) The MUDs will decrease property taxes in year 1 of the forecast by an amount equal to the amount identified in 1) and the City of Missouri City will be able to increase rates for these customers by an equal dollar amount.

D The City does not charge its impact fees to the MUDs

E Forecast of existing principal and interest based on debt service schedule for existing debt for each utility

F Forecast of wastewater O&M expense based on 50% inflation plus 50% inflation and customer growth combined less savings projection from eHT report

G Based on the applicable water capital projects in the 2011 eHT report (Table 4-20) updated to today's dollars; does not include any capital costs for the new transmission lines (which are complete) or the new raw water treatment plant (which is already out for bid)

H Based on Option 5 (without WC&ID #2) in the 2018 eHT report (Table 5-1) allocated to the MUDs based on total buildout connection counts

I Assumes inspection fees are negligible and tap fee revenue will increase with inflation and end at buildout

J Developer reimbursements, if any, would remain the obligation of the MUDs

K Assumes depreciation will fully fund capital needs for renewal and replacements

L Annual increases in forecast based on 50% inflation plus 50% inflation and customer growth combined

M Assumed to stay with the MUD

City of Missouri City
Scenario 2: Harris County MUDs

Line No.		Year 17 2036	Year 18 2037	Year 19 2038	Year 20 2039	Year 21 2040	Year 22 2041	Year 23 2042	Year 24 2043	Year 25 2044	Year 26 2045	Year 27 2046	Year 28 2047	Year 29 2048	Year 30 2049
1	**Revenues**														
2	Water Service	$ 2,110,319	$ 2,161,517	$ 2,214,086	$ 2,268,068	$ 2,323,505	$ 2,400,358	$ 2,479,503	$ 2,561,774	$ 2,647,308	$ 2,736,253	$ 2,828,761	$ 2,924,992	$ 2,990,788	$ 3,051,182
3	Property Tax	734,110	734,110	734,110	734,110	734,110	734,110	734,110	734,110	734,110	734,110	734,110	734,110	734,110	734,110
4	Wastewater Service	1,551,715	1,587,349	1,623,871	1,661,306	1,699,679	1,757,778	1,817,861	1,880,380	1,945,445	2,013,173	2,083,683	2,157,104	2,206,083	2,250,664
5	Garbage Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	Other Revenues	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Tap Connection and Inspection Fees	90,547	92,358	94,205	96,089	98,011	99,971	101,970	104,010	106,090	108,212	110,376	112,583	114,835	117,132
8	Water Impact Fee	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	Wastewater Impact Fee	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10		$ 4,486,691	$ 4,575,334	$ 4,666,273	$ 4,759,574	$ 4,855,305	$ 4,992,217	$ 5,133,445	$ 5,280,273	$ 5,432,954	$ 5,591,748	$ 5,756,931	$ 5,928,790	$ 6,045,816	$ 6,153,088
11															
12	**Operating Expenses**														
13	Purchased Water Services	$ 1,038,097	$ 1,059,832	$ 1,082,028	$ 1,104,697	$ 1,127,847	$ 1,154,498	$ 1,181,759	$ 1,209,708	$ 1,238,363	$ 1,267,744	$ 1,297,870	$ 1,328,761	$ 1,356,394	$ 1,383,792
14	Contracted Services	632,288	647,130	662,333	677,907	693,862	711,694	729,843	748,491	767,652	787,343	807,578	828,374	845,785	862,769
15	Repairs & Maintenance	604,874	620,115	635,755	651,804	668,274	686,509	705,017	724,063	743,663	763,834	784,594	805,961	823,042	839,503
16	Professional Fees	401,103	409,125	417,308	425,654	434,167	442,851	451,708	460,742	469,957	479,356	488,943	498,722	508,696	518,870
17	Depreciation & Amortization	441,694	452,877	464,353	476,130	488,218	501,455	514,883	528,698	542,912	557,539	572,589	588,078	600,524	612,534
18	Purchased Sewer Services	161,911	165,194	168,544	171,961	175,448	179,140	182,912	186,766	190,702	194,724	198,832	203,029	207,174	211,375
19	Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	Solid Waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	Utilities	278,820	285,478	292,311	299,323	306,520	315,693	325,110	334,869	344,983	355,467	366,337	377,610	385,925	393,748
22	Purchased Services	82,051	84,496	87,015	89,609	92,280	94,190	96,074	97,996	99,956	101,955	103,994	106,074	108,195	110,359
23		$ 3,640,838	$ 3,724,248	$ 3,809,647	$ 3,897,086	$ 3,986,616	$ 4,086,030	$ 4,187,306	$ 4,291,331	$ 4,398,187	$ 4,507,959	$ 4,620,736	$ 4,736,608	$ 4,835,736	$ 4,932,950
24															
25	**Net Income before Debt Service**	$ 845,853	$ 851,087	$ 856,626	$ 862,487	$ 868,689	$ 906,187	$ 946,138	$ 988,942	$ 1,034,767	$ 1,083,789	$ 1,136,195	$ 1,192,182	$ 1,210,080	$ 1,220,138
26															
27															
28	Capital Improvement Plan - Water														
29	Cost														
30	Principal	$ 72,256	$ 75,914	$ 79,757	$ 83,795	$ 88,037	$ 92,494	$ 97,177	$ 102,096	$ 107,265	$ 112,695	$ 118,400	$ 124,394	$ 130,692	$ 137,308
31	Interest	70,222	66,564	62,721	58,683	54,441	49,984	45,302	40,382	35,213	29,783	24,078	18,084	11,787	5,170
32	Total	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478
33															
34	Capital Improvement Plan - Wastewater														
35	Cost														
36	Principal	$ 149,137	$ 156,687	$ 164,619	$ 172,953	$ 181,709	$ 190,908	$ 200,572	$ 210,726	$ 221,394	$ 232,602	$ 244,378	$ 256,750	$ 269,747	$ 283,403
37	Interest	221,339	213,789	205,856	197,523	188,767	179,568	169,903	159,749	149,081	137,873	126,098	113,726	100,728	87,072
38	Total	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475
39															
40	**Net Income after Debt Service**	$ 332,900	$ 338,133	$ 343,672	$ 349,534	$ 355,735	$ 393,233	$ 433,185	$ 475,989	$ 521,813	$ 570,835	$ 623,241	$ 679,228	$ 697,126	$ 707,184
41															
42	**Net Present Value (at 5% discount rate)**														
43															

Line No.		Year 17 2036	Year 18 2037	Year 19 2038	Year 20 2039	Year 21 2040	Year 22 2041	Year 23 2042	Year 24 2043	Year 25 2044	Year 26 2045	Year 27 2046	Year 28 2047	Year 29 2048	Year 30 2049
44	MUD Revenues														
45	Garbage Service	228,198	232,828	237,552	242,372	247,290	252,308	257,428	262,652	267,981	273,419	278,967	284,628	290,404	296,297
46	Other Revenues	262,073	268,431	274,959	281,663	288,546	297,725	307,164	316,963	327,139	337,708	348,688	360,097	368,127	375,571
47	Revenue Total	$ 490,271	$ 501,259	$ 512,511	$ 524,035	$ 535,837	$ 550,034	$ 564,592	$ 579,615	$ 595,121	$ 611,128	$ 627,656	$ 644,725	$ 658,531	$ 671,867
48															
49	MUD Expenses														
50	Administrative Expenses	$ 73,887	$ 75,364	$ 76,872	$ 78,409	$ 79,977	$ 81,577	$ 83,208	$ 84,872	$ 86,570	$ 88,301	$ 90,067	$ 91,869	$ 93,706	$ 95,580
51	Other	248,501	253,471	258,540	263,711	268,985	274,365	279,852	285,449	291,158	296,982	302,921	308,980	315,159	321,462
52	Solid Waste	227,699	232,253	236,898	241,636	246,469	251,398	256,426	261,554	266,786	272,121	277,564	283,115	288,777	294,553
53	Expense Total	$ 550,086	$ 561,088	$ 572,310	$ 583,756	$ 595,431	$ 607,340	$ 619,486	$ 631,876	$ 644,514	$ 657,404	$ 670,552	$ 683,963	$ 697,642	$ 711,595
54															
55	Debt Service Schedule														
56	Principal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
57	Interest	-	-	-	-	-	-	-	-	-	-	-	-	-	-
58	Total	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
59															
60	Expense and Debt Total	$ 550,086	$ 561,088	$ 572,310	$ 583,756	$ 595,431	$ 607,340	$ 619,486	$ 631,876	$ 644,514	$ 657,404	$ 670,552	$ 683,963	$ 697,642	$ 711,595
61															
62	Net Income before Property Tax	$ (59,815)	$ (59,829)	$ (59,798)	$ (59,721)	$ (59,594)	$ (57,306)	$ (54,895)	$ (52,261)	$ (49,393)	$ (46,276)	$ (42,896)	$ (39,238)	$ (39,111)	$ (39,728)
63															
64	Property Tax	$ 2,218,218	$ 2,262,582	$ 2,307,834	$ 2,353,990	$ 2,401,070	$ 2,449,092	$ 2,498,073	$ 2,548,035	$ 2,598,996	$ 2,650,975	$ 2,703,995	$ 2,758,075	$ 2,813,236	$ 2,869,501
65															
66	Net Property Tax Revenue After Debt & Expenses	$ 2,158,402	$ 2,202,753	$ 2,248,035	$ 2,294,269	$ 2,341,476	$ 2,391,785	$ 2,443,179	$ 2,495,774	$ 2,549,602	$ 2,604,699	$ 2,661,099	$ 2,718,837	$ 2,774,125	$ 2,829,773
67															
68	Net Benefit to the City of Missouri City	$ 734,110	$ 734,110	$ 734,110	$ 734,110	$ 734,110	$ 734,110	$ 734,110	$ 734,110	$ 734,110	$ 734,110	$ 734,110	$ 734,110	$ 734,110	$ 734,110

Schedule 2
Dissolution

City of Missouri City
Scenario 2: Harris County MUDs

Line No.		Actual	Adjustments	Test Year		Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	Year 11 2030	Year 12 2031	Year 13 2032	Year 14 2033	Year 15 2034
1	**Revenues**																			
2	Water Service	$ 1,117,520	$ -	$ 1,117,520	B	$ 1,139,870	$ 1,187,227	$ 1,237,080	$ 1,289,580	$ 1,344,886	$ 1,403,169	$ 1,458,552	$ 1,516,546	$ 1,577,287	$ 1,640,918	$ 1,707,592	$ 1,772,265	$ 1,839,751	$ 1,910,184	$ 1,983,703
3	Property Tax	1,584,168	-	1,584,168	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	Wastewater Service	827,688	-	827,688	B	844,242	878,846	915,285	953,672	994,126	1,036,773	1,077,225	1,119,590	1,163,969	1,210,468	1,259,200	1,306,431	1,355,721	1,407,167	1,460,872
5	Garbage Service	162,225	-	162,225	J	165,470	168,827	172,253	175,749	179,316	182,954	186,667	190,455	194,320	198,263	202,286	206,391	210,579	214,852	219,211
6	Other Revenues	142,375	-	142,375	B	145,223	150,949	156,967	163,293	169,946	176,945	183,623	190,606	197,910	205,551	213,547	221,324	229,430	237,881	246,692
7	Tap Connection and Inspection Fees	64,665	-	64,665	I	65,958	67,277	68,623	69,995	71,395	72,823	74,280	75,765	77,281	78,826	80,403	82,011	83,651	85,324	87,031
8	Water Impact Fee	-	-	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	Wastewater Impact Fee	-	-	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10		$ 3,898,641	$ -	$ 3,898,641		$ 2,360,762	$ 2,453,126	$ 2,550,208	$ 2,652,290	$ 2,759,669	$ 2,872,664	$ 2,980,347	$ 3,092,962	$ 3,210,766	$ 3,334,027	$ 3,463,029	$ 3,588,422	$ 3,719,132	$ 3,855,407	$ 3,997,509
11																				
12	**Operating Expenses**																			
13	Purchased Water Services	$ 686,530	$ -	$ 686,530	J	$ 700,261	$ 718,211	$ 736,685	$ 755,701	$ 775,275	$ 795,427	$ 815,297	$ 835,712	$ 856,690	$ 878,247	$ 900,401	$ 922,483	$ 945,149	$ 968,414	$ 992,297
14	Contracted Services	380,880	-	380,880	J	388,498	401,295	414,552	428,287	442,517	457,261	471,479	486,167	501,343	517,023	533,224	549,113	565,498	582,397	599,825
15	Repairs & Maintenance	338,581	-	338,581	J	345,353	358,889	372,964	387,598	402,814	418,635	433,703	449,317	465,498	482,266	499,642	516,531	533,993	552,048	570,717
16	Professional Fees	286,453	-	286,453	A	292,182	298,026	303,986	310,066	316,267	322,593	329,044	335,625	342,338	349,185	356,168	363,292	370,558	377,969	385,528
17	Depreciation & Amortization	247,505	-	247,505	J K	252,455	262,322	272,581	283,246	294,333	305,861	316,846	328,229	340,024	352,246	364,911	377,224	389,955	403,118	416,727
18	Purchased Sewer Services	245,893	-	245,893	E	237,320	242,358	247,508	252,773	199,455	203,706	208,010	212,407	216,901	140,009	142,976	145,986	149,062	152,204	155,414
19	Other	177,470	-	177,470	A	181,019	184,640	188,333	192,099	195,941	199,860	203,857	207,934	212,093	216,335	220,662	225,075	229,576	234,168	238,851
20	Solid Waste	162,614	-	162,614	A	165,866	169,184	172,567	176,019	179,539	183,130	186,792	190,528	194,339	198,226	202,190	206,234	210,359	214,566	218,857
21	Utilities	158,443	-	158,443	B	161,612	167,407	173,477	179,837	186,505	193,498	200,218	207,227	214,540	222,171	230,137	237,922	246,020	254,444	263,209
22	Purchased Services	47,821	-	47,821	J	48,777	50,489	52,260	54,093	55,991	57,955	59,873	61,855	63,903	66,018	68,203	70,357	72,579	74,872	77,236
23		$ 2,732,190	$ -	$ 2,732,190		$ 2,773,343	$ 2,852,821	$ 2,934,913	$ 3,019,718	$ 3,048,636	$ 3,137,925	$ 3,225,120	$ 3,315,004	$ 3,407,668	$ 3,421,725	$ 3,518,513	$ 3,614,217	$ 3,712,748	$ 3,814,199	$ 3,918,661
24																				
25	**Net Income before Debt Service**	$ 1,166,451	$ -	$ 1,166,451		$ (412,581)	$ (399,695)	$ (384,705)	$ (367,428)	$ (288,967)	$ (265,261)	$ (244,773)	$ (222,041)	$ (196,902)	$ (87,698)	$ (55,484)	$ (25,795)	$ 6,384	$ 41,209	$ 78,848
26																				
27																				
28	Capital Improvement Plan - Water																			
29	Cost	$ 2,158,731			F															
30	Principal					$ 32,788	$ 34,448	$ 36,192	$ 38,024	$ 39,949	$ 41,971	$ 44,096	$ 46,328	$ 48,674	$ 51,138	$ 53,727	$ 56,446	$ 59,304	$ 62,306	$ 65,461
31	Interest					109,690	108,031	106,287	104,454	102,530	100,507	98,382	96,150	93,805	91,341	88,752	86,032	83,174	80,172	77,018
32	Total					$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478
33																				
34	Capital Improvement Plan - Wastewater																			
35	Cost	$ 5,613,185			G															
36	Principal					$ 8,526	$ 8,957	$ 9,411	$ 9,887	$ 65,804	$ 69,135	$ 72,635	$ 76,312	$ 80,175	$ 105,548	$ 110,891	$ 116,505	$ 122,403	$ 128,600	$ 135,111
37	Interest					28,522	28,090	27,637	27,161	212,053	208,722	205,222	201,545	197,681	264,927	259,584	253,970	248,072	241,875	235,365
38	Total					$ 37,048	$ 37,048	$ 37,048	$ 37,048	$ 277,857	$ 277,857	$ 277,857	$ 277,857	$ 277,857	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475
39																				
40	Defease Existing MUD Debt and Developer Reimbursement Obligations																			
41	Cost	$ 4,925,000			H															
42	Principal					$ 74,803	$ 78,590	$ 82,569	$ 86,749	$ 91,140	$ 95,754	$ 100,602	$ 105,695	$ 111,046	$ 116,667	$ 122,574	$ 128,779	$ 135,298	$ 142,148	$ 149,344
43	Interest					250,252	246,465	242,486	238,306	233,914	229,300	224,453	219,360	214,009	208,387	202,481	196,276	189,756	182,907	175,711
44	Total					$ 325,055	$ 325,055	$ 325,055	$ 325,055	$ 325,055	$ 325,055	$ 325,055	$ 325,055	$ 325,055	$ 325,055	$ 325,055	$ 325,055	$ 325,055	$ 325,055	$ 325,055
45																				
46	Total Debt Service					$ 504,580	$ 504,580	$ 504,580	$ 504,580	$ 745,389	$ 745,389	$ 745,389	$ 745,389	$ 745,389	$ 838,008	$ 838,008	$ 838,008	$ 838,008	$ 838,008	$ 838,008
47																				
48	**Net Income after Debt Service**					$ (917,161)	$ (904,275)	$ (889,285)	$ (872,009)	$ (1,034,356)	$ (1,010,650)	$ (990,162)	$ (967,431)	$ (942,291)	$ (925,706)	$ (893,492)	$ (863,803)	$ (831,624)	$ (796,799)	$ (759,161)
49																				
50	**Net Present Value (at 5% discount rate)**	($12,393,853)																		

City of Missouri City
Scenario 2: Harris County MUDs

Schedule 2
Dissolution

Line No.		Actual	Adjustments	Test Year	Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	Year 11 2030	Year 12 2031	Year 13 2032	Year 14 2033	Year 15 2034

Notes:

A Annual increases in forecast based on inflation only

B Annual increases in forecast based on inflation and customer growth

C There will no longer be MUD property taxes under this option

D The City does not charge its impact fees to the MUDs

E Forecast of wastewater O&M expense based on 50% inflation plus 50% inflation and customer growth combined less savings projection from eHT report

F Based on the applicable water capital projects in the 2011 eHT report (Table 4-20) updated to today's dollars; does not include any capital costs for the new transmission lines (which are complete) or the new raw water treatment plant (which is already out for bid)

G Based on Option 5 (without WC&ID #2) in the 2018 eHT report (Table 5-1) allocated to the MUDs based on total buildout connection counts

H Based on total principal outstanding on all existing MUD debt

I Assumes inspection fees are negligible and tap fee revenue will increase with inflation and end at buildout

J Annual increases in forecast based on 50% inflation plus 50% inflation and customer growth combined

K Assumes depreciation will fully fund capital needs for renewal and replacements

City of Missouri City
Scenario 2: Harris County MUDs

Line No.		Year 16 2035	Year 17 2036	Year 18 2037	Year 19 2038	Year 20 2039	Year 21 2040	Year 22 2041	Year 23 2042	Year 24 2043	Year 25 2044	Year 26 2045	Year 27 2046	Year 28 2047	Year 29 2048	Year 30 2049
1	**Revenues**															
2	Water Service	$ 2,060,454	$ 2,110,319	$ 2,161,517	$ 2,214,086	$ 2,268,068	$ 2,323,505	$ 2,400,358	$ 2,479,503	$ 2,561,774	$ 2,647,308	$ 2,736,253	$ 2,828,761	$ 2,924,992	$ 2,990,788	$ 3,051,182
3	Property Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	Wastewater Service	1,516,945	1,551,715	1,587,349	1,623,871	1,661,306	1,699,679	1,757,778	1,817,861	1,880,380	1,945,445	2,013,173	2,083,683	2,157,104	2,206,083	2,250,664
5	Garbage Service	223,660	228,198	232,828	237,552	242,372	247,290	252,308	257,428	262,652	267,981	273,419	278,967	284,628	290,404	296,297
6	Other Revenues	255,881	262,073	268,431	274,959	281,663	288,546	297,725	307,164	316,963	327,139	337,708	348,688	360,097	368,127	375,571
7	Tap Connection and Inspection Fees	88,771	90,547	92,358	94,205	96,089	98,011	99,971	101,970	104,010	106,090	108,212	110,376	112,583	114,835	117,132
8	Water Impact Fee	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	Wastewater Impact Fee	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10		$ 4,145,710	$ 4,242,852	$ 4,342,483	$ 4,444,674	$ 4,549,498	$ 4,657,031	$ 4,808,140	$ 4,963,926	$ 5,125,778	$ 5,293,964	$ 5,468,765	$ 5,650,476	$ 5,839,404	$ 5,970,237	$ 6,090,845
11																
12	**Operating Expenses**															
13	Purchased Water Services	$ 1,016,813	$ 1,038,097	$ 1,059,832	$ 1,082,028	$ 1,104,697	$ 1,127,847	$ 1,154,498	$ 1,181,759	$ 1,209,708	$ 1,238,363	$ 1,267,744	$ 1,297,870	$ 1,328,761	$ 1,356,394	$ 1,383,792
14	Contracted Services	617,800	632,288	647,130	662,333	677,907	693,862	711,694	729,843	748,491	767,652	787,343	807,578	828,374	845,785	862,769
15	Repairs & Maintenance	590,021	604,874	620,115	635,755	651,804	668,274	686,509	705,017	724,063	743,663	763,834	784,594	805,961	823,042	839,503
16	Professional Fees	393,239	401,103	409,125	417,308	425,654	434,167	442,851	451,708	460,742	469,957	479,356	488,943	498,722	508,696	518,870
17	Depreciation & Amortization	430,798	441,694	452,877	464,353	476,130	488,218	501,455	514,883	528,698	542,912	557,539	572,589	588,078	600,524	612,534
18	Purchased Sewer Services	158,694	161,911	165,194	168,544	171,961	175,448	179,140	182,912	186,766	190,702	194,724	198,832	203,029	207,174	211,375
19	Other	243,628	248,501	253,471	258,540	263,711	268,985	274,365	279,852	285,449	291,158	296,982	302,921	308,980	315,159	321,462
20	Solid Waste	223,234	227,699	232,253	236,898	241,636	246,469	251,398	256,426	261,554	266,786	272,121	277,564	283,115	288,777	294,553
21	Utilities	272,331	278,820	285,478	292,311	299,323	306,520	315,693	325,110	334,869	344,983	355,467	366,337	377,610	385,925	393,748
22	Purchased Services	79,676	82,051	84,496	87,015	89,609	92,280	94,190	96,074	97,996	99,956	101,955	103,994	106,074	108,195	110,359
23		$ 4,026,233	$ 4,117,038	$ 4,209,971	$ 4,305,085	$ 4,402,433	$ 4,502,070	$ 4,611,793	$ 4,723,584	$ 4,838,335	$ 4,956,131	$ 5,077,062	$ 5,201,221	$ 5,328,702	$ 5,439,672	$ 5,548,965
24																
25	**Net Income before Debt Service**	$ 119,477	$ 125,814	$ 132,512	$ 139,589	$ 147,065	$ 154,961	$ 196,347	$ 240,342	$ 287,443	$ 337,833	$ 391,703	$ 449,255	$ 510,702	$ 530,564	$ 541,880
26																
27																
28	Capital Improvement Plan - Water															
29	Cost															
30	Principal	$ 68,775	$ 72,256	$ 75,914	$ 79,757	$ 83,795	$ 88,037	$ 92,494	$ 97,177	$ 102,096	$ 107,265	$ 112,695	$ 118,400	$ 124,394	$ 130,692	$ 137,308
31	Interest	73,704	70,222	66,564	62,721	58,683	54,441	49,984	45,302	40,382	35,213	29,783	24,078	18,084	11,787	5,170
32	Total	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478	$ 142,478
33																
34	Capital Improvement Plan - Wastewate															
35	Cost															
36	Principal	$ 141,950	$ 149,137	$ 156,687	$ 164,619	$ 172,953	$ 181,709	$ 190,908	$ 200,572	$ 210,726	$ 221,394	$ 232,602	$ 244,378	$ 256,750	$ 269,747	$ 283,403
37	Interest	228,525	221,339	213,789	205,856	197,523	188,767	179,568	169,903	159,749	149,081	137,873	126,098	113,726	100,728	87,072
38	Total	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475	$ 370,475
39																
40	Defease Existing MUD Debt and Develc															
41	Cost															
42	Principal	$ 156,904	$ 164,848	$ 173,193	$ 181,961	$ 191,173	$ 200,851	$ 211,019	$ 221,702	$ 232,926	$ 244,717	$ 257,106	$ 270,122	$ 283,797	$ 298,164	$ 313,259
43	Interest	168,150	160,207	151,861	143,093	133,882	124,204	114,035	103,353	92,129	80,337	67,948	54,932	41,257	26,890	11,796
44	Total	$ 325,055	$ 325,055	$ 325,055	$ 325,055	$ 325,055	$ 325,055	$ 325,055	$ 325,055	$ 325,055	$ 325,055	$ 325,055	$ 325,055	$ 325,055	$ 325,055	$ 325,055
45																
46	Total Debt Service	$ 838,008	$ 838,008	$ 838,008	$ 838,008	$ 838,008	$ 838,008	$ 838,008	$ 838,008	$ 838,008	$ 838,008	$ 838,008	$ 838,008	$ 838,008	$ 838,008	$ 838,008
47																
48	**Net Income after Debt Service**	$ (718,531)	$ (712,194)	$ (705,497)	$ (698,419)	$ (690,943)	$ (683,047)	$ (641,661)	$ (597,667)	$ (550,565)	$ (500,175)	$ (446,305)	$ (388,753)	$ (327,306)	$ (307,444)	$ (296,128)
49																

Appendix I
NewGen Report on Scenario 3: Inside City MUDs

NewGen Strategies & Solutions
3420 Executive Center Drive
Suite 165
Austin, TX 78731
Phone: (512) 479-7900

Memorandum

To: Greenberg Traurig, P.A.

From: Dave Yanke, President – Environmental Practice, NewGen
Grant Rabon, Executive Consultant, NewGen

Date: July 30, 2019

Re: **Missouri City Feasibility Analysis Regarding Regionalization of Water/Wastewater Utility Providers for the City and the City's Extra Territorial Jurisdiction (Study): Financial Feasibility – Scenario 3: Inside City MUDs**

Background

Greenberg Traurig, P.A., retained NewGen Strategies & Solutions, LLC (NewGen) to provide a financial feasibility analysis related to the Study, including evaluating several Study consolidation scenarios as directed by City staff regarding the potential consolidation of several municipal utility districts (MUDs) located in and/or near the City of Missouri City (City) with the City's existing water/wastewater utility systems. In establishing the scenarios to analyze, NewGen with input from City staff identified geographically, technically, and developmentally related MUDs to be considered as natural groupings for consolidation.

As part of the Inside City MUDs scenario analysis, NewGen evaluated the forecasted customer growth, revenue, capital costs, debt service, and operations and maintenance (O&M) costs over a 30-year period (FY 2020 – FY 2049) to evaluate the financial impact that a consolidation may have on the City.

Methodology

For the Inside City MUDs scenario, NewGen studied the following MUDs in two sub-scenarios.

Scenario 3.1:

- Quail Valley Utility District (Quail Valley)
- Thunderbird Utility District (Thunderbird)

Scenario 3.2:

- Palmer Plantation MUD #1
- Palmer Plantation MUD #2
- Blue Ridge West MUD
- First Colony MUD #9

- Fort Bend County MUD #26
- Fort Bend County MUD #42
- Fort Bend County MUD #46
- Fort Bend County MUD #47
- Fort Bend County MUD #48
- Fort Bend County MUD #49
- Fort Bend County MUD #115
- Meadowcreek MUD

Although Scenario 3 did not originally contemplate having sub-scenarios, there was sufficient differences between the Scenario 3.1 MUDs (Quail Valley and Thunderbird) and all of the other MUDs in Scenario 3 to warrant separation and additional analysis. First, neither Quail Valley nor Thunderbird currently assesses or collects MUD property taxes and, instead, fund their MUD operations through user fees. Also, neither MUD shows any outstanding debt or developer reimbursement obligations on their most recent available annual financial statements.[1] Thus, these MUDs were sufficiently different from the other MUDs in Scenario 3 to justify segregation from the rest of the Scenario 3 MUDs.

Further, although Missouri City Management District #1 and Missouri City Management District #2 were originally identified to be included in Scenario 3, these two MUDs were excluded from the Study because they have no current customers and did not have any forecasted customers. Further, they have negligible operating expenses (primarily legal, accounting, or other contract service) that are primarily offset by advances or loans. Thus, their inclusion was not meaningful to the Study.

The most recently available financial audits for each MUD were used to develop a test year for the utilities. A test year reflects expected recurring revenue and expense line items, including existing debt service. The test year was then used to develop a 30-year forecast. Table 1 shows the revenue and expense categories used for the 30-year forecast, as applicable.

All categories were forecasted to increase at 2% per year to reflect inflation, except the bolded categories, which were forecasted based on a combination of inflation and customer growth (as identified in the footnotes of Table 1). For customer growth, NewGen utilized the growth projections from the 2018 Regional Water & Wastewater Planning Study Update (2018 eHT Study) prepared by Enprotec/Hibbs & Todd, Inc. (eHT) for the Study, which were validated by City staff. Table 2 shows the connection projections for the Inside City MUDs in this scenario. Note that NewGen did not independently verify the eHT projections, and any material change in actual customer growth (compared with the projections) could have a material impact on the financial analyses.

[1] Meadowcreek MUD and Palmer Plantation MUD #1 also have no outstanding debt or developer reimbursement obligations and the amount of debt outstanding for Fort Bend County MUD #49 is less than $0.5 million, but all of these MUDs utilize MUD property tax revenues in addition to user fees.

Table 1
Revenue and Expense Categories

Revenues	Expenses
Contracted Wastewater Fees	Administrative Expenses
Garbage Service[1]	Capital Outlay
Groundwater Reduction Fees[2]	Connection Fees
Other Revenues[2]	Contracted Services[1]
Other Tax	Depreciation & Amortization[1]
Participant Billings[2]	Groundwater Reduction Fees
Property Tax	Lease
Surface Water Fees[2]	Other
Tap Connection and Inspection Fees	Professional Fees
Wastewater Service[2]	Purchase of Capacity
Water Service[2]	Purchased Services[1]
Water Impact Fee	Purchased Sewer Services[1]
Wastewater Impact Fee	Purchased Water Services[1]
	Renewals & Replacements
	Repairs & Maintenance[1]
	Salaries and Benefits
	Solid Waste
	Surface Water Fee[2]
	Utilities[2]
	Payments to Master ("Connection Charges")[2]

1. Annual growth in forecast based on 50% inflation plus 50% inflation and customer growth combined
2. Annual growth in forecast based on inflation and customer growth

Table 2
Connection Projections [1]

MUD	Current	2020	2025	2030	2035	2040	Build Out
Scenario 3.1							
Quail Valley Utility District	4,439	4,443	4,453	4,463	4,473	4,483	4,514
Thunderbird Utility District	1,944	1,951	1,969	1,986	1,986	1,986	1,986
Scenario 3.2							
Blue Ridge West MUD	2,482	2,482	2,482	2,482	2,482	2,482	2,509
First Colony MUD #9	2,685	2,687	2,692	2,697	2,702	2,707	3,300
Fort Bend Colony MUD #26	1,502	1,507	1,518	1,529	1,540	1,552	2,145
Fort Bend Colony MUD #42	1,350	1,362	1,391	1,421	1,450	1,479	1,507
Fort Bend Colony MUD #46	784	784	784	784	784	784	1,073
Fort Bend Colony MUD #47	651	700	822	944	1,000	1,000	1,000
Fort Bend Colony MUD #48	1,198	1,293	1,529	1,671	1,671	1,671	1,671
Fort Bend Colony MUD #49	347	349	354	359	364	369	396
Fort Bend Colony MUD #115	571	571	571	571	571	571	580
Meadowcreek	848	852	862	872	882	892	985
Palmer Plantation MUD #1	652	654	659	664	669	674	798
Palmer Plantation MUD #2	821	825	835	845	855	865	1,000
Not Included in Analysis							
Missouri City Management District #1 [2]	-	-	-	-	-	-	-
Missouri City Management District #2 [2]	-	-	-	-	-	-	-
Total Connections	20,274	20,460	20,921	21,288	21,429	21,515	23,464

1. Source: 2018 Regional Water & Wastewater Planning Study Update by eHT
2. No projections available

NewGen developed its scenario analysis based on two potential consolidation implementation structures – 1) dissolution of each MUD and assumption by the City of each MUD's assets (including both water/wastewater assets and all other assets of the MUD) and liabilities (including MUD debt and all operating expense obligations); and 2) voluntary transfer by each MUD of its water/wastewater utility assets to the City, with each MUD continuing in existence.

Asset Acquisition

In the asset acquisition option, the MUDs would continue to exist to provide non-utility services (parks, roads, etc.), and to service outstanding water/wastewater debt. In this option, the MUD would continue to levy and collect at current levels the MUD property taxes to fund its administrative costs, remaining operating expenses, and existing debt service, which would not be assumed by the City but would be retired by the MUDs in the ordinary course of business. The scenario assumes that the City would continue the existing MUD utility rates in place, with annual adjustments for inflation, and would not raise rates to fund the acquisition. The scenario also assumes that the MUD will continue to collect the water/wastewater operating expenses imbedded in the MUDs property tax levy and transfer those funds

to the City for the same purpose. For purposes of our financial analyses, we have assumed that the amount the MUD collects from property taxes in excess of its administrative costs, non-utility operating expenses, and debt service is equal to the portion of water/wastewater utility operating expenses currently used in addition to revenues from utility rates to fund its water/wastewater utility service (i.e., the subsidy). This available property tax portion for funding water/wastewater utility operating costs would be transferred annually to the City to pay the water/wastewater operating costs not covered by rate revenues (mirroring the existing funding mechanism of the MUDs).[2]

MUD Dissolution

In the MUD dissolution option, the City would dissolve the MUDs, which would cause the MUDs to cease to exist as governmental entities. By law, upon dissolution of the MUDs, the City would obtain title to all of the MUDs' assets and assume all the MUDs' expenses, debts and other obligations. The City would not assume the MUDs' ability to levy a MUD property tax to fund the expenses, debts and other assumed obligations, and would have to identify other funding sources within the City to pay such assumed obligations. The MUDs in Scenario 3.1 do not appear to be using property tax revenues to pay any operating expenses or debt and, therefore, the loss of MUD property tax as a funding source does not impact Scenario 3.1. However, since the MUDs in Scenario 3.2 are using MUD property tax revenue to pay water/wastewater utility debt, and to supplement utility and other service rate revenues to pay operating expenses, the loss of MUD property tax revenue support has a very negative effect on the financial feasibility of Scenario 3.2. Under Scenario 3.2, the former MUD water/wastewater customers would face a lower overall tax burden as the MUD property tax expired, but the City would have to either substantially raise the former MUD customers' water/wastewater utility rates, or allocate general City tax revenues to subsidize the cost of water/wastewater utility service to the former MUD customers. In addition, the existing debt and developer reimbursement obligations of each MUD in Scenario 3.2 would have to be immediately paid off by the City via a new debt issuance by the City, with the City funding the debt service either through increased water/wastewater utility or other service user rates or City general fund revenues. Note: The City could not assume the Scenario 3.2 MUDs' existing debt as the debt is secured by MUD property taxes, which the City would have no recourse to. Finally, under both Scenario 3.1 and Scenario 3.2, the City would have to assume the provision of all other governmental services being provided by the MUDs in addition to water/wastewater services, again without recourse to any MUD property tax levies currently funding operation of those other services.

Capital Plans

Upon acquisition of the MUDs water/wastewater facilities for both sub-scenarios under both the dissolution and asset acquisition options, the City would assume the continuing obligation to maintain, upgrade, expand and replace the water/wastewater utility system infrastructure acquired, as conveyed in a Capital Improvement Plan (CIP). Based on input from eHT, the water/wastewater CIP were assumed to be the same in both the MUD dissolution and asset acquisition options.

[2] Alternatively, for the purposes of this analysis, the assumption could equally be that the City would be able to increase utility revenues equal to the subsidy in the first year of the forecast. However, factoring in political considerations NewGen believes that option is less likely.

The relevant water CIP projects were taken from Table 4-20 of the 2011 Regional Water and Wastewater Planning Study (2011 eHT Study) developed by eHT. Since the CIP project costs in the 2011 eHT Study were not in current dollars, NewGen increased the costs taken from the 2011 eHT Study by either approximately 3.6%[3] per year for interconnection projects or approximately 1.3%[4] per year for elevated storage tank projects. While the 2011 eHT Study lists 15 different water interconnection and storage projects, for this analysis NewGen focused on the projects directly related to the Inside City MUDs. In this case, NewGen identified several relevant water projects and allocated the costs to the relevant participants based on build out connection counts, as shown in Schedule 3 (in 2011 dollars), and then inflated the costs to 2019 dollars. The water capital costs included in the analysis are listed in Table 3 and assumed to be incurred in the first year of the forecast.

For wastewater CIP projects, per input from eHT and City staff, the most cost-effective means of providing wastewater service to the area would be to consolidate down to two master regional wastewater treatment plants (WWTPs) as seen in Option 5 in Table 5-1 in the 2018 eHT Study. Since the costs for this project cannot be pinpointed to each individual MUD, the costs were allocated based on the total build out size of each participant, as found in the 2018 eHT Study. The wastewater project cost shown in Table 3 represents the pro-rata share allocated to the Inside City MUDs.

Table 3
Capital Projects

Utility	Project Description	Project Cost
Scenario 3.1		
Water	New Interconnects	$180,472 [1]
Water	New Elevated Storage Tanks	$4,121,213 [1]
Wastewater	Consolidation into two master regional WWTPs (without WC&ID #2)	$10,149,014 [2]
Scenario 3.2		
Water	New Interconnects	$958,604 [1]
Water	New Elevated Storage Tanks	$2,486,626 [1]
Wastewater	Consolidation into two master regional WWTPs (without WC&ID #2)	$26,487,364 [2]

1. Costs have been inflated to 2019 dollars using an appropriate inflation factor and project cost reflects pro-rata share of the overall project cost based on build out connection counts of all participants in the project
2. Project cost reflects pro-rata share of the overall project cost based on build out connection counts of all participants in the project

[3] Based on the annualized change in the Handy Whitman Index cost for water mains (NARUC 331) within the South Central region of the country between January 2011 and January 2018

[4] Based on the annualized change in the Handy Whitman Index cost for elevated steel tanks (NARUC 330) within the South Central region of the country between January 2011 and January 2018

Since there are no projected revenues identified currently to fund the CIP, we have assumed the City would fund the CIP with the issuance of new debt, supported by customer utility revenue or property tax revenues. The timing of debt incurred to fund the wastewater CIP is assumed to be 10% of the total in year 1 of the forecast, 65% in year 5, and the remaining 25% in year 10. It is assumed that all capital projects will be debt funded over a 30-year term with a 5% interest rate and a 2% issuance fee.

Implementation of the wastewater CIP presents opportunities for O&M cost savings. By modernizing and consolidating facilities, eHT estimates that the overall wastewater O&M cost should decrease by approximately 54%[5] when compared to the status quo. Similar to the capital spending, the O&M savings are assumed to be phased in over time. The cost savings were applied in the financial forecast to the Purchased Sewer Services line item as well as the more general Purchased Services line item. Since Purchased Services presumably includes both water and wastewater expenses, NewGen assumed a 60/40 split in Purchased Services between water and sewer, respectively, for the purpose of calculating the wastewater O&M cost savings. The timing for the utility debt issuances and the O&M savings is shown in Table 4.

Table 4
Capital Project Debt and Savings Schedule

	Debt Issuance [1]		O&M [2]	
Year	Capital Debt %	Cumulative %	O&M Savings %	Cumulative %
2020	10%	10%	10%	10%
2024	65%	75%	40%	50%
2029	25%	100%	50%	100%

1. 10% of debt is issued in 2020, 65% of debt in 2024, and 25% in 2029 based on input from eHT
2. 10% of the 54% total O&M savings is realized in 2020, an additional 40% in 2024, and the final 50% in 2029 based on input from eHT

It is assumed that the depreciation (a non-cash item) included within the cash flow forecast will sufficiently fund any necessary capital renewals and replacements. It is also assumed that the CIP projects identified in Table 3 and the O&M savings discussed in the 2018 eHT report are realized as forecasted.

Analysis

Methodology

NewGen's analysis for both sub-scenarios under both options will focus on changes in revenue, operating expenses, and debt service expenses. Table 5 summarizes several of the key differences between an asset acquisition and a dissolution under the two sub-scenarios.

[5] Per Table 5-1 in the 2018 eHT Study

Table 5
Relevant Components for Each Option

Asset Acquisition	Dissolution
Revenues • Water Service • Property Tax Support [1, 2] • Wastewater Service • Tap Connection & Inspection Fees • Participant Billings • Surface Water Fees	Revenues • Water Service • No Property Taxes • Wastewater Service • Garbage Service (if any) • Other Revenues • Tap Connection & Inspection Fees • Participant Billings • Surface Water Fees • Other Tax
Operating Expenses • Treated the same, except excludes "Other" operating expenses (e.g., solid waste), which remain with the MUD	Operating Expenses • Treated the same, except includes "Other" operating expenses (e.g., solid waste)
Debt Service • Debt Service for new capital projects	Debt Service • Debt Service for new capital projects • Plus MUD Debt defeasance costs • Plus MUD developer reimbursement obligations

1. MUD Property Tax Revenue + Revenues for services retained by the MUD – MUD Debt Service – Expenses for services retained by the MUD = Portion of Tax Revenue Assigned to the City
   Example Scenario 3.2: Property Tax Revenue in 2020 = $16,746,850;
   Other MUD revenue for services in 2020 = $2,914,933;
   MUD Expenses for services in 2020 = $2,099,634; MUD Debt Service in 2020 = $9,453,958;
   City Tax Revenue Portion = $16,746,850 + $2,914,933 – $2,099,634 – $9,453,958 = $8,108,190
2. Amount City receives in 2020 is constant throughout the 30-year forecast.

Asset Acquisition

In the asset acquisition option, one key assumption for Scenario 3.2 involves the continuation of property tax revenue collected by the MUD to offset water/wastewater operating costs. This tax revenue will then be transferred to the City by the MUDs to supplement water/wastewater utility rate revenues. Table 6 and Table 7 show the cash flow for both sub-scenarios in the asset acquisition option. Schedule 1 shows a detailed breakdown of the cash flow. NewGen also assumes after asset acquisition Quail Valley will continue to operate the MUDs it currently operates and the other MUD operators continue to operate the MUDs they currently operate, although this assumption does not have an impact on the analysis.

Table 6
Cash Flow Analysis – Asset Acquisition – Scenario 3.1

Categories	2020	2025	2030	2035	2040	2045	2049
Revenues[1]	$11,088,170	$12,279,845	$13,598,556	$15,041,750	$16,638,051	$18,403,884	$19,950,570
Expenses[2]	11,479,049	12,594,399	13,787,972	15,234,303	16,832,332	18,598,046	20,143,080
Net Income before Debt Service	($390,879)	($314,554)	($189,416)	($192,553)	($194,282)	($194,162)	($192,510)
Debt Service[3]	350,900	786,298	953,760	953,760	953,760	953,760	953,760
Net Income after Debt Service	($741,779)	($1,100,852)	($1,143,176)	($1,146,312)	($1,148,041)	($1,147,921)	($1,146,269)

1. No property taxes included
2. Includes operating expenses except debt service
3. Debt service on debt to be issued by the City to fund the CIP

As shown in Table 6, the Scenario 3.1 MUDs are forecast to shortly need additional rate revenues to be self-supporting. This is due, in part, to the relatively small operating under-recovery, which narrows over the forecast period but does not disappear. The operating under-recoveries are consistent with (and actually less than) the under-recovery both Quail Valley and Thunderbird reported in 2016 and 2017, which appear to be purposeful and were funded from reserves. For example, Thunderbird budgeted a $411,216 decrease in fund balance in 2017. It is not clear why these MUDs are purposefully drawing down on their fund balance reserves. Once new debt service is added to these operating under-recoveries, the net income after debt service is forecasted to be meaningfully negative (unless MUD reserves were used to offset losses together with rate increases).

As shown in Table 7, Scenario 3.2 is forecasted to have positive net income after debt service in the first half of the 30-year forecast and then negative net income after debt service in the second half of the 30-year forecast. This is the result of operating expenses growing faster than revenues, which is, in part, due to the fact that the dollar amount of property tax revenues shared with the City is assumed to be the same in each year of the forecast, which may be an overly conservative assumption.

Table 7
Cash Flow Analysis – Asset Acquisition – Scenario 3.2

Categories	2020	2025	2030	2035	2040	2045	2049
Revenues[1]	$22,239,904	$24,109,279	$26,126,172	$28,066,349	$30,079,655	$32,533,574	$34,619,521
Expenses[2]	19,225,289	21,233,602	23,304,419	25,868,773	28,671,661	31,777,850	34,476,067
Net Income before Debt Service	$3,014,615	$2,875,677	$2,821,753	$2,197,576	$1,407,994	$755,724	$143,453
Debt Service[3]	402,207	1,538,531	1,975,579	1,975,579	1,975,579	1,975,579	1,975,579
Net Income after Debt Service	$2,612,408	$1,337,145	$846,174	$221,997	($567,585)	($1,219,855)	($1,832,126)

1. Includes the share of property taxes assumed to be transferred to the City by the MUDs
2. Includes operating expenses except debt service
3. Debt service on debt to be issued by the City to fund the CIP

Dissolution

One of the key differences between the MUDs dissolution option and the asset acquisition option for Scenario 3.2 is the need for the City to repay existing MUD debt (and other financial obligations). This amounts to approximately $67.8 million of current debt principal to be repaid for the Scenario 3.2 MUDs. The City will also inherit the responsibility for all outstanding Scenario 3.2 developer reimbursement obligations in Scenario 3.2, which currently amount to an additional $15.4 million. (Since the Scenario 3.1 MUDs do not appear to have any debt or outstanding developer reimbursement obligations these differences do not apply to Scenario 3.1). It is important to recognize that these obligations reflect a snapshot in time and these obligations could increase meaningfully in a short period of time. For example, each MUD could (and, in the case of Scenario 3.2, likely will) issue additional debt. Also, some MUDs are already committed to additional developer reimbursement obligations that are not yet reflected on the MUDs' balance sheets (or the amount listed above) because the projects are not yet complete. In the analysis, the defeasance of existing Scenario 3.2 MUD debt and payment of currently outstanding developer reimbursement obligations is facilitated by a new debt issue with the same term, rate, and issuance fees assumptions as the issuances for capital projects.

A second key difference between the Scenario 3.2 MUDs dissolution option and the asset acquisition option is the loss of MUD property tax revenues to fund water/wastewater operating expenses. Table 8 and Table 9 show cash flow analyses for the dissolution option for both Scenario 3.1 and Scenario 3.2, respectively. Schedule 2 shows a detailed breakdown of the cash flow.

Table 8
Cash Flow Analysis – Dissolution – Scenario 3.1

Categories	2020	2025	2030	2035	2040	2045	2049
Revenues[1]	$11,500,427	$12,736,704	$14,104,779	$15,601,614	$17,257,238	$19,088,685	$20,692,834
Expenses[2]	11,479,049	12,594,399	13,787,972	15,234,303	16,832,332	18,598,046	20,143,080
Net Income before Debt Service	$21,378	$142,305	$316,807	$367,311	$424,905	$490,639	$549,754
Debt Service[3]	350,900	786,298	953,760	953,760	953,760	953,760	953,760
Net Income after Debt Service	($329,522)	($643,994)	($636,953)	($586,448)	($528,854)	($463,121)	($404,005)

1. Includes no property taxes
2. Includes operating expenses except debt service
3. Debt service on debt to be issued by the City to fund the CIP

As shown in Table 8, the dissolution option for Scenario 3.1 results in relatively small negative net income after debt service over the entire analysis period, though with higher losses in some years and lower losses in other, due primarily to the timing of funding of the CIP and realization of operating cost reductions after completion of the CIP. Thus, dissolution could be self-supporting eventually, with the need to provide general tax infusions in certain years or modest additional revenue support through user fees. This is possible because the MUDs in Scenario 3.1 do not have outstanding debt or developer reimbursement obligations.

Table 9
Cash Flow Analysis – Dissolution – Scenario 3.2

Categories	2020	2025	2030	2035	2040	2045	2049
Revenues[1]	$17,046,647	$19,285,579	$21,706,233	$24,063,690	$26,526,285	$29,478,054	$31,999,231
Expenses[2]	20,789,657	22,960,791	25,211,375	27,974,206	30,996,229	34,344,361	37,254,142
Net Income before Debt Service	($3,743,010)	($3,675,212)	($3,505,142)	($3,910,517)	($4,469,944)	($4,866,307)	($5,254,911)
Debt Service[3]	5,892,471	7,028,795	7,465,842	7,465,842	7,465,842	7,465,842	7,465,842
Net Income after Debt Service	($9,635,481)	($10,704,006)	($10,970,984)	($11,376,359)	($11,935,786)	($12,332,149)	($12,720,753)

1. Includes no property taxes
2. Includes operating expenses except debt service
3. Debt service on debt to be issued by the City to repay the MUDs' outstanding debt, repay all outstanding developer reimbursement obligations, and fund the CIP

As shown in Table 9, the dissolution option for Scenario 3.2 results in significant operating losses even before any capital or debt service is considered. This is primarily due to the loss of property tax revenues. Thus, dissolution is not forecasted to be self-supporting in Scenario 3.2.

Net Present Value Analysis

NewGen developed a net present value (NPV) analysis that calculates the payback, if any, from each option over a 30-year period based on the net income after debt service and operating expenses for both sub-scenarios. The NPV analysis takes into account the relative timing of CIP and O&M expenditures and the impact they have on cash flow. If the NPV is negative, it indicates the existing water/wastewater utility revenues (even with customer growth and adjustments to rates for inflation) are not sufficient to keep the City from having to financially support the MUDs water/wastewater expenses from utility rate increases and/or general City revenues. In calculating the NPV analysis, NewGen utilized a 5% discount rate.

Table 10 summarizes the NPV for each sub-scenario for each option over the FY 2020 – FY 2049 timeframe. An asset acquisition for Scenario 3.1 would result in a negative NPV of approximately $16.1 million, unless anticipated user rate increases by the MUDs to fund future CIP programs that the MUDs anticipate (outside of the acquisition option) are considered; in which case the NPV would be closer to a break-even. An asset acquisition for Scenario 3.2 would result in a positive NPV of approximately $11.8 million, which could be used to upgrade utility systems, reduce the need for general fund support, or reduce assumed future rate increases. Dissolution would result in a negative NPV of approximately $8.0 million for Scenario 3.1 and $169.1 million for Scenario 3.2. For the dissolution option to break-even (on an NPV basis) the City would need to increase water/wastewater utility rate revenue or general fund subsidy by approximately $520,000 per year for Scenario 3.1 and approximately $11.0 million per year for Scenario 3.2 over the 30-year forecast.

Table 10
Net Present Value Analysis

Option	NPV [1]	
Scenario 3.1		
Asset Acquisition	($16,058,088)	unfavorable
Dissolution	($8,018,183)	unfavorable [2]
Scenario 3.2		
Asset Acquisition	$11,779,472	favorable
Dissolution	($169,120,624)	unfavorable

1. Based on a 5% discount rate
2. Relatively close to breakeven

Findings

Based on NewGen's financial analysis, we make the following findings as part of the Study for consideration by the City:

1. Although an asset acquisition for Scenario 3.1 has a negative NPV, this is due, in part, to programmatic operating under-recovery strategies by Quail Valley and Thunderbird and current rates not yet reflecting funding of anticipated CIP programs identified by these MUDs, which NewGen assumes will require rate increases. Annual revenue increases (or expense reductions) of approximately $1.0 million per year would yield a breakeven NPV.

2. The dissolution option for Scenario 3.1 has a negative NPV, but is relatively close to breakeven on an NPV basis due, in part, to the absence of outstanding debt or developer reimbursement obligations. Quail Valley and Thunderbird had combined current assets net of liabilities of approximately $6.4 million on their balance sheets in 2017, so the current assets may substantially offset the negative NPV (if the balances are still similar to what they were in 2017, and these balances when transferred to the City in a dissolution would be available to fund the projected CIP costs for the MUDs).

   It is important to point out that the NPVs for the two options for Scenario 3.1 flip-flop depending on the assumptions made with respect to reserves and rate increases for future CIP program costs, such that either option could potentially be feasible depending on direct discussions with the MUDs to understand their anticipated future rate adjustments. There may, however, be a side benefit to the City from the asset transfer option over the dissolution option in that the MUDs stay in existence and can continue to provide operational support for the City and the consolidated utility systems, which would not be available in a dissolution option.

3. **An asset acquisition for Scenario 3.2 represents a viable financial transaction that is forecasted to avoid general fund support**. The NPV of Scenario 3.2 is positive, meaning there is not forecasted to be a financial impact on the current MUDs water/wastewater customer or subsidy cost to the City of pursuing this option for this scenario. The main concern with an asset acquisition is the necessity of negotiating a voluntary acquisition transaction with the MUDs' Boards in accordance with the transaction assumptions/parameters identified above. Absent the revenue sharing parameters between the MUDs and the City, which underlie this analysis, **this option would be negatively impacted and the NPV would be approximately negative $112.9 million.**

4. **A dissolution of the Scenario 3.2 MUDs does not represent a viable financial transaction as it would require meaningful increases in utility rates or general fund subsidies due to the negative NPV**. The requirement to repay all of the MUDs' existing debt and developer reimbursement obligations, and the inability to supplement utility rate revenues via MUDs' continuing property tax revenues, means that the City would require significant utility rate increases and/or subsidies from the City's general funds under the assumptions identified above.

City of Missouri City
Scenario 3: Inside City MUDs

Schedule 1
Asset Acquisition
Scenario 3.1

Line No.		Actual	Adjustments	Test Year		Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	Year 11 2030	Year 12 2031	Year 13 2032	Year 14 2033	Year 15 2034
1	**Revenues**																			
2	Water Service	$ 1,723,314	$ -	$ 1,723,314	B	$ 1,757,780	$ 1,794,555	$ 1,832,101	$ 1,870,432	1,909,566	1,949,520	1,990,231	2,031,793	2,074,224	2,117,542	2,161,765	2,205,636	2,250,398	2,296,069	2,342,667
3	Property Tax	-	-	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	Wastewater Service	1,532,028	-	1,532,028	B	1,562,669	1,595,335	1,628,685	1,662,732	1,697,492	1,732,980	1,769,141	1,806,058	1,843,746	1,882,222	1,921,500	1,960,507	2,000,305	2,040,911	2,082,342
5	Garbage Service	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	Other Revenues	404,173	-	404,173	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Tap Connection and Inspection Fees	166,528	-	166,528	I	169,859	173,256	176,721	180,255	183,860	187,538	191,288	195,114	199,016	202,997	207,057	211,198	215,422	219,730	224,125
8	Contracted Wastewater Fees	61,200	-	61,200	A	62,424	63,672	64,946	66,245	67,570	68,921	70,300	71,706	73,140	74,602	76,095	77,616	79,169	80,752	82,367
9	Participant Billings	6,354,577	-	6,354,577	B	6,481,669	6,614,217	6,749,476	6,887,501	7,028,349	7,172,077	7,318,736	7,468,395	7,621,115	7,776,957	7,935,986	8,098,258	8,263,849	8,432,826	8,605,259
10	Surface Water Fees	1,033,108	-	1,033,108	B	1,053,770	1,075,834	1,098,360	1,121,358	1,144,838	1,168,810	1,193,236	1,218,172	1,243,630	1,269,620	1,296,154	1,322,452	1,349,283	1,376,659	1,404,590
11	Other Tax	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	Water Impact Fee	-	-	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	Wastewater Impact Fee	-	-	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14		$ 11,274,928	$ -	$ 11,274,928		$ 11,088,170	$ 11,316,869	$ 11,550,288	$ 11,788,523	$ 12,031,675	$ 12,279,845	$ 12,532,933	$ 12,791,239	$ 13,054,871	$ 13,323,939	$ 13,598,556	$ 13,875,667	$ 14,158,426	$ 14,446,948	$ 14,741,349
15																				
16	**Operating Expenses**																			
17	Purchased Water Services	$ -	$ -	$ -	L	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
18	Contracted Services	361,217	-	361,217	L	368,441	376,081	383,879	391,838	399,963	408,256	416,704	425,326	434,127	443,110	452,279	461,351	470,606	480,046	489,675
19	Repairs & Maintenance	5,220,950	-	5,220,950	L	5,325,369	5,433,465	5,543,756	5,656,286	5,771,100	5,888,245	6,007,729	6,129,637	6,254,020	6,380,926	6,510,409	6,641,919	6,776,086	6,912,963	7,052,605
20	Professional Fees	23,067	-	23,067	A	23,528	23,999	24,479	24,968	25,468	25,977	26,497	27,027	27,567	28,119	28,681	29,255	29,840	30,436	31,045
21	Depreciation & Amortization	588,316	-	588,316	L K	600,082	612,361	624,892	637,679	650,727	664,043	677,617	691,469	705,605	720,029	734,748	749,551	764,652	780,058	795,774
22	Purchased Sewer Services	413,327	-	413,327	F	398,917	407,262	415,781	424,479	334,819	341,823	348,954	356,233	363,664	234,673	239,568	244,360	249,247	254,232	259,316
23	Other	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	Solid Waste	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	Utilities	483,019	-	483,019	B	492,679	502,874	513,280	523,901	534,742	545,807	557,090	568,606	580,361	592,358	604,604	616,919	629,485	642,307	655,390
26	Purchased Services	-	-	-	O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	Capital Outlay	607,368	(607,368)	-	N K	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	Connection Fees	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	Lease	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	Renewals & Replacements	-	-	-	K	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	Salaries and Benefits	3,049,231	-	3,049,231	A	3,110,216	3,172,420	3,235,868	3,300,586	3,366,597	3,433,929	3,502,608	3,572,660	3,644,113	3,716,996	3,791,335	3,867,162	3,944,505	4,023,396	4,103,863
32	Surface Water Fee	1,137,075	-	1,137,075	B	1,159,817	1,184,079	1,208,850	1,234,139	1,259,958	1,286,318	1,313,177	1,340,598	1,368,592	1,397,171	1,426,347	1,455,295	1,484,830	1,514,965	1,545,711
33		$ 11,883,570	$ (607,368)	$ 11,276,202		$ 11,479,049	$ 11,712,541	$ 11,950,784	$ 12,193,876	$ 12,343,374	$ 12,594,399	$ 12,850,376	$ 13,111,557	$ 13,378,049	$ 13,513,382	$ 13,787,972	$ 14,065,812	$ 14,349,251	$ 14,638,402	$ 14,933,381
34																				
35	**Net Income before Debt Service**	$ (608,642)	$ 607,368	$ (1,274)		$ (390,879)	$ (395,672)	$ (400,497)	$ (405,353)	$ (311,699)	$ (314,554)	$ (317,443)	$ (320,319)	$ (323,178)	$ (189,443)	$ (189,416)	$ (190,145)	$ (190,825)	$ (191,455)	$ (192,031)
36																				
37																				
38	Capital Improvement Plan - Water																			
39	Cost	$ 4,301,686			G															
40	Principal					$ 65,336	$ 68,644	$ 72,119	$ 75,770	$ 79,605	$ 83,635	$ 87,870	$ 92,318	$ 96,991	$ 101,902	$ 107,060	$ 112,480	$ 118,175	$ 124,157	$ 130,443
41	Interest					218,579	215,272	211,797	208,146	204,310	200,280	196,046	191,597	186,924	182,014	176,855	171,435	165,741	159,758	153,472
42	Total					$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915
43																				
44	Capital Improvement Plan - Wastewater																			
45	Cost	$ 10,149,014			H															
46	Principal					$ 15,415	$ 16,195	$ 17,015	$ 17,876	$ 118,977	$ 125,001	$ 131,329	$ 137,977	$ 144,962	$ 190,838	$ 200,499	$ 210,649	$ 221,314	$ 232,518	$ 244,289
47	Interest					51,570	50,789	49,969	49,108	383,406	377,383	371,054	364,406	357,421	479,006	469,345	459,195	448,531	437,327	425,555
48	Total					$ 66,984	$ 66,984	$ 66,984	$ 66,984	$ 502,383	$ 502,383	$ 502,383	$ 502,383	$ 502,383	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844
49																				
50	**Total Debt Service**					$ 350,900	$ 350,900	$ 350,900	$ 350,900	$ 786,298	$ 786,298	$ 786,298	$ 786,298	$ 786,298	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760
51																				
52	**Net Income after Debt Service**					$ (741,779)	$ (746,572)	$ (751,397)	$ (756,253)	$ (1,097,998)	$ (1,100,852)	$ (1,103,742)	$ (1,106,617)	$ (1,109,477)	$ (1,143,202)	$ (1,143,176)	$ (1,143,904)	$ (1,144,585)	$ (1,145,214)	$ (1,145,791)
53																				
54	**Net Present Value (at 5% discount rate)**	($16,058,088)																		
55																				

City of Missouri City
Scenario 3: Inside City MUDs

Schedule 1
Asset Acquisition
Scenario 3.1

Line No.		Actual	Adjustments	Test Year		Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	Year 11 2030	Year 12 2031	Year 13 2032	Year 14 2033	Year 15 2034
56	MUD Revenues																			
57	Garbage Service	$ -	$ -	$ -	L	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
58	Other Revenues	404,173	-	404,173	B	412,256	420,814	429,549	438,466	447,568	456,859	466,330	475,998	485,867	495,941	506,223	516,524	527,033	537,757	548,699
59	Other Tax	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	Revenue Total	$ 404,173	$ -	$ 404,173		$ 412,256	$ 420,814	$ 429,549	$ 438,466	$ 447,568	$ 456,859	$ 466,330	$ 475,998	$ 485,867	$ 495,941	$ 506,223	$ 516,524	$ 527,033	$ 537,757	$ 548,699
61																				
62	MUD Expenses				J															
63	Administrative Expenses	$ 403,901	$ -	$ 403,901	A	$ 411,979	$ 420,219	$ 428,623	$ 437,195	$ 445,939	$ 454,858	$ 463,955	$ 473,234	$ 482,699	$ 492,353	$ 502,200	$ 512,244	$ 522,489	$ 532,939	$ 543,598
64	Other	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
65	Solid Waste	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
66	Capital Outlay	607,368	(607,368)	-	N K	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
67	Expense Total	$ 1,011,269	$ (607,368)	$ 403,901		$ 411,979	$ 420,219	$ 428,623	$ 437,195	$ 445,939	$ 454,858	$ 463,955	$ 473,234	$ 482,699	$ 492,353	$ 502,200	$ 512,244	$ 522,489	$ 532,939	$ 543,598
68																				
69	Debt Service Schedule																			
70	Principal				E	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
71	Interest				E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
72	Total					$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
73																				
74	Expense and Debt Total					$ 411,979	$ 420,219	$ 428,623	$ 437,195	$ 445,939	$ 454,858	$ 463,955	$ 473,234	$ 482,699	$ 492,353	$ 502,200	$ 512,244	$ 522,489	$ 532,939	$ 543,598
75																				
76	Net Income before Property Tax					$ 277	$ 595	$ 926	$ 1,270	$ 1,628	$ 2,000	$ 2,375	$ 2,764	$ 3,168	$ 3,588	$ 4,023	$ 4,279	$ 4,544	$ 4,819	$ 5,102
77																				
78	Property Tax	$ -	$ -	$ -	A	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
79																				
80	Net Property Tax Revenue After Debt & Expenses					$ 277	$ 595	$ 926	$ 1,270	$ 1,628	$ 2,000	$ 2,375	$ 2,764	$ 3,168	$ 3,588	$ 4,023	$ 4,279	$ 4,544	$ 4,819	$ 5,102
81																				
82	Net Benefit to the City of Missouri City				C	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

Notes:

A Annual increases in forecast based on inflation only
B Annual increases in forecast based on inflation and customer growth
C The MUDs in this sub-scenario do not assess or collect property taxes
D The City does not charge its impact fees to the MUDs
E Forecast of existing principal and interest based on debt service schedule for existing debt for each utility
F Annual increases in forecast based on 50% inflation plus 50% inflation and customer growth combined, but also account for the wastewater O&M savings projection from eHT report
G Based on the applicable water capital projects in the 2011 eHT report (Table 4-20) updated to today's dollars; does not include any capital costs for the new transmission lines (which are complete) or the new raw water treatment plant (which is already out for bid)
H Based on Option 5 (without WC&ID #2) in the 2018 eHT report (Table 5-1) allocated to the MUDs based on total buildout connection counts
I Assumes inspection fees are negligible and tap fee revenue will increase with inflation and end at buildout
J Developer reimbursements, if any, would remain the obligation of the MUDs
K Assumes depreciation will fully fund capital needs for renewal and replacements
L Annual increases in forecast based on 50% inflation plus 50% inflation and customer growth combined
M Assumed to stay with the MUD
N Adjusted to remove captial outlay
O Annual increases in forecast based on 50% inflation plus 50% inflation and customer growth combined, but also account for the wastewater O&M savings projection from eHT report based on an assumed 60/40 split in Purchased Services between water and sewer, respectively.

City of Missouri City
Scenario 3: Inside City MUDs

Schedule 1
Asset Acquisition
Scenario 3.1

Line No.		Year 16 2035	Year 17 2036	Year 18 2037	Year 19 2038	Year 20 2039	Year 21 2040	Year 22 2041	Year 23 2042	Year 24 2043	Year 25 2044	Year 26 2045	Year 27 2046	Year 28 2047	Year 29 2048	Year 30 2049
1	**Revenues**															
2	Water Service	2,390,210	2,438,717	2,488,208	2,538,704	2,590,224	2,642,791	2,696,427	2,751,151	2,806,986	2,863,955	2,922,080	2,981,384	3,041,893	3,103,630	3,166,619
3	Property Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	Wastewater Service	2,124,614	2,167,742	2,211,746	2,256,644	2,302,453	2,349,192	2,396,882	2,445,541	2,495,187	2,545,842	2,597,524	2,650,257	2,704,059	2,758,955	2,814,964
5	Garbage Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	Other Revenues	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Tap Connection and Inspection Fees	228,607	233,179	237,843	242,600	247,452	252,401	257,449	262,598	267,850	273,207	278,671	284,244	289,929	295,728	301,642
8	Contracted Wastewater Fees	84,014	85,695	87,409	89,157	90,940	92,759	94,614	96,506	98,436	100,405	102,413	104,461	106,551	108,682	110,855
9	Participant Billings	8,781,217	8,960,764	9,143,982	9,330,946	9,521,734	9,716,422	9,915,106	10,117,852	10,324,744	10,535,867	10,751,307	10,971,152	11,195,493	11,424,421	11,658,030
10	Surface Water Fees	1,433,088	1,462,164	1,491,829	1,522,097	1,552,978	1,584,486	1,616,635	1,649,437	1,682,904	1,717,050	1,751,889	1,787,435	1,823,702	1,860,705	1,898,459
11	Other Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	Water Impact Fee	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	Wastewater Impact Fee	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14		$ 15,041,750	$ 15,348,261	$ 15,661,017	$ 15,980,147	$ 16,305,781	$ 16,638,051	$ 16,977,113	$ 17,323,085	$ 17,676,108	$ 18,036,325	$ 18,403,884	$ 18,778,934	$ 19,161,627	$ 19,552,120	$ 19,950,570
15																
16	**Operating Expenses**															
17	Purchased Water Services	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
18	Contracted Services	499,498	509,517	519,738	530,163	540,798	551,646	562,711	573,999	585,513	597,258	609,239	621,460	633,926	646,642	659,613
19	Repairs & Maintenance	7,195,068	7,340,406	7,488,679	7,639,947	7,794,272	7,951,713	8,112,340	8,276,212	8,443,394	8,613,953	8,787,957	8,965,477	9,146,582	9,331,346	9,519,843
20	Professional Fees	31,666	32,299	32,945	33,604	34,276	34,962	35,661	36,374	37,102	37,844	38,601	39,373	40,160	40,963	41,783
21	Depreciation & Amortization	811,806	828,162	844,846	861,867	879,231	896,945	915,016	933,451	952,257	971,443	991,015	1,010,981	1,031,350	1,052,129	1,073,326
22	Purchased Sewer Services	264,503	269,793	275,189	280,692	286,306	292,032	297,873	303,831	309,907	316,105	322,427	328,876	335,453	342,163	349,006
23	Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	Solid Waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	Utilities	668,740	682,360	696,259	710,440	724,911	739,676	754,743	770,116	785,803	801,810	818,142	834,807	851,812	869,163	886,868
26	Purchased Services	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	Capital Outlay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	Connection Fees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	Lease	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	Renewals & Replacements	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	Salaries and Benefits	4,185,941	4,269,660	4,355,053	4,442,154	4,530,997	4,621,617	4,714,049	4,808,330	4,904,497	5,002,587	5,102,638	5,204,691	5,308,785	5,414,961	5,523,260
32	Surface Water Fee	1,577,082	1,609,088	1,641,744	1,675,062	1,709,057	1,743,742	1,779,133	1,815,242	1,852,084	1,889,673	1,928,026	1,967,157	2,007,083	2,047,819	2,089,381
33		$ 15,234,303	$ 15,541,285	$ 15,854,452	$ 16,173,931	$ 16,499,848	$ 16,832,332	$ 17,171,526	$ 17,517,554	$ 17,870,556	$ 18,230,672	$ 18,598,046	$ 18,972,822	$ 19,355,152	$ 19,745,186	$ 20,143,080
34																
35	**Net Income before Debt Service**	$ (192,553)	$ (193,024)	$ (193,435)	$ (193,784)	$ (194,067)	$ (194,282)	$ (194,413)	$ (194,470)	$ (194,449)	$ (194,347)	$ (194,162)	$ (193,889)	$ (193,525)	$ (193,066)	$ (192,510)
36																
37																
38	Capital Improvement Plan - Water															
39	Cost															
40	Principal	$ 137,046	$ 143,984	$ 151,274	$ 158,932	$ 166,978	$ 175,431	$ 184,312	$ 193,643	$ 203,446	$ 213,746	$ 224,567	$ 235,935	$ 247,879	$ 260,428	$ 273,613
41	Interest	146,869	139,931	132,642	124,983	116,937	108,484	99,603	90,272	80,469	70,170	59,349	47,980	36,036	23,487	10,303
42	Total	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915
43																
44	Capital Improvement Plan - Wastewater															
45	Cost															
46	Principal	$ 256,656	$ 269,649	$ 283,300	$ 297,642	$ 312,710	$ 328,541	$ 345,174	$ 362,648	$ 381,007	$ 400,296	$ 420,561	$ 441,852	$ 464,220	$ 487,721	$ 512,412
47	Interest	413,188	400,195	386,544	372,202	357,134	341,303	324,671	307,196	288,837	269,549	249,284	227,993	205,624	182,123	157,432
48	Total	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844
49																
50	**Total Debt Service**	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760
51																
52	**Net Income after Debt Service**	$ (1,146,312)	$ (1,146,784)	$ (1,147,195)	$ (1,147,543)	$ (1,147,826)	$ (1,148,041)	$ (1,148,173)	$ (1,148,229)	$ (1,148,209)	$ (1,148,107)	$ (1,147,921)	$ (1,147,648)	$ (1,147,284)	$ (1,146,826)	$ (1,146,269)
53																
54	**Net Present Value (at 5% discount rate)**															
55																

City of Missouri City
Scenario 3: Inside City MUDs

Line No.		Year 16 2035	Year 17 2036	Year 18 2037	Year 19 2038	Year 20 2039	Year 21 2040	Year 22 2041	Year 23 2042	Year 24 2043	Year 25 2044	Year 26 2045	Year 27 2046	Year 28 2047	Year 29 2048	Year 30 2049
56	MUD Revenues															
57	Garbage Service	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
58	Other Revenues	559,864	571,256	582,879	594,739	606,840	619,187	631,787	644,642	657,760	671,144	684,801	698,735	712,953	727,461	742,264
59	Other Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	Revenue Total	$ 559,864	$ 571,256	$ 582,879	$ 594,739	$ 606,840	$ 619,187	$ 631,787	$ 644,642	$ 657,760	$ 671,144	$ 684,801	$ 698,735	$ 712,953	$ 727,461	$ 742,264
61																
62	MUD Expenses															
63	Administrative Expenses	$ 554,470	$ 565,559	$ 576,870	$ 588,407	$ 600,176	$ 612,179	$ 624,423	$ 636,911	$ 649,649	$ 662,642	$ 675,895	$ 689,413	$ 703,201	$ 717,265	$ 731,611
64	Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
65	Solid Waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
66	Capital Outlay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
67	Expense Total	$ 554,470	$ 565,559	$ 576,870	$ 588,407	$ 600,176	$ 612,179	$ 624,423	$ 636,911	$ 649,649	$ 662,642	$ 675,895	$ 689,413	$ 703,201	$ 717,265	$ 731,611
68																
69	Debt Service Schedule															
70	Principal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
71	Interest	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
72	Total	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
73																
74	Expense and Debt Total	$ 554,470	$ 565,559	$ 576,870	$ 588,407	$ 600,176	$ 612,179	$ 624,423	$ 636,911	$ 649,649	$ 662,642	$ 675,895	$ 689,413	$ 703,201	$ 717,265	$ 731,611
75																
76	Net Income before Property Tax	$ 5,395	$ 5,697	$ 6,009	$ 6,331	$ 6,664	$ 7,008	$ 7,364	$ 7,731	$ 8,110	$ 8,502	$ 8,905	$ 9,322	$ 9,752	$ 10,195	$ 10,653
77																
78	Property Tax	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
79																
80	Net Property Tax Revenue After Debt & Expenses	$ 5,395	$ 5,697	$ 6,009	$ 6,331	$ 6,664	$ 7,008	$ 7,364	$ 7,731	$ 8,110	$ 8,502	$ 8,905	$ 9,322	$ 9,752	$ 10,195	$ 10,653
81																
82	Net Benefit to the City of Missouri City	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

City of Missouri City
Scenario 3: Inside City MUDs

Schedule 1
Asset Acquisition
Scenario 3.2

Line No.		Actual	Adjustments	Test Year		Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	Year 11 2030	Year 12 2031	Year 13 2032	Year 14 2033	Year 15 2034
1	**Revenues**																			
2	Water Service	$ 4,369,449	$ -	$ 4,369,449	B	$ 4,456,838	$ 4,567,027	$ 4,680,359	$ 4,796,943	4,916,892	5,040,324	5,160,682	5,284,153	5,410,825	5,540,791	5,674,149	5,798,487	5,925,589	6,055,517	6,188,334
3	Property Tax	16,418,480	-	16,418,480	C	8,108,190	8,108,190	8,108,190	8,108,190	8,108,190	8,108,190	8,108,190	8,108,190	8,108,190	8,108,190	8,108,190	8,108,190	8,108,190	8,108,190	8,108,190
4	Wastewater Service	4,818,158	-	4,818,158	B	4,914,521	5,043,563	5,176,636	5,313,895	5,455,500	5,601,621	5,739,374	5,880,793	6,025,988	6,175,068	6,328,150	6,465,248	6,605,350	6,748,523	6,894,835
5	Garbage Service	1,010,973	-	1,010,973	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	Other Revenues	1,846,804	-	1,846,804	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Tap Connection and Inspection Fees	640,745	-	640,745	I	531,532	542,163	553,006	564,066	575,348	586,854	598,592	610,563	622,775	635,230	647,935	552,024	563,064	574,326	585,812
8	Contracted Wastewater Fees	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	Participant Billings	-	-	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Surface Water Fees	4,145,905	-	4,145,905	B	4,228,823	4,331,727	4,437,434	4,546,033	4,657,619	4,772,289	4,885,500	5,001,571	5,120,581	5,242,612	5,367,749	5,487,138	5,609,213	5,734,035	5,861,665
11	Other Tax	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	Water Impact Fee	-	-	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	Wastewater Impact Fee	-	-	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14		$ 33,250,514	$ -	$ 33,250,514		$ 22,239,904	$ 22,592,670	$ 22,955,625	$ 23,329,127	$ 23,713,549	$ 24,109,279	$ 24,492,338	$ 24,885,270	$ 25,288,358	$ 25,701,892	$ 26,126,172	$ 26,411,087	$ 26,811,407	$ 27,220,590	$ 27,638,836
15																				
16	**Operating Expenses**																			
17	Purchased Water Services	$ 132,244	$ -	$ 132,244	L	$ 134,889	$ 137,779	$ 140,731	$ 143,746	$ 146,825	$ 149,971	$ 153,181	$ 156,460	$ 159,809	$ 163,229	$ 166,723	$ 170,289	$ 173,930	$ 177,650	$ 181,449
18	Contracted Services	2,572,938	-	2,572,938	L	2,624,397	2,686,412	2,749,986	2,815,162	2,881,983	2,950,495	3,017,512	3,086,097	3,156,289	3,228,127	3,301,650	3,371,428	3,442,687	3,515,459	3,589,776
19	Repairs & Maintenance	3,632,785	-	3,632,785	L	3,705,441	3,789,004	3,874,552	3,962,138	4,051,812	4,143,627	4,234,768	4,327,971	4,423,283	4,520,754	4,620,436	4,717,026	4,815,644	4,916,332	5,019,136
20	Professional Fees	1,710,357	-	1,710,357	A	1,744,564	1,779,455	1,815,045	1,851,345	1,888,372	1,926,140	1,964,663	2,003,956	2,044,035	2,084,916	2,126,614	2,169,146	2,212,529	2,256,780	2,301,915
21	Depreciation & Amortization	3,660,800	-	3,660,800	L K	3,734,016	3,823,180	3,914,627	4,008,421	4,104,626	4,203,310	4,299,073	4,397,092	4,497,422	4,600,120	4,705,243	4,803,887	4,904,609	5,007,453	5,112,465
22	Purchased Sewer Services	276,622	-	276,622	F	266,978	272,538	278,214	284,008	223,998	228,663	233,424	238,283	243,243	156,959	160,226	163,560	166,964	170,438	173,985
23	Other	1,031,868	-	1,031,868	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	Solid Waste	501,826	-	501,826	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	Utilities	707,547	-	707,547	B	721,698	737,557	753,782	770,382	787,365	804,743	822,371	840,399	858,836	877,693	896,979	916,243	935,925	956,033	976,576
26	Purchased Services	2,604,238	-	2,604,238	O	2,602,018	2,669,378	2,738,627	2,809,821	2,647,266	2,716,309	2,781,952	2,849,248	2,918,242	2,684,559	2,749,635	2,808,164	2,867,948	2,929,015	2,991,391
27	Capital Outlay	202,781	(202,781)	-	N K	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	Connection Fees	54,176	-	54,176	A	55,260	56,365	57,492	58,642	59,815	61,011	62,231	63,476	64,745	66,040	67,361	68,708	70,082	71,484	72,914
29	Lease	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	Renewals & Replacements	-	-	-	K	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	Salaries and Benefits	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
32	Surface Water Fee	3,564,735	-	3,564,735	B	3,636,030	3,715,156	3,796,011	3,878,633	3,963,060	4,049,332	4,137,441	4,227,475	4,319,476	4,413,486	4,509,551	4,607,548	4,707,682	4,810,000	4,914,550
33		$ 20,652,917	$ (202,781)	$ 20,450,136		$ 19,225,289	$ 19,666,823	$ 20,119,066	$ 20,582,297	$ 20,755,123	$ 21,233,602	$ 21,706,616	$ 22,190,456	$ 22,685,380	$ 22,795,882	$ 23,304,419	$ 23,795,999	$ 24,298,000	$ 24,810,643	$ 25,334,157
34																				
35	**Net Income before Debt Service**	$ 12,597,597	$ 202,781	$ 12,800,378		$ 3,014,615	$ 2,925,846	$ 2,836,558	$ 2,746,830	$ 2,958,426	$ 2,875,677	$ 2,785,722	$ 2,694,814	$ 2,602,978	$ 2,906,010	$ 2,821,753	$ 2,615,088	$ 2,513,407	$ 2,409,946	$ 2,304,679
36																				
37																				
38	Capital Improvement Plan - Water																			
39	Cost	$ 3,445,230			G															
40	Principal					$ 52,328	$ 54,977	$ 57,760	$ 60,684	$ 63,756	$ 66,984	$ 70,375	$ 73,938	$ 77,681	$ 81,613	$ 85,745	$ 90,086	$ 94,646	$ 99,438	$ 104,472
41	Interest					175,061	172,412	169,628	166,704	163,632	160,405	157,013	153,451	149,708	145,775	141,643	137,303	132,742	127,950	122,916
42	Total					$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388
43																				
44	Capital Improvement Plan - Wastewater																			
45	Cost	$ 26,487,364			H															
46	Principal					$ 40,230	$ 42,267	$ 44,407	$ 46,655	$ 310,513	$ 326,232	$ 342,748	$ 360,100	$ 378,330	$ 498,058	$ 523,272	$ 549,763	$ 577,594	$ 606,835	$ 637,556
47	Interest					134,589	132,552	130,412	128,164	1,000,630	984,911	968,395	951,043	932,813	1,250,133	1,224,919	1,198,428	1,170,596	1,141,355	1,110,634
48	Total					$ 174,819	$ 174,819	$ 174,819	$ 174,819	$ 1,311,143	$ 1,311,143	$ 1,311,143	$ 1,311,143	$ 1,311,143	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191
49																				
50	**Total Debt Service**					$ 402,207	$ 402,207	$ 402,207	$ 402,207	$ 1,538,531	$ 1,538,531	$ 1,538,531	$ 1,538,531	$ 1,538,531	$ 1,975,579	$ 1,975,579	$ 1,975,579	$ 1,975,579	$ 1,975,579	$ 1,975,579
51																				
52	**Net Income after Debt Service**					$ 2,612,408	$ 2,523,639	$ 2,434,351	$ 2,344,623	$ 1,419,895	$ 1,337,145	$ 1,247,190	$ 1,156,282	$ 1,064,447	$ 930,431	$ 846,174	$ 639,509	$ 537,828	$ 434,367	$ 329,100
53																				
54	**Net Present Value (at 5% discount rate)**	$11,779,472																		
55																				

City of Missouri City
Scenario 3: Inside City MUDs

Schedule 1
Asset Acquisition
Scenario 3.2

Line No.		Actual	Adjustments	Test Year		Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	Year 11 2030	Year 12 2031	Year 13 2032	Year 14 2033	Year 15 2034
56	MUD Revenues																			
57	Garbage Service	$ 1,010,973	$ -	$ 1,010,973	L	$ 1,031,192	$ 1,053,750	$ 1,076,822	$ 1,100,420	$ 1,124,558	$ 1,149,248	$ 1,174,253	$ 1,199,821	$ 1,225,964	$ 1,252,696	$ 1,280,031	$ 1,306,939	$ 1,334,416	$ 1,362,474	$ 1,391,126
58	Other Revenues	1,846,804	-	1,846,804	B	1,883,740	1,931,151	1,979,956	2,030,204	2,081,948	2,135,242	2,187,007	2,240,146	2,294,699	2,350,709	2,408,220	2,461,185	2,515,332	2,570,690	2,627,285
59	Other Tax	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	Revenue Total	$ 2,857,777	$ -	$ 2,857,777		$ 2,914,933	$ 2,984,901	$ 3,056,778	$ 3,130,624	$ 3,206,506	$ 3,284,490	$ 3,361,261	$ 3,439,967	$ 3,520,663	$ 3,603,405	$ 3,688,251	$ 3,768,123	$ 3,849,748	$ 3,933,164	$ 4,018,411
61																				
62	MUD Expenses				J															
63	Administrative Expenses	$ 524,771	$ -	$ 524,771	A	$ 535,266	$ 545,972	$ 556,891	$ 568,029	$ 579,390	$ 590,977	$ 602,797	$ 614,853	$ 627,150	$ 639,693	$ 652,487	$ 665,537	$ 678,847	$ 692,424	$ 706,273
64	Other	1,031,868	-	1,031,868	A	1,052,505	1,073,555	1,095,027	1,116,927	1,139,266	1,162,051	1,185,292	1,208,998	1,233,178	1,257,841	1,282,998	1,308,658	1,334,831	1,361,528	1,388,758
65	Solid Waste	501,826	-	501,826	A	511,863	522,100	532,542	543,193	554,056	565,138	576,440	587,969	599,729	611,723	623,958	636,437	649,165	662,149	675,392
66	Capital Outlay	202,781	(202,781)	-	N K	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
67	Expense Total	$ 2,261,246	$ (202,781)	$ 2,058,465		$ 2,099,634	$ 2,141,627	$ 2,184,460	$ 2,228,149	$ 2,272,712	$ 2,318,166	$ 2,364,529	$ 2,411,820	$ 2,460,056	$ 2,509,257	$ 2,559,442	$ 2,610,631	$ 2,662,844	$ 2,716,101	$ 2,770,423
68																				
69	Debt Service Schedule																			
70	Principal				E	$ 7,420,000	$ 7,910,000	$ 7,740,000	$ 7,585,000	$ 6,765,000	$ 6,285,000	$ 4,980,000	$ 3,535,000	$ 3,030,000	$ 2,180,000	$ 1,635,000	$ 1,350,000	$ 1,510,000	$ 1,715,000	$ 1,480,000
71	Interest				E	2,033,958	1,796,873	1,548,180	1,316,187	1,089,448	907,194	743,407	585,895	482,406	400,727	342,652	296,938	246,289	181,725	120,688
72	Total					$ 9,453,958	$ 9,706,873	$ 9,288,180	$ 8,901,187	$ 7,854,448	$ 7,192,194	$ 5,723,407	$ 4,120,895	$ 3,512,406	$ 2,580,727	$ 1,977,652	$ 1,646,938	$ 1,756,289	$ 1,896,725	$ 1,600,688
73																				
74	Expense and Debt Total					$ 11,553,592	$ 11,848,500	$ 11,472,640	$ 11,129,336	$ 10,127,160	$ 9,510,360	$ 8,087,936	$ 6,532,715	$ 5,972,462	$ 5,089,984	$ 4,537,094	$ 4,257,569	$ 4,419,133	$ 4,612,826	$ 4,371,111
75																				
76	Net Income before Property Tax					$ (8,638,660)	$ (8,863,599)	$ (8,415,862)	$ (7,998,712)	$ (6,920,654)	$ (6,225,870)	$ (4,726,676)	$ (3,092,748)	$ (2,451,799)	$ (1,486,579)	$ (848,844)	$ (489,446)	$ (569,385)	$ (679,662)	$ (352,699)
77																				
78	Property Tax	$ 16,418,480	$ -	$ 16,418,480	A	$ 16,746,850	$ 17,081,787	$ 17,423,422	$ 17,771,891	$ 18,127,329	$ 18,489,875	$ 18,859,673	$ 19,236,866	$ 19,621,603	$ 20,014,036	$ 20,414,316	$ 20,822,603	$ 21,239,055	$ 21,663,836	$ 22,097,112
79																				
80	Net Property Tax Revenue After Debt & Expenses					$ 8,108,190	$ 8,218,188	$ 9,007,560	$ 9,773,179	$ 11,206,675	$ 12,264,005	$ 14,132,997	$ 16,144,118	$ 17,169,804	$ 18,527,456	$ 19,565,472	$ 20,333,157	$ 20,669,670	$ 20,984,174	$ 21,744,413
81																				
82	Net Benefit to the City of Missouri City				C	$ 8,108,190	$ 8,108,190	$ 8,108,190	$ 8,108,190	$ 8,108,190	$ 8,108,190	$ 8,108,190	$ 8,108,190	$ 8,108,190	$ 8,108,190	$ 8,108,190	$ 8,108,190	$ 8,108,190	$ 8,108,190	$ 8,108,190

Notes:

A Annual increases in forecast based on inflation only

B Annual increases in forecast based on inflation and customer growth

C Net property tax revenue for the benefit of the City of Missouri City is based on one of two equivalent concepts:
1) The MUDs will pass along any property tax revenue not needed for debt service, administration, or other services retained by the MUDs in year 1 of the forecast and will continue to pass along this dollar amount each year for the remainder of the forecast; OR
2) The MUDs will decrease property taxes in year 1 of the forecast by an amount equal to the amount identified in 1) and the City of Missouri City will be able to increase rates for these customers by an equal dollar amount.

D The City does not charge its impact fees to the MUDs

E Forecast of existing principal and interest based on debt service schedule for existing debt for each utility

F Annual increases in forecast based on 50% inflation plus 50% inflation and customer growth combined, but also account for the wastewater O&M savings projection from eHT report

G Based on the applicable water capital projects in the 2011 eHT report (Table 4-20) updated to today's dollars; does not include any capital costs for the new transmission lines (which are complete) or the new raw water treatment plant (which is already out for bid)

H Based on Option 5 (without WC&ID #2) in the 2018 eHT report (Table 5-1) allocated to the MUDs based on total buildout connection counts

I Assumes inspection fees are negligible and tap fee revenue will increase with inflation and end at buildout

J Developer reimbursements, if any, would remain the obligation of the MUDs

K Assumes depreciation will fully fund capital needs for renewal and replacements

L Annual increases in forecast based on 50% inflation plus 50% inflation and customer growth combined

M Assumed to stay with the MUD

N Adjusted to remove captial outlay

O Annual increases in forecast based on 50% inflation plus 50% inflation and customer growth combined, but also account for the wastewater O&M savings projection from eHT report based on an assumed 60/40 split in Purchased Services between water and sewer, respectively.

City of Missouri City
Scenario 3: Inside City MUDs

Line No.		Year 16 2035	Year 17 2036	Year 18 2037	Year 19 2038	Year 20 2039	Year 21 2040	Year 22 2041	Year 23 2042	Year 24 2043	Year 25 2044	Year 26 2045	Year 27 2046	Year 28 2047	Year 29 2048	Year 30 2049
1	**Revenues**															
2	Water Service	6,324,106	6,458,844	6,596,464	6,737,027	6,880,596	7,027,236	7,177,167	7,330,309	7,486,732	7,646,506	7,808,297	7,971,756	8,138,644	8,309,035	8,483,001
3	Property Tax	8,108,190	8,108,190	8,108,190	8,108,190	8,108,190	8,108,190	8,108,190	8,108,190	8,108,190	8,108,190	8,108,190	8,108,190	8,108,190	8,108,190	8,108,190
4	Wastewater Service	7,044,356	7,194,221	7,347,287	7,503,624	7,663,302	7,826,392	7,993,162	8,163,502	8,337,488	8,515,199	8,694,771	8,875,700	9,060,403	9,248,959	9,441,448
5	Garbage Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	Other Revenues	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Tap Connection and Inspection Fees	597,528	411,387	419,614	428,007	436,567	445,298	454,204	463,288	472,554	482,005	491,645	469,047	478,428	487,997	497,757
8	Contracted Wastewater Fees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	Participant Billings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Surface Water Fees	5,992,170	6,122,433	6,255,538	6,391,548	6,530,527	6,672,539	6,817,890	6,966,419	7,118,197	7,273,296	7,430,671	7,590,064	7,752,887	7,919,215	8,089,125
11	Other Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	Water Impact Fee	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	Wastewater Impact Fee	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14		$ 28,066,349	$ 28,295,074	$ 28,727,094	$ 29,168,396	$ 29,619,182	$ 30,079,655	$ 30,550,613	$ 31,031,709	$ 31,523,162	$ 32,025,196	$ 32,533,574	$ 33,014,756	$ 33,538,552	$ 34,073,396	$ 34,619,521
15																
16	**Operating Expenses**															
17	Purchased Water Services	$ 185,329	$ 189,289	$ 193,333	$ 197,464	$ 201,683	$ 205,992	$ 210,400	$ 214,901	$ 219,499	$ 224,195	$ 228,992	$ 233,891	$ 238,895	$ 244,006	$ 249,227
18	Contracted Services	3,665,671	3,741,727	3,819,362	3,898,611	3,979,505	4,062,080	4,146,412	4,232,498	4,320,373	4,410,075	4,500,993	4,592,974	4,686,836	4,782,617	4,880,356
19	Repairs & Maintenance	5,124,099	5,229,406	5,336,879	5,446,563	5,558,503	5,672,746	5,789,367	5,908,388	6,029,859	6,153,829	6,279,905	6,408,011	6,538,730	6,672,118	6,808,228
20	Professional Fees	2,347,954	2,394,913	2,442,811	2,491,667	2,541,501	2,592,331	2,644,177	2,697,061	2,751,002	2,806,022	2,862,142	2,919,385	2,977,773	3,037,328	3,098,075
21	Depreciation & Amortization	5,219,690	5,326,979	5,436,475	5,548,224	5,662,273	5,778,669	5,897,506	6,018,790	6,142,570	6,268,899	6,397,280	6,527,604	6,660,584	6,796,275	6,934,732
22	Purchased Sewer Services	177,606	181,300	185,071	188,921	192,851	196,862	200,960	205,144	209,415	213,774	218,225	222,768	227,406	232,140	236,974
23	Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	Solid Waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	Utilities	997,565	1,018,738	1,040,362	1,062,446	1,085,000	1,108,036	1,131,579	1,155,625	1,180,183	1,205,266	1,230,663	1,256,320	1,282,513	1,309,253	1,336,552
26	Purchased Services	3,055,106	3,117,805	3,181,791	3,247,092	3,313,734	3,381,746	3,451,194	3,522,071	3,594,404	3,668,224	3,743,320	3,819,650	3,897,538	3,977,016	4,058,115
27	Capital Outlay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	Connection Fees	74,372	75,859	77,377	78,924	80,503	82,113	83,755	85,430	87,139	88,881	90,659	92,472	94,322	96,208	98,132
29	Lease	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	Renewals & Replacements	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	Salaries and Benefits	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
32	Surface Water Fee	5,021,381	5,130,462	5,241,920	5,355,808	5,472,179	5,591,087	5,712,780	5,837,131	5,964,199	6,094,043	6,225,670	6,358,825	6,494,836	6,633,766	6,775,677
33		$ 25,868,773	$ 26,406,477	$ 26,955,381	$ 27,515,720	$ 28,087,732	$ 28,671,661	$ 29,268,131	$ 29,877,038	$ 30,498,642	$ 31,133,209	$ 31,777,850	$ 32,431,900	$ 33,099,434	$ 33,780,728	$ 34,476,067
34																
35	**Net Income before Debt Service**	$ 2,197,576	$ 1,888,597	$ 1,771,713	$ 1,652,677	$ 1,531,450	$ 1,407,994	$ 1,282,482	$ 1,154,671	$ 1,024,520	$ 891,987	$ 755,724	$ 582,856	$ 439,119	$ 292,668	$ 143,453
36																
37																
38	Capital Improvement Plan - Water															
39	Cost															
40	Principal	$ 109,761	$ 115,317	$ 121,155	$ 127,289	$ 133,733	$ 140,503	$ 147,616	$ 155,089	$ 162,941	$ 171,189	$ 179,856	$ 188,961	$ 198,527	$ 208,578	$ 219,137
41	Interest	117,628	112,071	106,233	100,099	93,655	86,885	79,772	72,299	64,448	56,199	47,532	38,427	28,861	18,811	8,251
42	Total	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388
43																
44	Capital Improvement Plan - Wastewater															
45	Cost															
46	Principal	$ 669,833	$ 703,743	$ 739,370	$ 776,800	$ 816,126	$ 857,442	$ 900,850	$ 946,456	$ 994,370	$ 1,044,710	$ 1,097,599	$ 1,153,164	$ 1,211,543	$ 1,272,878	$ 1,337,317
47	Interest	1,078,358	1,044,448	1,008,821	971,390	932,065	890,748	847,340	801,735	753,820	703,480	650,592	595,026	536,647	475,313	410,873
48	Total	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191
49																
50	**Total Debt Service**	$ 1,975,579	$ 1,975,579	$ 1,975,579	$ 1,975,579	$ 1,975,579	$ 1,975,579	$ 1,975,579	$ 1,975,579	$ 1,975,579	$ 1,975,579	$ 1,975,579	$ 1,975,579	$ 1,975,579	$ 1,975,579	$ 1,975,579
51																
52	**Net Income after Debt Service**	$ 221,997	$ (86,982)	$ (203,866)	$ (322,902)	$ (444,129)	$ (567,585)	$ (693,097)	$ (820,908)	$ (951,059)	$ (1,083,592)	$ (1,219,855)	$ (1,392,723)	$ (1,536,460)	$ (1,682,911)	$ (1,832,126)
53																
54	**Net Present Value (at 5% discount rate)**															
55																

City of Missouri City
Scenario 3: Inside City MUDs

Line No.		Year 16 2035	Year 17 2036	Year 18 2037	Year 19 2038	Year 20 2039	Year 21 2040	Year 22 2041	Year 23 2042	Year 24 2043	Year 25 2044	Year 26 2045	Year 27 2046	Year 28 2047	Year 29 2048	Year 30 2049
56	MUD Revenues															
57	Garbage Service	$ 1,420,384	$ 1,449,450	$ 1,479,112	$ 1,509,380	$ 1,540,268	$ 1,571,789	$ 1,603,944	$ 1,636,758	$ 1,670,243	$ 1,704,414	$ 1,739,284	$ 1,774,868	$ 1,811,180	$ 1,848,235	$ 1,886,049
58	Other Revenues	2,685,147	2,742,238	2,800,545	2,860,096	2,920,915	2,983,031	3,046,392	3,111,101	3,177,189	3,244,684	3,313,386	3,383,257	3,454,604	3,527,458	3,601,851
59	Other Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	Revenue Total	$ 4,105,531	$ 4,191,688	$ 4,279,657	$ 4,369,476	$ 4,461,183	$ 4,554,820	$ 4,650,336	$ 4,747,860	$ 4,847,432	$ 4,949,098	$ 5,052,670	$ 5,158,125	$ 5,265,784	$ 5,375,693	$ 5,487,900
61																
62	MUD Expenses															
63	Administrative Expenses	$ 720,398	$ 734,806	$ 749,502	$ 764,492	$ 779,782	$ 795,378	$ 811,285	$ 827,511	$ 844,061	$ 860,942	$ 878,161	$ 895,725	$ 913,639	$ 931,912	$ 950,550
64	Other	1,416,534	1,444,864	1,473,762	1,503,237	1,533,302	1,563,968	1,595,247	1,627,152	1,659,695	1,692,889	1,726,747	1,761,282	1,796,507	1,832,437	1,869,086
65	Solid Waste	688,900	702,678	716,731	731,066	745,687	760,601	775,813	791,329	807,156	823,299	839,765	856,560	873,691	891,165	908,988
66	Capital Outlay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
67	Expense Total	$ 2,825,831	$ 2,882,348	$ 2,939,995	$ 2,998,795	$ 3,058,771	$ 3,119,946	$ 3,182,345	$ 3,245,992	$ 3,310,912	$ 3,377,130	$ 3,444,673	$ 3,513,566	$ 3,583,837	$ 3,655,514	$ 3,728,624
68																
69	Debt Service Schedule															
70	Principal	$ 980,000	$ 405,000	$ 415,000	$ 435,000	$ 135,000	$ 140,000	$ 145,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
71	Interest	78,319	52,800	39,375	25,288	15,750	10,687	5,437	-	-	-	-	-	-	-	-
72	Total	$ 1,058,319	$ 457,800	$ 454,375	$ 460,288	$ 150,750	$ 150,687	$ 150,437	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
73																
74	Expense and Debt Total	$ 3,884,150	$ 3,340,148	$ 3,394,370	$ 3,459,083	$ 3,209,521	$ 3,270,633	$ 3,332,782	$ 3,245,992	$ 3,310,912	$ 3,377,130	$ 3,444,673	$ 3,513,566	$ 3,583,837	$ 3,655,514	$ 3,728,624
75																
76	Net Income before Property Tax	$ 221,380	$ 851,540	$ 885,287	$ 910,393	$ 1,251,663	$ 1,284,187	$ 1,317,554	$ 1,501,868	$ 1,536,521	$ 1,571,968	$ 1,607,997	$ 1,644,559	$ 1,681,946	$ 1,720,179	$ 1,759,276
77																
78	Property Tax	$ 22,539,055	$ 22,989,836	$ 23,449,632	$ 23,918,625	$ 24,396,998	$ 24,884,938	$ 25,382,636	$ 25,890,289	$ 26,408,095	$ 26,936,257	$ 27,474,982	$ 28,024,481	$ 28,584,971	$ 29,156,671	$ 29,739,804
79																
80	Net Property Tax Revenue After Debt & Expenses	$ 22,760,435	$ 23,841,376	$ 24,334,919	$ 24,829,018	$ 25,648,660	$ 26,169,124	$ 26,700,190	$ 27,392,157	$ 27,944,615	$ 28,508,225	$ 29,082,979	$ 29,669,040	$ 30,266,917	$ 30,876,849	$ 31,499,080
81																
82	Net Benefit to the City of Missouri City	$ 8,108,190	$ 8,108,190	$ 8,108,190	$ 8,108,190	$ 8,108,190	$ 8,108,190	$ 8,108,190	$ 8,108,190	$ 8,108,190	$ 8,108,190	$ 8,108,190	$ 8,108,190	$ 8,108,190	$ 8,108,190	$ 8,108,190

Schedule 2
Dissolution
Scenario 3.1

City of Missouri City
Scenario 3: Inside City MUDs

Line No.		Actual	Adjustments	Test Year			Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	Year 11 2030	Year 12 2031	Year 13 2032	Year 14 2033	Year 15 2034
1	**Revenues**																				
2	Water Service	$ 1,723,314	$ -	$ 1,723,314	B		$1,757,780	$1,794,555	$1,832,101	$1,870,432	$1,909,566	$1,949,520	$1,990,231	$2,031,793	$2,074,224	$2,117,542	$2,161,765	$2,205,636	$2,250,398	$2,296,069	$2,342,667
3	Property Tax	0	-	0	C		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	Wastewater Service	1,532,028	-	1,532,028	B		1,562,669	1,595,335	1,628,685	1,662,732	1,697,492	1,732,980	1,769,141	1,806,058	1,843,746	1,882,222	1,921,500	1,960,507	2,000,305	2,040,911	2,082,342
5	Garbage Service	0	-	0	L		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	Other Revenues	404,173	-	404,173	B		412,256	420,814	429,549	438,466	447,568	456,859	466,330	475,998	485,867	495,941	506,223	516,524	527,033	537,757	548,699
7	Tap Connection and Inspection Fees	166,528	-	166,528	I		169,859	173,256	176,721	180,255	183,860	187,538	191,288	195,114	199,016	202,997	207,057	211,198	215,422	219,730	224,125
8	Contracted Wastewater Fees	61,200	-	61,200	A		62,424	63,672	64,946	66,245	67,570	68,921	70,300	71,706	73,140	74,602	76,095	77,616	79,169	80,752	82,367
9	Participant Billings	6,354,577	-	6,354,577	B		6,481,669	6,614,217	6,749,476	6,887,501	7,028,349	7,172,077	7,318,736	7,468,395	7,621,115	7,776,957	7,935,986	8,098,258	8,263,849	8,432,826	8,605,259
10	Surface Water Fees	1,033,108	-	1,033,108	B		1,053,770	1,075,834	1,098,360	1,121,358	1,144,838	1,168,810	1,193,236	1,218,172	1,243,630	1,269,620	1,296,154	1,322,452	1,349,283	1,376,659	1,404,590
11	Other Tax	-	-	-	A		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	Water Impact Fee	-	-	-	D		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	Wastewater Impact Fee	-	-	-	D		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14		$ 11,274,928	$ -	$ 11,274,928			$ 11,500,427	$ 11,737,683	$ 11,979,837	$ 12,226,989	$ 12,479,243	$ 12,736,704	$ 12,999,263	$ 13,267,237	$ 13,540,738	$ 13,819,880	$ 14,104,779	$ 14,392,191	$ 14,685,460	$ 14,984,705	$ 15,290,049
15																					
16	**Operating Expenses**																				
17	Purchased Water Services	$ -	$ -	$ -	L		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
18	Contracted Services	361,217	-	361,217	L		368,441	376,081	383,879	391,838	399,963	408,256	416,704	425,326	434,127	443,110	452,279	461,351	470,606	480,046	489,675
19	Repairs & Maintenance	5,220,950	-	5,220,950	L		5,325,369	5,433,465	5,543,756	5,656,286	5,771,100	5,888,245	6,007,729	6,129,637	6,254,020	6,380,926	6,510,409	6,641,919	6,776,086	6,912,963	7,052,605
20	Professional Fees	23,067	-	23,067	A		23,528	23,999	24,479	24,968	25,468	25,977	26,497	27,027	27,567	28,119	28,681	29,255	29,840	30,436	31,045
21	Depreciation & Amortization	588,316	-	588,316	L	K	600,082	612,361	624,892	637,679	650,727	664,043	677,617	691,469	705,605	720,029	734,748	749,551	764,652	780,058	795,774
22	Purchased Sewer Services	413,327	-	413,327	J		398,917	407,262	415,781	424,479	334,819	341,823	348,954	356,233	363,664	234,673	239,568	244,360	249,247	254,232	259,316
23	Other	-	-	-	A		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	Solid Waste	-	-	-	A		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	Utilities	483,019	-	483,019	B		492,679	502,874	513,280	523,901	534,742	545,807	557,090	568,606	580,361	592,358	604,604	616,919	629,485	642,307	655,390
26	Purchased Services	-	-	-	M		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	Capital Outlay	607,368	(607,368)	-	E	K	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	Connection Fees	-	-	-	A		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	Lease	-	-	-	A		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	Renewals & Replacements	-	-	-	K		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	Salaries and Benefits	3,049,231	-	3,049,231	A		3,110,216	3,172,420	3,235,868	3,300,586	3,366,597	3,433,929	3,502,608	3,572,660	3,644,113	3,716,996	3,791,335	3,867,162	3,944,505	4,023,396	4,103,863
32	Surface Water Fee	1,137,075	-	1,137,075	B		1,159,817	1,184,079	1,208,850	1,234,139	1,259,958	1,286,318	1,313,177	1,340,598	1,368,592	1,397,171	1,426,347	1,455,295	1,484,830	1,514,965	1,545,711
33		$ 11,883,570	$ (607,368)	$ 11,276,202			$ 11,479,049	$ 11,712,541	$ 11,950,784	$ 12,193,876	$ 12,343,374	$ 12,594,399	$ 12,850,376	$ 13,111,557	$ 13,378,049	$ 13,513,382	$ 13,787,972	$ 14,065,812	$ 14,349,251	$ 14,638,402	$ 14,933,381
34																					
35	**Net Income before Debt Service**	$ (608,642)	$ 607,368	$ (1,274)			$ 21,378	$ 25,142	$ 29,052	$ 33,113	$ 135,868	$ 142,305	$ 148,887	$ 155,680	$ 162,689	$ 306,498	$ 316,807	$ 326,379	$ 336,209	$ 346,303	$ 356,668

City of Missouri City
Scenario 3: Inside City MUDs

Line No.		Actual	Adjustments	Test Year		Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	Year 11 2030	Year 12 2031	Year 13 2032	Year 14 2033	Year 15 2034
36																				
37																				
38	Capital Improvement Plan - Water																			
39	Cost	$ 4,301,686			F															
40	Principal					$ 65,336	$ 68,644	$ 72,119	$ 75,770	$ 79,605	$ 83,635	$ 87,870	$ 92,318	$ 96,991	$ 101,902	$ 107,060	$ 112,480	$ 118,175	$ 124,157	$ 130,443
41	Interest					218,579	215,272	211,797	208,146	204,310	200,280	196,046	191,597	186,924	182,014	176,855	171,435	165,741	159,758	153,472
42	Total					$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915
43																				
44	Capital Improvement Plan - Wastewater																			
45	Cost	$ 10,149,014			G															
46	Principal					$ 15,415	$ 16,195	$ 17,015	$ 17,876	$ 118,977	$ 125,001	$ 131,329	$ 137,977	$ 144,962	$ 190,838	$ 200,499	$ 210,649	$ 221,314	$ 232,518	$ 244,289
47	Interest					51,570	50,789	49,969	49,108	383,406	377,383	371,054	364,406	357,421	479,006	469,345	459,195	448,531	437,327	425,555
48	Total					$ 66,984	$ 66,984	$ 66,984	$ 66,984	$ 502,383	$ 502,383	$ 502,383	$ 502,383	$ 502,383	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844
49																				
50	Defease Existing MUD Debt and Developer Reimbursement Obligations																			
51	Cost	$ -			H															
52	Principal					$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
53	Interest					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
54	Total					$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
55																				
56	Total Debt Service					$ 350,900	$ 350,900	$ 350,900	$ 350,900	$ 786,298	$ 786,298	$ 786,298	$ 786,298	$ 786,298	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760
57																				
58	**Net Income after Debt Service**					$ (329,522)	$ (325,758)	$ (321,847)	$ (317,787)	$ (650,430)	$ (643,994)	$ (637,411)	$ (630,619)	$ (623,609)	$ (647,262)	$ (636,953)	$ (627,381)	$ (617,551)	$ (607,457)	$ (597,092)
59																				
60	**Net Present Value (at 5% discount rate)**	($8,018,183)																		

Notes:

A Annual increases in forecast based on inflation only

B Annual increases in forecast based on inflation and customer growth

C There will no longer be MUD property taxes under this option

D The City does not charge its impact fees to the MUDs

E Adjusted to remove captial outlay

F Based on the applicable water capital projects in the 2011 eHT report (Table 4-20) updated to today's dollars; does not include any capital costs for the new transmission lines (which are complete) or the new raw water treatment plant (which is already out for bid)

G Based on Option 5 (without WC&ID #2) in the 2018 eHT report (Table 5-1) allocated to the MUDs based on total buildout connection counts

H Based on total principal outstanding on all existing MUD debt plus all existing developer reimbursement obligations

I Assumes inspection fees are negligible and tap fee revenue will increase with inflation and end at buildout

J Annual increases in forecast based on 50% inflation plus 50% inflation and customer growth combined, but also account for the wastewater O&M savings projection from eHT report

K Assumes depreciation will fully fund capital needs for renewal and replacements

L Annual increases in forecast based on 50% inflation plus 50% inflation and customer growth combined

M Annual increases in forecast based on 50% inflation plus 50% inflation and customer growth combined, but also account for the wastewater O&M savings projection from eHT report based on an assumed 60/40 split in Purchased Services between water and sewer, respectively.

City of Missouri City
Scenario 3: Inside City MUDs

Line No.		Year 16 2035	Year 17 2036	Year 18 2037	Year 19 2038	Year 20 2039	Year 21 2040	Year 22 2041	Year 23 2042	Year 24 2043	Year 25 2044	Year 26 2045	Year 27 2046	Year 28 2047	Year 29 2048	Year 30 2049
1	**Revenues**															
2	Water Service	$2,390,210	$2,438,717	$2,488,208	$2,538,704	$2,590,224	$2,642,791	$2,696,427	$2,751,151	$2,806,986	$2,863,955	$2,922,080	$2,981,384	$3,041,893	$3,103,630	$3,166,619
3	Property Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	Wastewater Service	2,124,614	2,167,742	2,211,746	2,256,644	2,302,453	2,349,192	2,396,882	2,445,541	2,495,187	2,545,842	2,597,524	2,650,257	2,704,059	2,758,955	2,814,964
5	Garbage Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	Other Revenues	559,864	571,256	582,879	594,739	606,840	619,187	631,787	644,642	657,760	671,144	684,801	698,735	712,953	727,461	742,264
7	Tap Connection and Inspection Fees	228,607	233,179	237,843	242,600	247,452	252,401	257,449	262,598	267,850	273,207	278,671	284,244	289,929	295,728	301,642
8	Contracted Wastewater Fees	84,014	85,695	87,409	89,157	90,940	92,759	94,614	96,506	98,436	100,405	102,413	104,461	106,551	108,682	110,855
9	Participant Billings	8,781,217	8,960,764	9,143,982	9,330,946	9,521,734	9,716,422	9,915,106	10,117,852	10,324,744	10,535,867	10,751,307	10,971,152	11,195,493	11,424,421	11,658,030
10	Surface Water Fees	1,433,088	1,462,164	1,491,829	1,522,097	1,552,978	1,584,486	1,616,635	1,649,437	1,682,904	1,717,050	1,751,889	1,787,435	1,823,702	1,860,705	1,898,459
11	Other Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	Water Impact Fee	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	Wastewater Impact Fee	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14		$ 15,601,614	$ 15,919,516	$ 16,243,896	$ 16,574,886	$ 16,912,621	$ 17,257,238	$ 17,608,899	$ 17,967,727	$ 18,333,867	$ 18,707,469	$ 19,088,685	$ 19,477,669	$ 19,874,580	$ 20,279,580	$ 20,692,834
15																
16	**Operating Expenses**															
17	Purchased Water Services	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
18	Contracted Services	499,498	509,517	519,738	530,163	540,798	551,646	562,711	573,999	585,513	597,258	609,239	621,460	633,926	646,642	659,613
19	Repairs & Maintenance	7,195,068	7,340,406	7,488,679	7,639,947	7,794,272	7,951,713	8,112,340	8,276,212	8,443,394	8,613,953	8,787,957	8,965,477	9,146,582	9,331,346	9,519,843
20	Professional Fees	31,666	32,299	32,945	33,604	34,276	34,962	35,661	36,374	37,102	37,844	38,601	39,373	40,160	40,963	41,783
21	Depreciation & Amortization	811,806	828,162	844,846	861,867	879,231	896,945	915,016	933,451	952,257	971,443	991,015	1,010,981	1,031,350	1,052,129	1,073,326
22	Purchased Sewer Services	264,503	269,793	275,189	280,692	286,306	292,032	297,873	303,831	309,907	316,105	322,427	328,876	335,453	342,163	349,006
23	Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	Solid Waste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	Utilities	668,740	682,360	696,259	710,440	724,911	739,676	754,743	770,116	785,803	801,810	818,142	834,807	851,812	869,163	886,868
26	Purchased Services	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	Capital Outlay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	Connection Fees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	Lease	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	Renewals & Replacements	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	Salaries and Benefits	4,185,941	4,269,660	4,355,053	4,442,154	4,530,997	4,621,617	4,714,049	4,808,330	4,904,497	5,002,587	5,102,638	5,204,691	5,308,785	5,414,961	5,523,260
32	Surface Water Fee	1,577,082	1,609,088	1,641,744	1,675,062	1,709,057	1,743,742	1,779,133	1,815,242	1,852,084	1,889,673	1,928,026	1,967,157	2,007,083	2,047,819	2,089,381
33		$ 15,234,303	$ 15,541,285	$ 15,854,452	$ 16,173,931	$ 16,499,848	$ 16,832,332	$ 17,171,526	$ 17,517,554	$ 17,870,556	$ 18,230,672	$ 18,598,046	$ 18,972,822	$ 19,355,152	$ 19,745,186	$ 20,143,080
34																
35	**Net Income before Debt Service**	$ 367,311	$ 378,232	$ 389,444	$ 400,955	$ 412,773	$ 424,905	$ 437,374	$ 450,173	$ 463,311	$ 476,797	$ 490,639	$ 504,847	$ 519,429	$ 534,395	$ 549,754

City of Missouri City
Scenario 3: Inside City MUDs

Line No.		Year 16 2035	Year 17 2036	Year 18 2037	Year 19 2038	Year 20 2039	Year 21 2040	Year 22 2041	Year 23 2042	Year 24 2043	Year 25 2044	Year 26 2045	Year 27 2046	Year 28 2047	Year 29 2048	Year 30 2049
36																
37																
38	Capital Improvement Plan - Water															
39	Cost															
40	Principal	$ 137,046	$ 143,984	$ 151,274	$ 158,932	$ 166,978	$ 175,431	$ 184,312	$ 193,643	$ 203,446	$ 213,746	$ 224,567	$ 235,935	$ 247,879	$ 260,428	$ 273,613
41	Interest	146,869	139,931	132,642	124,983	116,937	108,484	99,603	90,272	80,469	70,170	59,349	47,980	36,036	23,487	10,303
42	Total	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915	$ 283,915
43																
44	Capital Improvement Plan - Wastewate															
45	Cost															
46	Principal	$ 256,656	$ 269,649	$ 283,300	$ 297,642	$ 312,710	$ 328,541	$ 345,174	$ 362,648	$ 381,007	$ 400,296	$ 420,561	$ 441,852	$ 464,220	$ 487,721	$ 512,412
47	Interest	413,188	400,195	386,544	372,202	357,134	341,303	324,671	307,196	288,837	269,549	249,284	227,993	205,624	182,123	157,432
48	Total	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844	$ 669,844
49																
50	Defease Existing MUD Debt and Develc															
51	Cost															
52	Principal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
53	Interest	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
54	Total	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
55																
56	Total Debt Service	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760	$ 953,760
57																
58	**Net Income after Debt Service**	$ (586,448)	$ (575,528)	$ (564,316)	$ (552,805)	$ (540,987)	$ (528,854)	$ (516,386)	$ (503,587)	$ (490,449)	$ (476,963)	$ (463,121)	$ (448,913)	$ (434,331)	$ (419,365)	$ (404,005)

City of Missouri City
Scenario 3: Inside City MUDs

Schedule 2
Dissolution
Scenario 3.2

Line No.		Actual	Adjustments	Test Year		Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	Year 11 2030	Year 12 2031	Year 13 2032	Year 14 2033	Year 15 2034
1	**Revenues**																			
2	Water Service	$ 4,369,449	$ -	$ 4,369,449	B	$4,456,838	$4,567,027	$4,680,359	$4,796,943	$4,916,892	$5,040,324	$5,160,682	$5,284,153	$5,410,825	$5,540,791	$5,674,149	$5,798,487	$5,925,589	$6,055,517	$6,188,334
3	Property Tax	16,418,480	-	16,418,480	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	Wastewater Service	4,818,158	-	4,818,158	B	4,914,521	5,043,563	5,176,636	5,313,895	5,455,500	5,601,621	5,739,374	5,880,793	6,025,988	6,175,068	6,328,150	6,465,248	6,605,350	6,748,523	6,894,835
5	Garbage Service	1,010,973	-	1,010,973	L	1,031,192	1,053,750	1,076,822	1,100,420	1,124,558	1,149,248	1,174,253	1,199,821	1,225,964	1,252,696	1,280,031	1,306,939	1,334,416	1,362,474	1,391,126
6	Other Revenues	1,846,804	-	1,846,804	B	1,883,740	1,931,151	1,979,956	2,030,204	2,081,948	2,135,242	2,187,007	2,240,146	2,294,699	2,350,709	2,408,220	2,461,185	2,515,332	2,570,690	2,627,285
7	Tap Connection and Inspection Fees	640,745	-	640,745	I	531,532	542,163	553,006	564,066	575,348	586,854	598,592	610,563	622,775	635,230	647,935	552,024	563,064	574,326	585,812
8	Contracted Wastewater Fees	0	-	0	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	Participant Billings	0	-	0	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Surface Water Fees	4,145,905	-	4,145,905	B	4,228,823	4,331,727	4,437,434	4,546,033	4,657,619	4,772,289	4,885,500	5,001,571	5,120,581	5,242,612	5,367,749	5,487,138	5,609,213	5,734,035	5,861,665
11	Other Tax	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	Water Impact Fee	-	-	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	Wastewater Impact Fee	-	-	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14		$ 33,250,514	$ -	$ 33,250,514		$ 17,046,647	$ 17,469,381	$ 17,904,213	$ 18,351,561	$ 18,811,865	$ 19,285,579	$ 19,745,408	$ 20,217,047	$ 20,700,831	$ 21,197,107	$ 21,706,233	$ 22,071,021	$ 22,552,965	$ 23,045,564	$ 23,549,057
15																				
16	**Operating Expenses**																			
17	Purchased Water Services	$ 132,244	$ -	$ 132,244	L	$ 134,889	$ 137,779	$ 140,731	$ 143,746	$ 146,825	$ 149,971	$ 153,181	$ 156,460	$ 159,809	$ 163,229	$ 166,723	$ 170,289	$ 173,930	$ 177,650	$ 181,449
18	Contracted Services	2,572,938	-	2,572,938	L	2,624,397	2,686,412	2,749,986	2,815,162	2,881,983	2,950,495	3,017,512	3,086,097	3,156,289	3,228,127	3,301,650	3,371,428	3,442,687	3,515,459	3,589,776
19	Repairs & Maintenance	3,632,785	-	3,632,785	L	3,705,441	3,789,004	3,874,552	3,962,138	4,051,812	4,143,627	4,234,768	4,327,971	4,423,283	4,520,754	4,620,436	4,717,026	4,815,644	4,916,332	5,019,136
20	Professional Fees	1,710,357	-	1,710,357	A	1,744,564	1,779,455	1,815,045	1,851,345	1,888,372	1,926,140	1,964,663	2,003,956	2,044,035	2,084,916	2,126,614	2,169,146	2,212,529	2,256,780	2,301,915
21	Depreciation & Amortization	3,660,800	-	3,660,800	L K	3,734,016	3,823,180	3,914,627	4,008,421	4,104,626	4,203,310	4,299,073	4,397,092	4,497,422	4,600,120	4,705,243	4,803,887	4,904,609	5,007,453	5,112,465
22	Purchased Sewer Services	276,622	-	276,622	J	266,978	272,538	278,214	284,008	223,998	228,663	233,424	238,283	243,243	156,959	160,226	163,560	166,964	170,438	173,985
23	Other	1,031,868	-	1,031,868	A	1,052,505	1,073,555	1,095,027	1,116,927	1,139,266	1,162,051	1,185,292	1,208,998	1,233,178	1,257,841	1,282,998	1,308,658	1,334,831	1,361,528	1,388,758
24	Solid Waste	501,826	-	501,826	A	511,863	522,100	532,542	543,193	554,056	565,138	576,440	587,969	599,729	611,723	623,958	636,437	649,165	662,149	675,392
25	Utilities	707,547	-	707,547	B	721,698	737,557	753,782	770,382	787,365	804,743	822,371	840,399	858,836	877,693	896,979	916,243	935,925	956,033	976,576
26	Purchased Services	2,604,238	-	2,604,238	M	2,602,018	2,669,378	2,738,627	2,809,821	2,647,266	2,716,309	2,781,952	2,849,248	2,918,242	2,684,559	2,749,635	2,808,164	2,867,948	2,929,015	2,991,391
27	Capital Outlay	202,781	(202,781)	-	E K	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	Connection Fees	54,176	-	54,176	A	55,260	56,365	57,492	58,642	59,815	61,011	62,231	63,476	64,745	66,040	67,361	68,708	70,082	71,484	72,914
29	Lease	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	Renewals & Replacements	-	-	-	K	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	Salaries and Benefits	-	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
32	Surface Water Fee	3,564,735	-	3,564,735	B	3,636,030	3,715,156	3,796,011	3,878,633	3,963,060	4,049,332	4,137,441	4,227,475	4,319,476	4,413,486	4,509,551	4,607,548	4,707,682	4,810,000	4,914,550
33		$ 20,652,917	$ (202,781)	$ 20,450,136		$ 20,789,657	$ 21,262,479	$ 21,746,635	$ 22,242,416	$ 22,448,445	$ 22,960,791	$ 23,468,348	$ 23,987,423	$ 24,518,286	$ 24,665,447	$ 25,211,375	$ 25,741,094	$ 26,281,996	$ 26,834,320	$ 27,398,307
34																				
35	**Net Income before Debt Service**	$ 12,597,597	$ 202,781	$ 12,800,378		$ (3,743,010)	$ (3,793,097)	$ (3,842,422)	$ (3,890,855)	$ (3,636,580)	$ (3,675,212)	$ (3,722,940)	$ (3,770,376)	$ (3,817,455)	$ (3,468,340)	$ (3,505,142)	$ (3,670,073)	$ (3,729,031)	$ (3,788,756)	$ (3,849,250)

City of Missouri City
Scenario 3: Inside City MUDs

Line No.		Actual	Adjustments	Test Year		Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	Year 11 2030	Year 12 2031	Year 13 2032	Year 14 2033	Year 15 2034
36																				
37																				
38	Capital Improvement Plan - Water																			
39	Cost	$ 3,445,230			F															
40	Principal					$ 52,328	$ 54,977	$ 57,760	$ 60,684	$ 63,756	$ 66,984	$ 70,375	$ 73,938	$ 77,681	$ 81,613	$ 85,745	$ 90,086	$ 94,646	$ 99,438	$ 104,472
41	Interest					175,061	172,412	169,628	166,704	163,632	160,405	157,013	153,451	149,708	145,775	141,643	137,303	132,742	127,950	122,916
42	Total					$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388
43																				
44	Capital Improvement Plan - Wastewater																			
45	Cost	$ 26,487,364			G															
46	Principal					$ 40,230	$ 42,267	$ 44,407	$ 46,655	$ 310,513	$ 326,232	$ 342,748	$ 360,100	$ 378,330	$ 498,058	$ 523,272	$ 549,763	$ 577,594	$ 606,835	$ 637,556
47	Interest					134,589	132,552	130,412	128,164	1,000,630	984,911	968,395	951,043	932,813	1,250,133	1,224,919	1,198,428	1,170,596	1,141,355	1,110,634
48	Total					$ 174,819	$ 174,819	$ 174,819	$ 174,819	$ 1,311,143	$ 1,311,143	$ 1,311,143	$ 1,311,143	$ 1,311,143	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191
49																				
50	Defease Existing MUD Debt and Developer Reimbursement Obligations																			
51	Cost	$ 83,184,637			H															
52	Principal					$ 1,263,445	$ 1,327,407	$ 1,394,607	$ 1,465,209	$ 1,539,385	$ 1,617,316	$ 1,699,193	$ 1,785,214	$ 1,875,591	$ 1,970,543	$ 2,070,301	$ 2,175,110	$ 2,285,225	$ 2,400,915	$ 2,522,461
53	Interest					4,226,818	4,162,857	4,095,657	4,025,055	3,950,878	3,872,947	3,791,070	3,705,049	3,614,672	3,519,721	3,419,962	3,315,153	3,205,038	3,089,348	2,967,802
54	Total					$ 5,490,263	$ 5,490,263	$ 5,490,263	$ 5,490,263	$ 5,490,263	$ 5,490,263	$ 5,490,263	$ 5,490,263	$ 5,490,263	$ 5,490,263	$ 5,490,263	$ 5,490,263	$ 5,490,263	$ 5,490,263	$ 5,490,263
55																				
56	Total Debt Service					$ 5,892,471	$ 5,892,471	$ 5,892,471	$ 5,892,471	$ 7,028,795	$ 7,028,795	$ 7,028,795	$ 7,028,795	$ 7,028,795	$ 7,465,842	$ 7,465,842	$ 7,465,842	$ 7,465,842	$ 7,465,842	$ 7,465,842
57																				
58	**Net Income after Debt Service**					$ (9,635,481)	$ (9,685,568)	$ (9,734,893)	$ (9,783,326)	$ (10,665,375)	$ (10,704,006)	$ (10,751,734)	$ (10,799,171)	$ (10,846,249)	$ (10,934,182)	$ (10,970,984)	$ (11,135,915)	$ (11,194,873)	$ (11,254,598)	$ (11,315,092)
59																				
60	**Net Present Value (at 5% discount rate)**	($169,120,624)																		

Notes:

A Annual increases in forecast based on inflation only

B Annual increases in forecast based on inflation and customer growth

C There will no longer be MUD property taxes under this option

D The City does not charge its impact fees to the MUDs

E Adjusted to remove captial outlay

F Based on the applicable water capital projects in the 2011 eHT report (Table 4-20) updated to today's dollars; does not include any capital costs for the new transmission lines (which are complete) or the new raw water treatment plant (which is already out for bid)

G Based on Option 5 (without WC&ID #2) in the 2018 eHT report (Table 5-1) allocated to the MUDs based on total buildout connection counts

H Based on total principal outstanding on all existing MUD debt plus all existing developer reimbursement obligations

I Assumes inspection fees are negligible and tap fee revenue will increase with inflation and end at buildout

J Annual increases in forecast based on 50% inflation plus 50% inflation and customer growth combined, but also account for the wastewater O&M savings projection from eHT report

K Assumes depreciation will fully fund capital needs for renewal and replacements

L Annual increases in forecast based on 50% inflation plus 50% inflation and customer growth combined

M Annual increases in forecast based on 50% inflation plus 50% inflation and customer growth combined, but also account for the wastewater O&M savings projection from eHT report based on an assumed 60/40 split in Purchased Services between water and sewer, respectively.

City of Missouri City
Scenario 3: Inside City MUDs

Line No.		Year 16 2035	Year 17 2036	Year 18 2037	Year 19 2038	Year 20 2039	Year 21 2040	Year 22 2041	Year 23 2042	Year 24 2043	Year 25 2044	Year 26 2045	Year 27 2046	Year 28 2047	Year 29 2048	Year 30 2049
1	**Revenues**															
2	Water Service	$6,324,106	$6,458,844	$6,596,464	$6,737,027	$6,880,596	$7,027,236	$7,177,167	$7,330,309	$7,486,732	$7,646,506	$7,808,297	$7,971,756	$8,138,644	$8,309,035	$8,483,001
3	Property Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	Wastewater Service	7,044,356	7,194,221	7,347,287	7,503,624	7,663,302	7,826,392	7,993,162	8,163,502	8,337,488	8,515,199	8,694,771	8,875,700	9,060,403	9,248,959	9,441,448
5	Garbage Service	1,420,384	1,449,450	1,479,112	1,509,380	1,540,268	1,571,789	1,603,944	1,636,758	1,670,243	1,704,414	1,739,284	1,774,868	1,811,180	1,848,235	1,886,049
6	Other Revenues	2,685,147	2,742,238	2,800,545	2,860,096	2,920,915	2,983,031	3,046,392	3,111,101	3,177,189	3,244,684	3,313,386	3,383,257	3,454,604	3,527,458	3,601,851
7	Tap Connection and Inspection Fees	597,528	411,387	419,614	428,007	436,567	445,298	454,204	463,288	472,554	482,005	491,645	469,047	478,428	487,997	497,757
8	Contracted Wastewater Fees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	Participant Billings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Surface Water Fees	5,992,170	6,122,433	6,255,538	6,391,548	6,530,527	6,672,539	6,817,890	6,966,419	7,118,197	7,273,296	7,430,671	7,590,064	7,752,887	7,919,215	8,089,125
11	Other Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	Water Impact Fee	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	Wastewater Impact Fee	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14		$ 24,063,690	$ 24,378,572	$ 24,898,561	$ 25,429,682	$ 25,972,175	$ 26,526,285	$ 27,092,759	$ 27,671,378	$ 28,262,404	$ 28,866,104	$ 29,478,054	$ 30,064,691	$ 30,696,146	$ 31,340,899	$ 31,999,231
15																
16	**Operating Expenses**															
17	Purchased Water Services	$ 185,329	$ 189,289	$ 193,333	$ 197,464	$ 201,683	$ 205,992	$ 210,400	$ 214,901	$ 219,499	$ 224,195	$ 228,992	$ 233,891	$ 238,895	$ 244,006	$ 249,227
18	Contracted Services	3,665,671	3,741,727	3,819,362	3,898,611	3,979,505	4,062,080	4,146,412	4,232,498	4,320,373	4,410,075	4,500,993	4,592,974	4,686,836	4,782,617	4,880,356
19	Repairs & Maintenance	5,124,099	5,229,406	5,336,879	5,446,563	5,558,503	5,672,746	5,789,367	5,908,388	6,029,859	6,153,829	6,279,905	6,408,011	6,538,730	6,672,118	6,808,228
20	Professional Fees	2,347,954	2,394,913	2,442,811	2,491,667	2,541,501	2,592,331	2,644,177	2,697,061	2,751,002	2,806,022	2,862,142	2,919,385	2,977,773	3,037,328	3,098,075
21	Depreciation & Amortization	5,219,690	5,326,979	5,436,475	5,548,224	5,662,273	5,778,669	5,897,506	6,018,790	6,142,570	6,268,899	6,397,280	6,527,604	6,660,584	6,796,275	6,934,732
22	Purchased Sewer Services	177,606	181,300	185,071	188,921	192,851	196,862	200,960	205,144	209,415	213,774	218,225	222,768	227,406	232,140	236,974
23	Other	1,416,534	1,444,864	1,473,762	1,503,237	1,533,302	1,563,968	1,595,247	1,627,152	1,659,695	1,692,889	1,726,747	1,761,282	1,796,507	1,832,437	1,869,086
24	Solid Waste	688,900	702,678	716,731	731,066	745,687	760,601	775,813	791,329	807,156	823,299	839,765	856,560	873,691	891,165	908,988
25	Utilities	997,565	1,018,738	1,040,362	1,062,446	1,085,000	1,108,036	1,131,579	1,155,625	1,180,183	1,205,266	1,230,663	1,256,320	1,282,513	1,309,253	1,336,552
26	Purchased Services	3,055,106	3,117,805	3,181,791	3,247,092	3,313,734	3,381,746	3,451,194	3,522,071	3,594,404	3,668,224	3,743,320	3,819,650	3,897,538	3,977,016	4,058,115
27	Capital Outlay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	Connection Fees	74,372	75,859	77,377	78,924	80,503	82,113	83,755	85,430	87,139	88,881	90,659	92,472	94,322	96,208	98,132
29	Lease	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	Renewals & Replacements	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	Salaries and Benefits	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
32	Surface Water Fee	5,021,381	5,130,462	5,241,920	5,355,808	5,472,179	5,591,087	5,712,780	5,837,131	5,964,199	6,094,043	6,225,670	6,358,825	6,494,836	6,633,766	6,775,677
33		$ 27,974,206	$ 28,554,018	$ 29,145,873	$ 29,750,022	$ 30,366,720	$ 30,996,229	$ 31,639,191	$ 32,295,519	$ 32,965,493	$ 33,649,396	$ 34,344,361	$ 35,049,742	$ 35,769,632	$ 36,504,330	$ 37,254,142
34																
35	**Net Income before Debt Service**	$ (3,910,517)	$ (4,175,446)	$ (4,247,313)	$ (4,320,340)	$ (4,394,545)	$ (4,469,944)	$ (4,546,432)	$ (4,624,141)	$ (4,703,088)	$ (4,783,292)	$ (4,866,307)	$ (4,985,051)	$ (5,073,486)	$ (5,163,431)	$ (5,254,911)

City of Missouri City
Scenario 3: Inside City MUDs

Line No.		Year 16 2035	Year 17 2036	Year 18 2037	Year 19 2038	Year 20 2039	Year 21 2040	Year 22 2041	Year 23 2042	Year 24 2043	Year 25 2044	Year 26 2045	Year 27 2046	Year 28 2047	Year 29 2048	Year 30 2049
36																
37																
38	Capital Improvement Plan - Water															
39	Cost															
40	Principal	$ 109,761	$ 115,317	$ 121,155	$ 127,289	$ 133,733	$ 140,503	$ 147,616	$ 155,089	$ 162,941	$ 171,189	$ 179,856	$ 188,961	$ 198,527	$ 208,578	$ 219,137
41	Interest	117,628	112,071	106,233	100,099	93,655	86,885	79,772	72,299	64,448	56,199	47,532	38,427	28,861	18,811	8,251
42	Total	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388	$ 227,388
43																
44	Capital Improvement Plan - Wastewate															
45	Cost															
46	Principal	$ 669,833	$ 703,743	$ 739,370	$ 776,800	$ 816,126	$ 857,442	$ 900,850	$ 946,456	$ 994,370	$ 1,044,710	$ 1,097,599	$ 1,153,164	$ 1,211,543	$ 1,272,878	$ 1,337,317
47	Interest	1,078,358	1,044,448	1,008,821	971,390	932,065	890,748	847,340	801,735	753,820	703,480	650,592	595,026	536,647	475,313	410,873
48	Total	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191	$ 1,748,191
49																
50	Defease Existing MUD Debt and Develc															
51	Cost															
52	Principal	$ 2,650,161	$ 2,784,325	$ 2,925,282	$ 3,073,374	$ 3,228,964	$ 3,392,430	$ 3,564,172	$ 3,744,608	$ 3,934,179	$ 4,133,346	$ 4,342,597	$ 4,562,441	$ 4,793,415	$ 5,036,081	$ 5,291,033
53	Interest	2,840,102	2,705,938	2,564,981	2,416,889	2,261,300	2,097,833	1,926,091	1,745,655	1,556,085	1,356,917	1,147,666	927,822	696,848	454,182	199,230
54	Total	$ 5,490,263	$ 5,490,263	$ 5,490,263	$ 5,490,263	$ 5,490,263	$ 5,490,263	$ 5,490,263	$ 5,490,263	$ 5,490,263	$ 5,490,263	$ 5,490,263	$ 5,490,263	$ 5,490,263	$ 5,490,263	$ 5,490,263
55																
56	Total Debt Service	$ 7,465,842	$ 7,465,842	$ 7,465,842	$ 7,465,842	$ 7,465,842	$ 7,465,842	$ 7,465,842	$ 7,465,842	$ 7,465,842	$ 7,465,842	$ 7,465,842	$ 7,465,842	$ 7,465,842	$ 7,465,842	$ 7,465,842
57																
58	**Net Income after Debt Service**	$ (11,376,359)	$ (11,641,289)	$ (11,713,155)	$ (11,786,182)	$ (11,860,387)	$ (11,935,786)	$ (12,012,274)	$ (12,089,983)	$ (12,168,931)	$ (12,249,135)	$ (12,332,149)	$ (12,450,893)	$ (12,539,328)	$ (12,629,273)	$ (12,720,753)

Schedule 3
Allocation of Water Captial Projects

No.	Project	Connections at Build Out [2]	Estimated Capital Cost (2011 dollars) [1]	Impact on Scenario
1	Interconnection Project		$ 607,000	
	Allocation [3]			
	First Colony MUD #9	3,300	**$ 516,263**	**3**
	Fort Bend County MUD #115	580	**$ 90,737**	**3**
		3,880	$ 607,000	
2	Interconnection Project		$ 799,000	
	Allocation [3]			
	Mustang Bayou WTP System [8]	5,106	$ 592,376	4
	Sienna Plantation MUD #2	1,781	**$ 206,624**	**1.2**
		6,887	$ 799,000	
3	Interconnection Project		$ 683,500	
	Allocation [3]			
	Mustang Bayou WTP System [8]	5,106	$ 452,066	4
	Sienna Plantation MUD #3	2,614	**$ 231,434**	**1.2**
		7,720	$ 683,500	
4	Interconnection Project		$ 458,000	
	Allocation [3]			
	Sienna Plantation MUD #1 [4]	9,939	**$ 228,299**	**1.2**
	Sienna Plantation MUD #5 [4]	10,000	**$ 229,701**	**1.3**
		19,939	$ 458,000	
5	Interconnection Project		$ 927,500	
	Allocation [3]			
	Sienna Plantation System (MUD #1) [5]	9,939	**$ 444,540**	**1.2**
	Sienna Plantation System (MUD #5) [5]	10,000	**$ 447,268**	**1.3**
	Palmer Plantation MUD #1	798	**$ 35,692**	**3**
		20,737	$ 927,500	
6	Interconnection Project		$ 154,000	
	Allocation [3]			
	Silver Ridge Development [7]	1,122	$ 15,621	(none)
	Sienna Plantation MUD #1 [4]	9,939	**$ 138,379**	**1.2**
		11,061	$ 154,000	
7	Interconnection Project		$ 579,000	
	Allocation [3]			
	Fort Bend County MUD #149	1,700	**$ 84,569**	**1.1**
	Sienna Plantation MUD #1 [4]	9,939	**$ 494,431**	**1.2**
		11,639	$ 579,000	

No.	Project	Connections at Build Out [2]	Estimated Capital Cost (2011 dollars) [1]	Impact on Scenario
8	Interconnection Project		$ 298,000	
	Allocation [3]			
	Mustang Bayou WTP System [8]	5,106	$ 220,392	4
	Palmer Plantation [6]	1,798	**$ 77,608**	**3**
		6,904	$ 298,000	
9	Interconnection Project		$ 289,000	
	Allocation [3]			
	Mustang Bayou WTP System [8]	5,106	$ 153,392	4
	Quail Valley Utility District	4,514	**$ 135,608**	**3**
		9,620	$ 289,000	
10	Elevated Storage Project		$ 4,602,000	
	Sienna Plantation MUD #1		**$ 4,602,000**	**1.2**
11	Elevated Storage Project		$ 1,947,000	
	Allocation [3]			
	Mustang Bayou WTP System [8]	5,106	$ 660,776	4
	Sienna Plantation MUD #1 [4]	9,939	**$ 1,286,224**	**1.2**
		15,045	$ 1,947,000	
12	Elevated Storage Project		$ 6,372,000	
	Allocation [3]			
	Fort Bend County MUD #149	1,700	**$ 814,956**	**1.1**
	Sienna Plantation MUD #1 [4]	9,939	**$ 4,764,618**	**1.2**
	Ft. Bend County MUD #46	1,073	**$ 514,381**	**3**
	Ft. Bend County MUD #115	580	**$ 278,044**	**3**
		13,292	$ 6,372,000	
13	Elevated Storage Project		$ 3,717,000	
	Allocation [3]			
	Palmer Plantation MUD #2	1,000	**$ 443,927**	**3**
	Palmer Plantation MUD #1	798	**$ 354,254**	**3**
	Ft. Bend County MUD #49	396	**$ 175,795**	**3**
	Ft. Bend County MUD #46	1,073	**$ 476,334**	**3**
	Mustang Bayou WTP System [8]	5,106	$ 2,266,691	4
		8,373	$ 3,717,000	
14	Elevated Storage Project		$ 3,717,000	
	Thunderbird Utility District		**$ 3,717,000**	**3**

Schedule 3
Allocation of Water Captial Projects

No.	Project	Connections at Build Out [2]	Estimated Capital Cost (2011 dollars) [1]	Impact on Scenario
15	Elevated Storage Project		$ 1,947,000	
	Harris County WCID - Fondren Road		**$ 1,947,000**	**2**

Footnotes:

[1] Source: eHT 2011 Regional Water & Wastewater Planning Study, Table 4-20 (Page 4-16)

[2] Source: eHT 2018 Regional Water & Wastewater Planning Study, dated January 2019, Table 2-1 (Page 2-4)

[3] Based on build out connection count

[4] Connection count includes subservient MUDs

[5] Sienna Plantation System is assumed to include all the Sienna Plantation MUDs

[6] Assumes Palmer Plantation is composed of Palmer Plantation MUD #1 and Palmer Plantation MUD #2

[7] Silver Ridge Development build out provided by City staff

[8] Connection count for Mustang Bayou WTP System from revised growth projection provided by City staff

Appendix J
FINANCIAL ADVISER WRITTEN ANALYSIS

Joe Morrow
Managing Director

August 8 2018

Ms. Edena Atmore
Director of Finance
1522 Texas Parkway
Missouri City, Texas 77489

Dear: Edena

As a part of the City's review of Municipal Utility Districts (the "MUDs") within the City of Missouri City, Texas, (the "City") I have been asked to comment on the debt of these entities and the ability of the City to absorb their debt onto its own balance sheet. Specifically, if this debt were to become an ad valorem tax debt of the City, what impact would it have?

The MUDs currently treat their debt as ad valorem tax debt thereby levying a tax to support the annual debt payments. This would be difficult for the City to duplicate given its own capital needs. Currently, the goal of the City has been to maintain debt at a level that will keep the City within its rating category medians. This focus has led to an annual review of the capacity of the City to issue additional ad valorem tax debt without having a negative impact on the credit rating. There is not capacity to take on the additional MUD debt and do the general purpose Capital Improvement Plan of the City.

Further, the amount of debt that the City has from direct and indirect debt, pension and other post-employment benefits is referenced as above average in Moody's Credit Report. Moody's Investor Service lists increasing the net debt burden due to additional issuance absent tax base growth or a reduction in the support from the surface water utility as a factor that could lead to a downgrade. The City currently has a strong credit rating of Aa2. It is important to stay in the Aa category for a low cost of borrowing. Other credit factors that help offset debt are above average income levels, strong fund balance levels (typically unrestricted in excess of 30% of annual requirements) and a low level of debt as a percent of the overall general purpose budget. Changes in these other credit factors take time and are viewed on a five year historical basis for trend analysis.

Most cities that have essential service utility systems treat them as a business. Therefore, the system is not supported from the levy of taxes but rather from user fees. The City would need to establish a utility system revenue stream from user fees. Because the user fees currently being charged are supplemented with ad valorem taxes, it is reasonable to assume a large rate increase in user fees would be required to cash flow the operations and debt of the system. This may not be an option the City would consider but it would allow the City to continue with its own capital improvement plan.

Hilltop Securities Inc.
700 Milam Street
Suite 500
Houston, Texas 77002

Joe.morrow@hilltopsecurities.com
HilltopSecurities.com

Let me know if you have any questions or if I may provide further information.

Sincerely yours,

Joe Morrow
Managing Director

Appendix K
List of Persons Providing Written Comments

Name	Organization
Chad E. Hablinski, P.E.	Costello Engineering & Surveying
Nancy Carter	The Muller Law Group, PLLC
Michael R. Willis	Sanford Kuhl Hagan Kugle Parker Kahn LLP
E Joyce Iyamu	City Attorney, City of Missouri City