City of Sealy, Texas

Master Drainage Plan for Allens Creek Watershed 2010 - 2020

SPI Project No. 301401.00

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Submitted by:

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1.0 Executive Summary

Schaumburg & Polk, Inc. (SPI) has been contracted by the City of Sealy to prepare a Master Drainage Plan (MDP). The study area for the MDP is broken down into two sections: the Little Bernard Tributary Watershed (herein referred to as Section 1 of the MDP), and the Allens Creek Watershed (Section 2 of the MDP). Section 1 of the MDP was adopted by the City of Sealy City Council on August 24, 2010. This document represents the Master Plan for Section 2 – the Allens Creek Watershed.

The objective of this study is to evaluate the projected ultimate development conditions for the City of Sealy, and to identify the drainage facilities needed to support anticipated growth. The main purpose for this document is to serve as a planning tool for the City in several aspects:

1. To serve as a guide for developing and implementing shorter and nearer term drainage capital improvement plans
2. To provide the City the authority to require right-of-way through the development process
3. To aid in planning for major drainage crossings as new roadways are constructed or existing roadways are improved
4. To work in parallel with the City's other ordinances and regulations, such as Chapter 27, "Drainage Criteria."

The resulting plan will consist of features that are large in scale. The intent and expectation is not to implement and construct these projects immediately or all at one time. Development will have a significant impact on how the plan is implemented, and can even take on much of the responsibility for the construction of portions of the ultimate channels described in this report. Furthermore, while the plan features will facilitate new development, the implementation of the plan is not a prerequisite for development activity.

Subsequent to the adoption of this Master Plan, the City may adopt a more defined CIP for the nearer-term growth that can build on the projects and concepts outlined in this Plan.

The study was developed as follows:

- Evaluation of existing conditions of the project area, including defining existing land uses, identifying seven main basins within the project area (to be introduced later as AC-100, W TRIB1, W TRIB2, W TRIB3, N TRIB, E TRIB, and FRONT STREET), and evaluating service levels of existing drainage facilities.

- Identification of anticipated ultimate development conditions, and identifying drainage conveyance infrastructure required to support that growth.

- Calculation of estimated project costs, which include those associated with construction, right-of-way, pipeline and utility adjustments and engineering.

2.0 Introduction

This document describes and presents a master plan for drainage facilities within the current corporate limits of the City of Sealy and its Extra-Territorial Jurisdiction (ETJ) that drain toward Allens Creek. This document is Section 2 of the overall development of the City of Sealy Master Drainage Plan (MDP).

2.1 Purpose

The purpose of the Master Drainage Plan (MDP) is to identify future drainage infrastructure that will improve the economic well being of the City of Sealy (City). This includes the reduction of existing flood risks as well as the overall improvement of drainage during more frequent events. It also includes the encouragement of future investment in the City by providing a mechanism to drain properties.

The MDP was developed with the following goals, objectives, and constraints:

- Identify improvements to be made to existing drainage infrastructure (channels and roadway crossings) required to support drainage for the entire basin
- Identify future drainage channels that will convey runoff to outfall points along the existing major waterways adjacent to the City
- Identify right-of-way requirements for channel improvements and proposed channels such that the City will have the authority to require right-of-way through the development process
- Avoid increased flood levels in Allens Creek

This document and accompanying exhibits will assist the City in the future programming of Capital Improvement Plans and will provide guidance in the planning of future development. As a master plan, this document is designed to incorporate built-in flexibility, and is intended to serve as a guide for future activity, not to dictate future activity. It is also designed to work in parallel with the City's existing ordinances and regulations, such as Chapter 27, "Drainage Criteria."

2.2 Project Area

The project area for Section 2 of the MDP is shown on Exhibits 1, 2 and 3. The project area includes the areas within the City or the ETJ that naturally drain toward Allens Creek along with areas that naturally drain elsewhere but where drainage could be potentially redirected to Allens Creek. Most areas within this basin already have direct access to Allens Creek, and the focus in these areas is on Allens Creek itself. The southwest portion of the basin is currently mostly undeveloped, and while it naturally drains towards Allens Creek, no defined channel network is currently in place for new development to access. The focus in this area is to provide new channels for drainage access.

There is a large tributary that extends north and east from Allens Creek that collects runoff from areas east of the City. North of Interstate 10, this tributary extends upstream to the east, where it collects runoff from the northeast portion of the City. This tributary drains a large area that is almost outside of the ETJ of Sealy, and has therefore been excluded from this study. However, existing condition runoff

from this area was included in the evaluation of Allens Creek in order to properly represent and plan for the total anticipated flows to Allens Creek.

2.3 Previous Projects and Studies

The following summarizes some of the most relevant projects and studies that were taken into consideration for this master plan, and that warrant discussion.

1 – Sealy Business & Professional Women's Park Pond

The City owns a park located in the northernmost portion of the watershed near Peschel Road and Lux Road. The park includes a pond, and in 2008/2009, the City completed improvements to that pond to provide additional storage. According to a memorandum from DPK Engineering dated June 25, 2009, the pond was surveyed, and the improvements resulted in approximately 26 acre-feet of storage.

2 – Improvements – US 90 & Rexville Road

Channel improvements were completed to Allens Creek between US 90 and Rexville Road around 2005. A low-water crossing at Rexville was eliminated and large box culverts were installed for a new crossing. This improved channel section not only provides for improved hydraulic conveyance, but can also provide additional storage volume to help alleviate flooding during the less frequent storm events.

3 – US 90 Improvements

US 90 was widened through Sealy in recent years, including the crossing over Allens Creek. As part of the construction, TxDOT made improvements to the crossing. However, it is understood that the culvert crossing was simply extended, but no additional capacity was added.

4 –Other Major Crossings - Interstate 10, SH 36 and BNSF Railroad

Interstate Highway 10 was constructed by the Texas State Department of Highways and Public Transportation, now known as the Texas Department of Transportation (TxDOT) in the 1960's. Allens Creek crosses the IH-10 mainlanes and both feeder roads via six 6'X5' box culverts.

Nearer the downstream side of the project area, Allens Creek crosses State Highway 36 via six 6'X6' box culverts. It also crosses the BNSF Railroad via a railroad trestle approximately 60 feet in length, with an average depth of approximately 5 feet.

5 - Wal-Mart channel crossing and LOMR

In 2007, a Wal-Mart was constructed along SH 36 and west of Meyer Street. Allens Creek runs adjacent to and through the site. As part of the development, fill was placed on the property to raise it out of the floodplain. In addition, a bridge was constructed to provide access to Wal-Mart to SH 36, which lies on the other side of Allens Creek. The bridge profile was perched to

raise it clear of the 100-year floodplain. A Letter of Map Revision was obtained from FEMA to recognize the bridge and to reclaim land from the 100-year floodplain of Allens Creek. The construction of the Wal-Mart also included a detention basin to prevent increases in flood flows.

6 – Allens Creek Reservoir

The State of Texas Water Plan for Region H includes a large reservoir known as the Allens Creek Reservoir. It is located along the mouth of Allens Creek upstream of its confluence with the Brazos River, between the cities of Wallis and Sealy. Once constructed, this reservoir will be fed from water diverted from the Brazos River as well as from regular inflows from Allens Creek. Construction of this reservoir is not anticipated until 2025 or later. The land for the reservoir has been acquired, and is currently undeveloped. The ETJ for the City of Sealy extends south to include the area to be occupied by the proposed reservoir.

7- 2003 Drainage Committee Report by Pledger Kalkomey, Inc.

In February, 2003, Pledger Kalkomey, Inc. prepared a Drainage Committee report on behalf of the City. The focus of the study was on Allens Creek Watershed, but also touched on addressing some local flooding issues.

The study identified several recommendations for improvements to Allens Creek. These recommendations included improving Allens Creek downstream of SH 36, as well as constructing a diversion channel to Allens Creek Reservoir. The proposed channel right-of-way for these improvements would vary from 150 feet to 200 feet in width, and an estimated cost of approximately $1.4 million was presented.

This study also identified the need for improvements to the channel between US 90 and Rexville Road, as well as replacement of both of the road crossing structures. This work has since been completed.

Alternatives were also presented for addressing the flooding issues in the Westview Subdivision, including a detention facility near Peschel Road, construction of a channel along the former Cane Belt Railroad, or construction of a storm sewer system through the subdivision.

8- 2006 Downstream Allens Creek Drainage Improvement Plan by Pledger Kalkomey, Inc.

In March 2006, Pledger Kalkomey, Inc. prepared a drainage report addressing the downstream portion of Allens Creek on behalf of the City. The study used HEC-HMS modeling to evaluate the creek, and found that its most significant restriction was at the existing crossing of the BNSF railroad. Their recommendation was to enlarge this crossing, while recognizing that this would be a large undertaking, and may not even be feasibly possible. Alternatives including installation of various pipes in lieu of replacing the entire trestle were briefly discussed.

Regardless, it was recommended that this restriction be addressed. A result of removing or reducing this restriction is increased flow to the channel downstream. The report discussed

various methods to mitigate this increase, including improving Allens Creek its entire length, installing a diversion channel to the proposed reservoir, or to provide detention. A detention volume of 300 acre-feet was calculated (translating to a pond footprint of approximately 45 acres), with a suggested location near Stockhold Road. Recommended channel improvements upstream of the pond included widening Allens Creek to have a 50-foot bottom width and a 100-foot top width.

9 - Comprehensive Plan

Kendig Keast Collaborative prepared a report entitled *Choices – City of Sealy Comprehensive Plan*. This report provided a comprehensive growth plan and vision for the City, and was adopted on May 13, 2009. The recommendations included a number of provisions related to drainage and stormwater – namely the development of a regional drainage system that adequately and efficiently handles stormwater flows and minimizes flooding of property.

The report included a number of recommendations to reduce the impact of runoff, including the use of detention as well as the recommendation of the utilization of low impact development techniques.

The comprehensive plan also included a Thoroughfare Plan, and for which any future roadway crossings were planned for as part of this Master Drainage Plan.

2.4 Data

A number of data sources were used in the development of this master plan. The City of Sealy provided GIS coverages of existing infrastructure as well as relevant regional data. Information was also obtained from the reports cited above. Existing drainage infrastructure was determined from field observations and measurements. Information was also drawn from the Sealy Comprehensive Plan.

The City also provided aerial photography, a digital elevation model, and 1-foot contours for the city limits and ETJ. This information was prepared by DAS, Inc. for the City in mid-2009.

3.0 Project Area Description

3.1 Land Use

In terms of land use, the project area can be subdivided into areas north of Interstate 10 and areas south of IH 10. The area north of IH 10 includes the area traditionally known as Sealy, including areas such as downtown and Sealy High School. This area is mostly developed, with some occasional undeveloped in-fill tracts. There is also one large contiguous area of mostly undeveloped land to the west of Allens Creek between IH 10 and Rexville Road.

The areas south of Interstate 10 are mostly undeveloped. These areas consist of undeveloped range land, some forested areas, and some large lot "ranchettes". There is a concentration of commercial development along the SH 36 corridor just south of IH 10.

3.2 Topography

Exhibit 4 shows the topographic contours on an aerial photograph. Allens Creek runs from north to south, and the land generally falls to the southwest (areas east of Allens Creek) and to the southeast (areas west of Allens Creek). South of IH 10, the land generally drains toward the east or southeast, as the tributaries feeding Allens Creek run in a southeastern direction. Nearer to IH 10 the land has substantial fall, sometimes as high as 50 feet per mile. Further south, the land is substantially flatter.

3.3 Drainage Overview

Allens Creek serves as the primary drainage artery, and collects runoff from a substantial area upstream of IH 10 as well as the highly developed area just south of IH 10. Most of the developed areas upstream of IH 10 have drainage systems that discharge into the well defined channel. The channel is very wide and shallow, as the depth of the culverts crossing IH 10 restrict the depth available for the channel. This restriction at IH-10 contributes to the wide floodplain north of IH-10, as depicted in the recently adopted FEMA Flood Insurance Rate Map No. 480017. Copies of the FIRM maps as adopted on September 3, 2010 are included as Appendix A. The written FIS (Flood Insurance Study) accommodating the new maps stated that as-built drawings for Allens Creek between SH 36 and Rexville Road were utilized in the HEC-RAS computer models, and also acknowledged the previously-constructed channel improvements between US 90 and Westview Terrace. The report also indicated that the analysis under these modified conditions resulted in a base flood elevation 1 to 2 feet lower than the previous BFE for the upper third of the study reach, which appears to be the portion of Allens Creek upstream of SH 36.

South of IH 10, Allens Creek is somewhat wide and shallow, and the depth is constrained by the flowline of the existing culverts crossing SH 36, as well as the depth of the BNSF railroad bridge just downstream of SH 36. Just downstream of the railroad crossing is a wastewater treatment plant, and south of the plant the channel enters into a dense wooded area, where the channel becomes much smaller.

There are several smaller drainage tributaries of varied size that convey runoff to Allens Creek, including three main tributaries draining areas west of SH 36, a small tributary at the north end of the watershed, and two tributaries from the east. These are depicted on Exhibit 2, and are described in more detail in Sections 6.2 – 6.7.

4.0 Hydrology

In order to facilitate this analysis, it was necessary to determine a method to compute existing and proposed flowrates in the channels. This section describes a generally accepted drainage methodology for areas local to Sealy that was used to develop runoff hydrographs for the purposes of this project.

Parameters such as the amount of impervious cover and the channel slope were adjusted to accurately reflect the characteristics of the Sealy drainage areas, and the resultant flow vs. drainage area were plotted for slope, Manning's "n" value, and channel slope. A regression analysis was utilized to develop the following flow equations:

$$Q = K(1 + 26I)(.06/N)^{.60}(.13S)^{.}21(A/640)^{.77}$$

Where:	Q	=	Flowrate (cubic feet per second)
	I	=	Impervious Cover (%/100)
	N	=	Manning's "n" Value of Channel
	S	=	Slope of Longest Watercourse (ft/ft)
	A	=	Drainage Area (acres)
	K	=	557 (100-yr frequency)
			390 (25-yr frequency)
			295 (10-yr frequency)
			134 (2-yr frequency)

This equation returns estimated flow rates that were consistent with those determined using more detailed methodologies.

5.0 Planning Elements and Assumptions

There are four primary components to the MDP – channels, structures, right-of-way, and cost. This section of the report describes how these components are treated in the plan development and recommendations. For the purposes of this study, it was assumed that detention mitigation for new development will be provided on-site in accordance with the City's ordinances and regulations, such as Chapter 27, "Drainage Criteria."

To facilitate planning, the Allen's Creek project area was developed into various proposed subareas (see Exhibit 3). These drainage subareas vary slightly from the existing drainage subareas, which are illustrated on Exhibit 2. For example, a tract of land may naturally sheet flow one direction today, but upon development, those flows may be captured by storm sewers and drained in the opposite direction to the nearest drainage channel. Proposed drainage subareas were established based on determining which existing or future drainage channel was the most feasible drainage access point for future development.

Areas contributing directly to Allens Creek are denoted as "AC 100" areas. This large AC 100 area was further broken down into smaller sub areas denoted with the letters "A" through "D" (i.e. – AC 100A, AC 100B, etc.) The breaks in these subareas from upstream to downstream are generally located at US 90, Rexville Road, the BNSF Railroad, and Stockhold Road.

Other subareas include those associated with proposed tributaries, including three tributaries serving the west side of the basin (denoted as W Trib 1, 2 and 3). The W Trib 1 area was split into separate areas north and south of IH-10 as W Trib 1A and W Trib 1 B. The "N Trib" area includes the area drained by the upper end of Allens Creek along the western branch of where the channel makes a "Y," including the Sealy Business and Professional Women's Park. An "E Trib" area serves the area south of US 90 generally between the BNSF railroad and Kersten Road. The last area includes the strip of land on either side of SH 36 and the railroad north of where Allens Creek crosses SH 36, referred to herein as "Front Street". This area extends north into the older part of downtown Sealy.

The location of each of the above-described proposed subareas is shown on Exhibit 3.

5.1 Planning Element: ***Channels***

The proposed channel network forms the backbone of the MDP. The channel network is necessary to provide drainage access to the full extent of the project area. Some minor second order systems will need to be constructed by land developers – this project does not propose to establish the drainage network at this level.

As it pertains to drainage, the primary need for the development of a property is outfall. Specifically, outfall depth is desired. In order to construct a curb and gutter type of subdivision, on outfall depth of at least 8 feet is typically required. Smaller developments do not require as much depth, but depth is a desirable feature to attract the most desirable types of development.

It is assumed that new development will utilize on-site detention, but it is recognized that regional detention is a future possibility. The channel network is sized to accommodate 100-year flowrates based upon existing land use with one-foot of freeboard. Freeboard is the difference between the 100-year water surface elevation and the banks of the channel. The calculated existing 100-year discharge is considered the "design" discharge for the project.

- The possible future utilization of regional detention requires that the channel network have capacity to convey the additional flows from the development site to the detention basin, if the basin is located downstream of the site. As such, it is desirable to have some extra capacity within the channels. While the proposed channels were designed to accommodate the existing 100-year flowrates, a second analysis was conducted utilizing the existing condition 100-year discharges increased by 20%. This increased discharge is considered the "check" discharge for the project. The proposed channels were evaluated with the criteria that they should convey the increased discharges within their banks, but not necessarily with any freeboard. This

analysis indicated that that most of the proposed channels are capable of conveying this additional discharge within their banks.

- Near where W Tribs 2 and 3 tie in to Allens Creek, the natural ground is somewhat low-lying (as illustrated at on Exhibits 10 and 11 at the downstream limit of each tributary). Due to depth restrictions in the downstream channel, the desired channel depth could not be obtained. Channel sizes meeting the criteria described above would have resulted in an extremely and unreasonably wide channel. Since these areas are also in the floodplain of Allens Creek, it was decided that it was permissible to violate this criteria.

- Also, the channel in W Trib 3 is constrained by the size of the railroad crossing. This results in some out of bank flows for a slight distance upstream of SH 36. Accordingly, this could be an ideal location for a regional detention basin, should regional detention become a consideration.

HEC-RAS, an open channel computer simulation model developed by the U.S. Army Corps of Engineers, was utilized to analyze and size the proposed channels and structures.

In general, the channel cross sections have a minimum bottom width of six feet, and side-slopes of 4:1 (h: v). The largest channel section for the proposed tributaries has a bottom width of twenty feet. As expected, Allens Creek will require a much larger cross section than the tributaries, and the proposed bottom widths range from 20 feet to 30 feet upstream of the BNSF railroad, and widen to 40 and 50 feet downstream of the railroad. Exhibits 8 through 12 each include a graphical depiction of the typical section. The minimum channel slope is 0.08% (0.0008 ft/ft), and the maximum channel slope is 0.5%.

The proposed channel flowlines were determined to obtain the desired depth, to minimize right-of-way requirements and to minimize excavation costs. The channels are grass lined, although the plan does call for slope paving through the railroad crossings and along Allens Creek between the railroad bridge and the wastewater treatment plant, where right-of-way is constrained.

As mentioned earlier, some ground adjacent to the channel may require filling in order to ensure that adequate depth and freeboard are obtained. This would be relatively minor, and may require upsizing of the backslope drains to allow gravity access to the channel while the adjacent lands are in their pre-development condition. These areas are depicted in the water surface profiles.

The horizontal alignment of the channel network was determined to minimize costs, maximize the service area, and to minimize impact to landowners. Where possible, the proposed channel straddles a property line in order to share the impact and benefit between two adjacent properties.

Specific alignment challenges and recommendations are discussed in Section 6.

5.2 Planning Element: ***Structures***

The channel network will cross existing and proposed roadways, as well as the existing BNSF railroad. The MDP identifies the existing and proposed structures at each existing or future roadway. Most of the

crossings can be accomplished with box culverts, and the plan identifies the sizes and dimensions of the box culverts, as well as the flowlines.

The culverts were sized using the HEC-RAS model mentioned in Section 5.1. They were sized in a manner to minimize construction cost while providing for minimal headloss through the structure.

5.3 Planning Element: ***Right-of-Way***

Right-of-Way is a significant component of the cost of the plan. Right-of-Way is determined from the channel geometry. Thirty-foot maintenance berms are assumed for each side of the channel. The computed right-of-way is then rounded upwards to provide for a more conservative estimate. As development occurs, these widths may be difficult to obtain, and the City can consider modifying these assumptions to reduce the required widths. In the event that significant modifications to the channel geometry itself, it is recommended that a hydraulic analysis is conducted to ensure no impact to the capacity of the channel.

In areas where the channel alignment is parallel and adjacent to public roadways, the proposed right-of-way was reduced to account for the access provided by the public right-of-way. Additionally, in areas where Allen's Creek is clearly defined, the land currently encumbered by the existing ditch was not included in the calculation of land costs.

A detailed discussion of the recommended projects is included in Section 6, and some specifics regarding right-of-way through narrow developed areas are discussed.

5.4 Planning Element: ***Costs***

Costs for major drainage projects such as those presented in this report are dominated namely by right-way, excavation, engineering, structures, and pipeline relocations. There are other incidental costs associated with these types of projects, such as clearing and grubbing, back-slope swales and drains, hydromulch, etc. These costs are comparatively small and do not impact the selection of the plan. Rather than itemizing the costs for these items separately, the costs have been included in the unit cost for the large ticket items, and a contingency has been added to the estimates to account for items associated with construction that may not be identifiable and/or quantifiable at the current macroscopic planning level.

Costs for right-of-way are based on Austin County Appraisal District information. The average appraised land values throughout the project area are approximately $10,000 per acre. A good rule of thumb when cost planning for land acquisition is to double the appraised values, which essentially will account for the costs associated with surveying, generating parcel maps, negotiating with property owners, legal fees, etc. A land value of $20,000 per acre was used for purposes of this study.

Pipeline adjustment costs are difficult to estimate before detailed information about each specific pipeline is obtained, and is highly dependent on the specific facility owner's preferences and requirements. Recently, several locally-negotiated pipeline adjustments came in with figures in the $200,000 to $400,000 range. A unit cost of $500,000 for each pipeline crossing was used for the

purposes of this report. A print-out from Railroad Commission of Texas' Public GIS Map Viewer for Oil, Gas and Pipeline Data is included as Appendix B. Potential pipeline conflicts with the proposed channel projects have been identified and circled on this exhibit.

6.0 The Plan: Analysis and Recommendations

The following section presents master plan concepts for each of the planning areas including the proposed arterial channel network, service areas, recommended structures, and estimated costs. The purpose of a master drainage plan is to serve as a planning guide for the City as it experiences growth and development. It is important to recognize that the recommended features presented in the plan were developed with the ultimate build-out conditions of the City in mind. The implementation of this plan is extremely long-term, and the location and timing of new development will have an impact on the timing of the construction of these projects.

The plan is broken down into subsections for each service area (AC 100, W Trib 1, W Trib 2, W Trib 3, N Trib, E Trib, and Front Street). Each subsection of this portion of the report includes a discussion on the existing service area, alternatives analysis, master plan recommendations, and in some cases, some near-term implementation recommendations.

6.1 ALLENS CREEK MAIN CHANNEL SERVICE AREAS

The largest service area for the Allens Creek Project Area is made up of the areas that basically drain directly into Allens Creek, and are depicted on Exhibit 3 as the "AC 100" areas. This service area has been further subdivided into sub-service areas "A" through "D" along the alignment of the channel to more clearly define when and where the flows reach the creek itself.

6.1.1 Service Area Descriptions – AC 100 "A" through "D"

AC 100A is the northernmost subarea which includes most of Westview Subdivision. Flows within Westview are conveyed towards Allens Creek via storm sewers and sheet flow in the streets, and are discharged into the channel at a low point at the southern end of Westview Terrace Drive at the southern boundary of the subdivision. From there, the channel drains around the west side of Sealy Junior High School and meets up with a tributary serving what is identified as the "North Trib" area, which is discussed in greater detail in Section 6.5. Subarea AC 100B begins at the confluence of these two channels (the upper portion of Allens Creek and the North Trib). This subarea includes a portion of the junior high school property north of US 90, as well as a larger undeveloped area south of US 90 between Rexville Road and Eagle Lake Road.

Rexville Road represents the boundary between AC 100B and 100C, and Allens Creek crosses under Rexville via four (4) 10'X7' box culverts. These culverts were installed by the City several years ago, and completed some channel improvements to Allens Creek between US 90 and Rexville. The improved channel not only provides for improved hydraulic conveyance, but can

also provide additional storage volume to help alleviate flooding during the less frequent storm events. As seen in Table 2, the new culverts were sized such that no improvements will be recommended at this crossing. This is an example of good planning on the City's part, and an illustration of the benefits proper planning can provide.

The channel skirts the western boundary of a residential subdivision and turns south to cross under IH-10. The crossing under IH-10 includes three separate crossings (each feeder road and the mainlanes) of five (5) 6'X5' box culverts. During larger events, flow will cross over the top of IH-10. In recent years, TxDOT has installed a barrier between the east bound and west bound mainlanes, and this barrier has the potential to block these overflows and further exasperate flooding north of IH-10. A potential solution to this overflow blockage would be replacement of this section of barrier with cable traffic barrier, as can be found along sections of IH-10 west of Sealy. Gebhardt Road runs parallel to the south feeder road approximately 50 feet away. A separate set of five (5) 6'X5' box culverts make up the Gebhardt crossing. The channel continues southeast behind the commercial developments along SH 36, and crosses underneath the bridge installed at the driveway into the Wal-Mart shopping center located west of the channel.

The channel continues southeast and crosses under SH 36 via six (6) 6'X6' box culverts and then under the BNSF railroad. The existing railroad trestle has an open area of approximately 300 square feet at this crossing. During larger flood events, these two crossings present a fairly significant restriction and contribute to the expansive floodplain. The channel takes a somewhat sharp turn southeast at the railroad crossing to avoid the City's wastewater treatment plant located on the other side of the railroad. South of the treatment plant, the channel enters an area with dense overgrowth. From this point on, moving downstream, Allens Creek is substantially smaller and less efficient.

6.1.2 Alternative Analysis and Recommendations for AC 100

The AC 100 project area is the largest and most complex subarea of the Allens Creek project area. This section discusses the recommended improvements to Allens Creek through this area, which have been broken down by type of improvement (channel, culvert and bridge), as well as separate discussions on some downstream long-term, and near-term implementation recommendations.

Channel Improvements

The master plan proposes to enlarge and deepen Allens Creek throughout the Project Area. This serves to increase the capacity of the channel and to provide necessary depth to receive outfall drainage from adjacent development projects and tributary channels. The addition of capacity and depth extends downstream to Stockhold Road. There is an existing 2-foot drop structure at the downstream face of Stockhold Road. It is recommended that the channel and the culverts crossing under Stockhold be lowered to meet this elevation. Detailed information about the

proposed channel AC-100 geometry is provided in the channel profile information on Exhibit 8.

Section 5.3 provided a summary of how the recommended channel right-of-way widths were calculated, and touched on the fact that it may not be feasible to obtain these widths through existing developments due to limited available space. Allowance for deviation from the recommended widths will be on a case-by-case basis, and any deviations should be supported with analysis to ensure no impact to the capacity of the channel. Two specific locations within the AC 100 basin were analyzed as part of this study to determine if a narrower right-of-way could be acceptable through those areas:

1. **Near Wal-Mart** – This area was evaluated to determine if the proposed ROW fits between existing structures and parking lots. The ROW does not fit, although the channel size does. There is about 150' available at the tightest point, and the recommended ROW is 190'. It is possible that arrangements could be made to utilize parking lots to access the channel, making the maintenance berms less important. It is recommended to maintain the recommended channel section through this area, but it is acceptable to narrow the recommended ROW down to 150' if necessary, with the understanding that there will be limited maintenance berms and that access will be required via the adjacent parking areas.

2. **Channel Section between US 90 and IH-10** – This section of channel runs adjacent to an existing neighborhood to its east, and proposed developments to its west. The existing channel ROW is approximately 85' wide, and the calculated future ROW is 190'. This width is not feasible through this area. South of Rexville, it appears that there is a 25 or 30-foot easement east of the channel ROW, which could serve as the maintenance berm. Modification of the proposed channel section to include a bottom width of 10 feet and side slopes of 3:1 results in a top width of 88 feet. With a 15-foot maintenance berm to the west, this results in a minimum width of 103 feet. It is recommended that the City seek dedication of a minimum of 20 feet along the west side of the existing right-of-way throughout this section, resulting in a ROW of 105 feet. North of Rexville, the called ROW is 150 feet. The existing ROW appears to be 120 feet, which is acceptable as-is if the proposed development to the west will be able to provide access to the channel.

This information has been included for the City's use and consideration. Exhibits 6-7 maintain the calculated ultimate ROW width recommendations, and have not incorporated these specific exceptions.

Improvements at Culvert Crossings

Along with improving the channel itself, various crossings will also require work. Installation of additional (and lower) box culverts is recommended at the US 90, SH 36 and IH-10 crossings (See Table 2 for detailed information on sizes, etc.).

Improvements to the culvert crossing at IH-10 are considerably more complex than those at US 90 and SH 36. In the event that TxDOT moves forward with a freeway expansion project through Sealy, these improvements can be implemented into their project. However, TxDOT's timeframe for this project is unknown, and may not occur before the City desires the additional capacity. Construction of additional capacity as a stand-alone project is complex, and will require substantial coordination with TxDOT. The potential for construction via both tunneling and open cut was considered. After consideration, it was determined that open cut was the most logical recommendation for installing additional capacity. This will require the temporary closing of lanes in one direction along IH-10. It was determined, however, that this closing would only be required for a few days at a time.

In providing flood reduction, it is not always most economical to pursue 100-year protection. However, if the city were to incur the expense of closing IH-10 and installing additional capacity, it is logical to utilize such an opportunity to provide protection up to a 100-year level. Because of this, the 100-year event was utilized as the design threshold for the recommended plan.

Based upon the analysis accompanying this study, it is recommended that the four separate existing crossings each be supplemented by two 12'x12' box culverts adjacent to the existing culverts. Furthermore, it is recommended that the culvert crossing underneath Gebhardt Road be connected to the culvert crossing under the west bound ramp of IH-10.

No changes are recommended to the structure at Rexville Road.

Improvements at Bridge Crossings

In order to facilitate the deepened channel, it will also be necessary to substantially lower the flowline elevation though the BNSF bridge and the Wal-Mart bridge. While desirable to replace the BNSF bridge, it will likely be difficult to gain the permission of Burlington Northern without considerable expense. Instead, it is recommended that the potential of lowering the existing channel under the bridge by providing armoring in the form of slope paving and making necessary structural modifications to the bridge be pursued. This likely would incur substantial expense, but would likely be much less costly than replacing the bridge. A similar investigation is recommended for the Wal-Mart bridge, although modification underneath this structure should be much simpler.

Downstream Considerations

The implementation of the measures described in this plan will help alleviate flooding along Allens Creek in the Project Area. However, over time it will also result in more flow at the downstream end of the flow area, and this flow will be passed downstream to areas outside the project area. At some point, consideration should be given to some downstream measures to handle the increase in flow. This may be in the form of extending channel improvements further down Allens Creek or constructing a new channel to the future Allens Creek Reservoir, or implementing detention within the Allens Creek system to mitigate the flows as major choke

points are eliminated. These projects will require coordination between the City and the County.

Near Term Implementation

The master plan described for Allens Creek would substantially reduce flood risk in much of the City of Sealy. This plan is ambitious, and will likely take many years to implement. However, there are a number of measures that can be implemented that will notably decrease the occurrence of flooding during the more frequent rainfall events. These measures are provided to provide near term projects that can be implemented to address the most pressing concerns. These near term measures are as follows:

- Upstream of IH-10, enlarge and deepen Allen's Creek as much as possible, allowing it to perform as hybrid conveyance/storage feature. Making this type of improvement will help increase the level of protection from flooding for homes in this area.
    - Installation of a pump structure at the TxDOT culverts to empty the channel to allow it to flow into the TxDOT culverts at IH-10 will allow for an even deeper channel / in-line storage pond.
- Increase flow capacity through the BNSF railroad by installing slope paving between the SH 36 outfall and the sharp bend downstream of the BNSF bridge.
- Improve Allens Creek between the wastewater treatment plan and Stockhold Road. The channel could be deepened by about two feet and tie into the elevation on the downstream side of the drop structure at Stockhold Road. This project should involve the acquisition of drainage easements along this portion of Allens Creek, and should be followed up with a regular maintenance program.

6.2 W TRIB 1

The previously-completed Section 1 of the Sealy Master Plan was for the Little Bernard Creek watershed, which included service areas LBC 100, 200 and 300. The land east of these service areas and west of the railroad are part of the Allens Creek watershed, and are being addressed in this Section 2 of the Master Plan for Allens Creek. The area may be broken down into four main subareas, herein referred to as W Trib1A, W Trib 1B, W Trib 2, and W Trib 3 This section considers W Trib 1A and W Trib 1B. Subsequent sections consider W Trib 2 and W Trib 3.

6.2.1 Service Area Description – W TRIB 1

The West Tributary 1 channel originates at an outfall from IH-10, and conveys flows toward the southeast to Allens Creek. The area draining to this channel is broken down into two subareas – W Trib 1A and W Trib 1B. W Trib1A covers an area north of IH-10 and W Trib 1B covers an area south of IH-10. W Trib 1A is bordered by US 90, IH-10, FM 3538 and Rexville Road. This area is mostly developed, with the exception of a few undeveloped tracts, and includes Sealy High School. The area drains to existing triple 5'X2' box culverts under IH-10 (the crossing is actually a set of twin 5'X2' boxes along with a single 5'X2' box about 100' to the east). The area south of

IH-10 (W Trib 1B) drains via a shallow swale that runs southeast from the IH-10 culverts, crosses Gebhardt via triple 36" culverts and runs parallel to Gebhardt southeast across Schmidt via four (4) 48" culverts, turns east and crosses FM 3013 via five (5) 48" culverts. The drainage path is shallow and somewhat undefined in much of this area. The FM 3013 crossing is immediately upstream of the five (5) 6'X4' box culvert crossing underneath SH 36. The channel crosses under the BNSF railroad via a railroad trestle with an open area of approximately 800 square feet, and immediately ties into the main Allens Creek channel (AC-100). The WT1B area is mostly undeveloped agricultural land, with the exception of a few residences.

6.2.2 Alternative Analysis and Recommendations for W TRIB 1

As described above, much of the existing drainage pathway for this area is shallow and fairly undefined. The proposed project includes construction of a defined channel with a 6-foot wide bottom width with an approximate depth of 7 to 8 feet. This will include constructing new roadway crossings at Schmidt and Gebhardt (four 7'X7' box culverts each), as well as adding culverts to the existing crossings at FM 3013 and SH 36 (adding dual 6'X6' box culverts each). The existing opening at the railroad trestle at this location appears to have sufficient capacity to handle the calculated flows, along with sufficient depth to accommodate the proposed channel. Therefore, no modifications to this crossing are recommended.

6.3 W TRIB 2

6.3.1 Service Area Description – W TRIB 2

The W Trib2 area is located just south of the above-described W Trib1 area and can be generally described as the acreages between Harrison Road and Gebhardt Road, bordered on the west by the previously-defined LBC200 drainage basin, and on the east by the BNSF Railroad.

There is not much of a defined drainage pathway through this area. The channel crosses FM 3013 via six (6) 36" culverts; however, by the time the channel reaches Gebhardt, it crosses with only a single 36" pipe. The crossing at SH 36 just north of the Gebhardt/Stockhold intersection consists of four (4) 6'X4' box culverts, followed by a railroad trestle, and the water eventually works its way over to Allens Creek. The SH 36 culverts and the railroad bridge crossing have a large amount of sediment accumulation, suggesting that flow velocities are low and that it is likely that flow through the bridge actually diverts south along the swale parallel to the railroad.

This area is also mostly undeveloped, with the exception of a few developments along FM 3013, along with a small commercial area near the intersection of SH 36 and Gebhardt.

6.3.2 Alternative Analysis and Recommendations for W TRIB 2

The proposed plan for this service area includes the construction of a new channel to provide drainage outfall for the future development in this subarea. This new channel extends from Allens Creek upstream to provide drainage to undeveloped tracts northwest of FM 3013. The

proposed channel will have a 6-foot bottom width and an approximate depth of between 8 and 10 feet (the depth is closer to six feet near the confluence with Allens Creek).

In order to achieve the necessary depth for the channel, the plan calls for the lowering of the channel underneath the BNSF bridge. The flowline underneath the bridge must be lowered by about 3.5 feet and armored with slope paving. This is potentially a significant lowering, although in reality the current design depth of the channel appears to be a couple of feet lower than the existing elevation, as there is significant deposition of sediment underneath the bridge. An engineering study would be necessary to determine the feasibility and method of lowering the channel. Furthermore, coordination and permission from Burlington Northern will be required.

6.4 W TRIB 3

6.4.1 Service Area Description – W TRIB 3

The W Trib3 area is the southernmost West Tributary area located immediately south of W Trib2, and includes the area between Harrison Road and FM 3538 (excluding the Wal-Mart distribution center), and between FM 3013 and Orange Hill Road. Generally, most of this area naturally drains to the identified crossing under SH 36 near Orange Hill Road; however, the southwestern most properties abutting FM 3538 and 3013 tend to naturally flow to the southeast.

Two culvert crossings were previously constructed across FM 3013 between Harrison Road and FM 3538. The crossing nearest Harrison Road is five (5) 24" pipes. The outfall halfway between Harrison Road and FM 3538 also serves as the outfall for the Wal-Mart Distribution Center pond, and it consists of five (5) 42" pipes. It does not appear that any downstream channel improvements were completed in conjunction with these crossings, and the water simply collects and stands along FM 3013.

These areas were included with the W Trib 3 area in order to provide a more additional outfall depth to these properties, as only a shallow drainage way exists to the southeast. This property is located within the City's ETJ, and it is smart planning to provide a means for all properties within the ETJ to drain.

6.4.2 Alternative Analysis and Recommendations for W TRIB 3

The proposed plan for this service area calls for a new channel to be constructed from Allens Creek upstream across FM 3013 and to the tracts immediately north of and adjacent to the Wal-Mart Distribution Facility. At the upstream end, the channel will have a bottom width of 6 feet and an approximate depth ranging from 9 to 12 feet. The new culvert crossings at Harrison and FM 3013 call for two (2) 7'X7' box culverts. There is also a private driveway serving a farm house that must be crossed, and this crossing requires four (4) 7'X7' box culverts.

The alignment of the proposed middle reach of the channel runs parallel and adjacent to Orange Hill Road. As such, it has the potential to restrict access to the undeveloped tracts along the north side of the roadway. If ultimately constructed by a development interest, the channel would likely include a new roadway crossing to provide access to these properties.

There is a notable hill to the west of and upstream of SH 36. The channel will follow the alignment of the roadway down this hill, and then the grade becomes substantially flatter. At this point, the plans call for the channel to have a bottom width of 20-feet and an approximate depth of 7 to 8 feet.

Due to the depth limitations presented by the existing channel depth in Allens Creek, the 100-year water surface elevations along the tributary exceed their channel banks from the mouth to a point upstream of SH 36. The areas downstream of the railroad are already subject to the 100-year flood from Allens Creek, so there is no concern regarding the potential floodplain. However, the area just west of SH 36 is not in the 100-year floodplain, and the plan as proposed would introduce the 100-year floodplain to this area. This area includes an existing structure. Since the channel would require a significant road culvert crossing at this driveway, and since this property is low lying and would be subject to flooding, it is recommended that a regional detention basin be located just upstream of SH 36 along W Trib 3. This could potentially involve purchasing the home along Orange Hill Road near SH 36, although the need for this will likely be many years in the future.

Interim Implementation

As detailed above, there are two existing major culvert crossings along FM 3013 that do not have a defined outfall. The existing pipes daylight to natural ground or defined low areas, but it appears that no drainage course to carry this flow away from the roadway was ever established. As such, the outfall pipes result in substantial inundation after rainfall events.

While this master plan calls for a tributary to convey the drainage in this area southwest to Allen's Creek via a new tributary (W Trib 3), the lack of drainage should be addressed in the interim. Outfall channels should've been constructed to convey the runoff away from the roadway at the time the culverts were installed. The culvert crossing near the Wal-Mart detention pond consists of five (5) 42" pipes. Assuming a flow velocity of 6 fps, these culverts are capable of discharging 240 cfs. To convey this rate of flow away from the culverts requires a grass lined trapezoidal channel with a depth of 4-feet and a bottom width of 10-feet (assuming side slopes of 3:1 and a longitudinal slope of 0.1%).

The culvert crossing closest to Harrison Road consists of five (5) 24" pipes. Assuming a flow velocity of 6 fps, these culverts are capable of discharging 80 cfs. To convey this rate of flow away from the culverts requires a grass lined trapezoidal channel with a depth of 3-feet and a bottom width of 6-feet (assuming side slopes of 3:1 and a longitudinal slope of 0.1%).

The above recommendations are based on calculated flows based on how much flow the existing pipes are capable of conveying, but this information was also checked against the contributing drainage areas. The contributing area to the culvert crossing near the Wal-Mart facility suggests that the peak 100-year discharge to the culverts is only 130 cfs. However, there is a much larger contributing drainage area to the smaller culverts near Harrison Road. The upstream areas drain along Harrison Road, and then at FM 3013 the flow splits to both the north and south along FM 3013. It is estimated that the peak 100-year discharge to the five (5) 24" pipes is 435 cfs. Since these culverts are not nearly able to convey this amount, the area upstream of the culverts will become surcharged, and the excess flow will then flow toward the culverts near the Wal-Mart pond. Because of this, it is likely that the culverts will reach their capacity of 240 cfs during larger events.

6.5 N TRIB

6.5.1 Service Area Description – N TRIB

A drainage subarea referred to as the "North Trib" area near the upstream limit of Allens Creek was briefly mentioned in Section 6.1.1. Near the upper end of Allens Creek, the channel extends upward via one branch of a "Y". The tributary that forms the other portion of the "Y" is known as N TRIB. N TRIB is an existing channel that extends upstream to Eagle Lake Boulevard. There is also a small stub that terminates at Miller Road. The N TRIB area includes the Business and Professional Women's Park, which contains a detention basin that provides approximately 26 acre-feet of storage. This basin contains storage capacity above a permanent pool elevation, which was designed to be managed by the City. The excess storage is drained via a valve that allows flow to drain into the Westview storm sewer system. The City manages the pond by opening the valve after storm events have passed. During larger events, the basin will overflow and sheet flow toward the existing outfalls.

The drainage area to N TRIB is partially developed, with the development including the areas around the existing channel. The upstream areas are mostly undeveloped, and currently include extensive areas upstream of Peschel Road as well as the Sealy Business and Professional Women's Park (including the existing detention basin). Phase 1 of the MDP proposes to convey the area upstream of Peschel Road toward the Little Bernard system.

6.5.2 Alternative Analysis and Recommendations for N TRIB

The plan calls for two small channel extensions at the upper portion of the watershed. The new channels are known as North Trib, East Branch and North Trib, West Branch. These channels are proposed to have a bottom width of six feet, an average depth of four feet and a proposed right-of-way width of 90 feet. They extend to provide drainage access to undeveloped tracts on the south side of Peschel Road as well as to provide a defined outfall for overflows from the existing detention basin in Sealy Business and Professional Women's Park.

6.6 E TRIB

6.6.1 Service Area Description – E TRIB

Allens Creek also provides drainage for some areas east of SH 36 and the railroad, which is identified in this study as the E Trib area. A portion of the area between US 90 and IH-10 drains to existing culverts that cross under IH-10 just west of Kersten Road. From there, a shallow swale drains south towards Allens Creek, and joins up with the creek just north of Stockhold Road.

This subarea is mostly undeveloped, with the exception of a few scattered residences and a small subdivision located between US 90 and IH-10.

6.6.2 Alternative Analysis and Recommendations for E TRIB

The plan calls for the construction of a channel from the outfall at IH-10 to Allens Creek. As shown, the plan diverts from the existing swale in order to preserve a stand of trees along the swale. However, if desired, the new channel could easily be placed along the alignment of the existing channel without changing the ultimate recommendations presented in this plan.

The proposed channel has a 6-foot wide bottom width and an approximate depth of between 6 and 8 feet. There are no proposed crossings, and no improvements are proposed for the IH-10 crossing.

6.7 FRONT STREET

6.7.1 Service Area Description – FRONT STREET

As discussed in Section 6.1.1, a portion of the west part of downtown Sealy eventually works its way into the headwaters of Allens Creek. The remainder, however, works its way down to Allens Creek much further downstream via two a system herein as the “Front Street” system. The headwaters of the Front Street system is actually separated by the railroad; however, the system east of the railroad crosses over and joins up with the system on the west just north of IH-10. The western subarea includes the development north of IH-10 along the west and east sides of SH 36. The area west of SH 36 is a strip of two blocks, and is mainly residential and small commercial development. The area between SH 36 and the railroad is mostly commercial development. These areas drain via sheet flow or small storm sewers to a ditch located along Front Street, which is located immediately adjacent to the west side of the railroad. This drainage ditch is relatively narrow, and is nothing more than a roadside ditch. The ditch crosses under US 90 and IH-10and joins up with Allens Creek immediately before it crosses at under the BNSF bridge. There is an existing private lake located along Front Street between IH-10 and US 90.

6.7.2 Alternative Analysis and Recommendations for FRONT STREET

This plan does not present any specific recommendations to convey the 100-year flows to Allens Creek. However, two different alternatives were considered.

The first alternative is to replace Front Street with a concrete lined channel capable of carrying the 100-year discharge of 734 cfs. This channel would have a 6-foot bottom width, 2:1 (h:v) side slopes, a depth of 6-feet, and a top-width of 30-feet for a length of 4,900 feet. However, the roadway carries significant traffic and provides an alternate route from the city center to the commercial development south of IH-10.

The second alternative is to construct an underground conduit underneath a reconstructed Front Street. This conduit would consist of twin 8'X7' box culverts for a length of 4,900 feet, which would be very costly.

Given the above, it will be challenging to convey the 100-year discharge from the Front Street area to Allens Creek. The recommended plan, therefore, consists of maximizing drainage capacity in the right-of-way of Front Street via storm sewers and/or roadside ditches. If the roadway is reconstructed in the future, the goal is to include the capacity to drain the 100-year discharge of 734 cfs. In the unlikely event that such structures are not economical, an analysis should be conducted to confirm that new drainage is capable of draining the 2-year event, and the road should be graded to sheet flow drain excessive flows to areas south of IH-10 and on to Allens Creek.

Some drainage relief could be acquired by utilizing the existing lake. An outfall structure should be designed to lower the permanent water surface elevation by a few feet, reserving the new volume above the permanent pool for potential detention.

6.8 Channel Rights-of-Way

The channel rights-of-way associated with the proposed projects are presented on Exhibits 6 and 7. The proposed rights-of-way include the width required for the channels themselves plus 30-foot maintenance berms on each side of the channel. These exhibits are extremely important to this drainage master plan from an implementation standpoint, as they serve as a guide for requesting land dedications from property owners and developers as the service areas continue to grow.

As noted on the exhibits, the centerline of the proposed channels should typically be centered on property lines and/or run adjacent to existing rights-of-way. Unfortunately, the GIS-based parcel maps obtained from the Austin County Appraisal District do not exactly line up as they should. Because the aerial imagery was so recently obtained by DAS, Inc., the proposed channel alignments were generated based on this information. When overlaying the parcel maps with the aerial imagery, the parcel lines and right-of-way lines do not exactly line up. A note has been added to the exhibits to recognize this, and also specifies that right-of-way dedications shall be coordinated through the City of Sealy to ensure accurate acquisition limits.

As development occurs, the proposed channel alignments can vary slightly from what is presented in Exhibits 6 and 7 as desired by the developers and approved by the City. For example, if the plan calls for a proposed channel to skirt the outer boundary of a piece of property, but the developer wishes to incorporate the channel as an amenity channel through the middle of their development, this may be acceptable. These modifications will be on a case-by-case basis, and are all subject to the review and approval of the City. Consideration should always be given to ensure the modification does not have any negative impact on the overall objectives of the master plan.

6.9 Channel Profiles

Channel profiles have been generated for the recommended projects, and are provided in Exhibits 8-12. The digital elevation information gathered by DAS, Inc. in 2009 was used as a base for generating these profiles. These profiles identify the proposed channel flowlines, roadway crossings and structures, the 100-year water surface elevation, ROW widths, 100-year flows in cubic feet per second (cfs) and 100-year water surface elevations. The profiles also depict the natural ground elevation along the centerline of the proposed ditches. The Allen's Creek profile includes an additional profile line depicting the elevation of natural ground along the high-bank of the proposed channel in order to provide a clear illustration of the proposed depth of the channel.

This information will be invaluable to the City as development continues. This information may be used to serve as the preliminary engineering for the final design of any segment of the proposed channels, whether the design is being completed by the City, or by a private developer. Additionally, in the event that developers or dirt contractors wish to obtain fill dirt, these profiles may be used as a guide for the general limits and depths of excavation.

These documents will be powerful tools as development continues. GIS-based tools may also be developed and used in many capacities to help implement the plan as well as track dedications, excavation, etc. These tools and procedures may be further presented in an implementation memo to be presented subsequent to this Master Plan.

6.10 Cost Summary

As discussed previously, costs for major drainage projects are dominated namely by right-way, excavation, structures, pipeline relocations and engineering; and that the minor costs such as clearing and grubbing, back-slope swales and drains, hydromulch, etc. are comparatively small and have simply been accounted for in the unit costs of the large ticket items. A 20% contingency was included with each project estimate to account for items associated with construction that may not be identifiable and/or quantifiable at the current macroscopic planning level.

A detailed construction cost breakdown for the recommended alternatives is provided as Table 1. The total estimated project cost for the recommended channel conveyance projects are as follows:

Service Area AC 100

- Channel Construction, Pipeline Adjustments, Engineering: $12,379,000.00
- Channel ROW $782,000.00
- **Total Channel Project Cost: $13,161,000.00**

Service Area W TRIB 1

- Channel Construction, Pipeline Adjustments, Engineering: $5,190,000.00
- Channel ROW $561,000.00
- **Total Channel Project Cost: $5,751,000.00**

Service Area W TRIB 2

- Channel Construction, Pipeline Adjustments, Engineering: $3,652,000.00
- Channel ROW $600,000.00
- **Total Channel Project Cost: $4,252,000.00**

Service Area W TRIB 3

- Channel Construction, Pipeline Adjustments, Engineering: $6,232,000.00
- Channel ROW $1,040,000.00
- **Total Channel Project Cost: $7,272,000.00**

Service Area N TRIB

- Channel Construction, Engineering: $260,000.00
- Channel ROW $232,000.00
- **Total Channel Project Cost: $492,000.00**

Service Area E TRIB

- Channel Construction, Pipeline Adjustments, Engineering: $2,581,000.00
- Channel ROW $258,000.00
- **Total Channel Project Cost: $2,839,000.00**

Total Master Plan Channel Cost:

- Channel Construction, Pipeline Adjustments, Engineering: $30,294,000.00
- Channel ROW $3,473,000.00
- **Total Channel Project Cost: $33,767,000.00**

Table 1

Cost Estimate Break-Down for Proposed Master Plan Projects

City of Sealy Master Drainage Plan - Allens Creek

Item	Description	Qty	Unit	Unit Cost	Extension	Subtotal
AC 100 Channel Improvements						
1	Channel Construction	253,000	CY	$10.00	$2,530,000	
2	Add (2) 8'X8' RCBC to US 90 Roadway Crossing, including headwalls, roadway restoration, TxDOT coordination, etc.	160	LF	$1,250	$200,000	
3	Add six-foot drop structure downstream of Rexville Road crossing, including rip rap, etc.	1	LS	$150,000	$200,000	
4	Add (2) 12'X12' RCBC to IH-10 WB Ramp Crossing, including headwalls, roadway restoration, TxDOT coordination, etc.	120	LF	$2,000	$240,000	
5	Add (2) 12'X12' RCBC to IH-10 Main Lane Crossing, including headwalls, roadway restoration, TxDOT coordination, etc.	350	LF	$2,500	$875,000	
6	Add (2) 12'X12' RCBC to IH-10 EB Ramp and Gebhardt Crossing, including headwalls, roadway restoration, TxDOT coordination, etc.	290	LF	$2,000	$580,000	
7	Modify Bridge Piers at Existing Wal Mart Crossing for Deeper Channel	1	LS	$100,000	$100,000	
8	Add (2) 10'X10' RCBC to SH 36 Crossing, including headwalls, roadway restoration, TxDOT coordination, etc.	140	LF	$1,750	$245,000	
9	Modifications at Railroad Bridge Crossing, including slope paving, excavation, stabilization, pier armoring, coord w/BNSF, etc.	1	LS	$500,000	$500,000	
10	Stockhold Road Bridge	1	LS	$500,000	$500,000	
11	Pipeline (5) and Utility Adjustments	1	LS	$3,000,000	$3,000,000	
Subtotal Construction Costs						$8,970,000
Contingencies (approximately 20%)						$1,794,000
Subtotal						$10,764,000
Engineering (approximately 15%)						$1,615,000
Total Estimated						**$12,379,000**

* Note: Above-listed prices include built-in costs for site preparation and restoration, traffic control, SWPPP, and other anticipated costs associated with construction

Table 1

Cost Estimate Break-Down for Proposed Master Plan Projects

City of Sealy Master Drainage Plan - Allens Creek

Item	Description	Qty	Unit	Unit Cost	Extension	Subtotal
W Trib 1 Channel Improvements						
1	Channel Construction	111,000	CY	$10.00	$1,110,000	
2	Add (2) 6'X6' RCBC to SH 36 Roadway Crossing, including headwalls, roadway restoration, TxDOT coordination, etc.	140	LF	$1,000	$140,000	
3	Add (2) 6'X6' RCBC to FM 3013Roadway Crossing, including headwalls, roadway restoration, TxDOT coordination, etc.	140	LF	$900	$126,000	
4	Add (4) 7'X7' RCBC to Schmidt Roadway Crossing, including headwalls, roadway restoration, etc.	200	LF	$900	$180,000	
5	Add (4) 7'X7' RCBC to Gebhardt Roadway Crossing, including headwalls, roadway restoration, etc.	200	LF	$900	$180,000	
6	Add (2) 7'X7' RCBC to IH-10 Roadway Crossing, including headwalls, roadway restoration, TxDOT coordination, etc.	350	LF	$1,500	$525,000	
7	Pipeline (3) and Utility Adjustments	1	LS	$1,500,000	$1,500,000	
Subtotal Construction Costs						$3,761,000
Contingencies (approximately 20%)						$752,000
Subtotal						$4,513,000
Engineering (approximately 15%)						$677,000
Total Estimated						**$5,190,000**

Item	Description	Qty	Unit	Unit Cost	Extension	Subtotal
W Trib 2 Channel Improvements						
1	Channel Construction	66,000	CY	$10.00	$660,000	
2	Add (3) 6'X5' RCBC to SH 36 Roadway Crossing, including headwalls, roadway restoration, TxDOT coordination, etc.	210	LF	$900	$189,000	
3	New (3) 7'X7' RCBC at FM 3013 Roadway Crossing, including headwalls, roadway restoration, TxDOT coordination, etc.	240	LF	$1,000	$240,000	
4	New (2) 6'X6' RCBC at Schmidt Roadway Crossing, including headwalls, roadway restoration, etc.	80	LF	$800	$64,000	
5	New (4) 8'X6' RCBC at Gebhardt Roadway Crossing, including headwalls, roadway restoration, etc.	160	LF	$900	$144,000	
6	Modifications at Railroad Bridge Crossing, including slope paving, excavation, stabilization, pier armoring, coord w/BNSF, etc.	1	LS	$350,000	$350,000	
7	Pipeline (2) and Utility Adjustments	1	LS	$1,000,000	$1,000,000	
Subtotal Construction Costs						$2,647,000
Contingencies (approximately 20%)						$529,000
Subtotal						$3,176,000
Engineering (approximately 15%)						$476,000
Total Estimated						**$3,652,000**

* Note: Above-listed prices include built-in costs for site preparation and restoration, traffic control, SWPPP, and other anticipated costs associated with construction

Table 1

Cost Estimate Break-Down for Proposed Master Plan Projects

City of Sealy Master Drainage Plan - Allens Creek

Item	Description	Qty	Unit	Unit Cost	Extension	Subtotal
W Trib 3 Channel Improvements						
1	Channel Construction	209,000	CY	$10.00	$2,090,000	
2	Add (4) 7'X7' RCBC to SH 36 Roadway Crossing, including headwalls, roadway restoration, TxDOT coordination, etc.	280	LF	$1,000	$280,000	
3	New (2) 7'X7' RCBC at FM 3013 Roadway Crossing, including headwalls, roadway restoration, TxDOT coordination, etc.	160	LF	$1,000	$160,000	
4	New (2) 7X7' RCBC at Harrison Roadway Crossing, including headwalls, roadway restoration, etc.	80	LF	$900	$72,000	
5	New (4) 7'X7' RCBC at Private Roadway Crossing, including headwalls, roadway restoration, etc.	80	LF	$800	$64,000	
6	Modifications at Railroad Bridge Crossing, including slope paving, excavation, stabilization, pier armoring, coord w/BNSF, etc.	1	LS	$350,000	$350,000	
7	Pipeline (3) and Utility Adjustments	1	LS	$1,500,000	$1,500,000	
Subtotal Construction Costs						$4,516,000
Contingencies (approximately 20%)						$903,000
Subtotal						$5,419,000
Engineering (approximately 15%)						$813,000
Total Estimated						**$6,232,000**

N Trib Channel Improvements						
1	N Trib, W Branch Channel Construction	8,400	CY	$10.00	$84,000	
2	N Trib, W Branch Channel Construction	10,400	CY	$10	$104,000	
Subtotal Construction Costs						$188,000
Contingencies (approximately 20%)						$38,000
Subtotal						$226,000
Engineering (approximately 15%)						$34,000
Total Estimated						**$260,000**

E Trib Channel Improvements						
1	Channel Construction	37,000	CY	$10.00	$370,000	
2	Pipeline (3) and Utility Adjustments	1	LS	$1,500,000	$1,500,000	
Subtotal Construction Costs						$1,870,000
Contingencies (approximately 20%)						$374,000
Subtotal						$2,244,000
Engineering (approximately 15%)						$337,000
Total Estimated						**$2,581,000**

* Note: Above-listed prices include built-in costs for site preparation and restoration, traffic control, SWPPP, and other anticipated costs associated with

Table 2

Channel Crossing Structure Evaluation

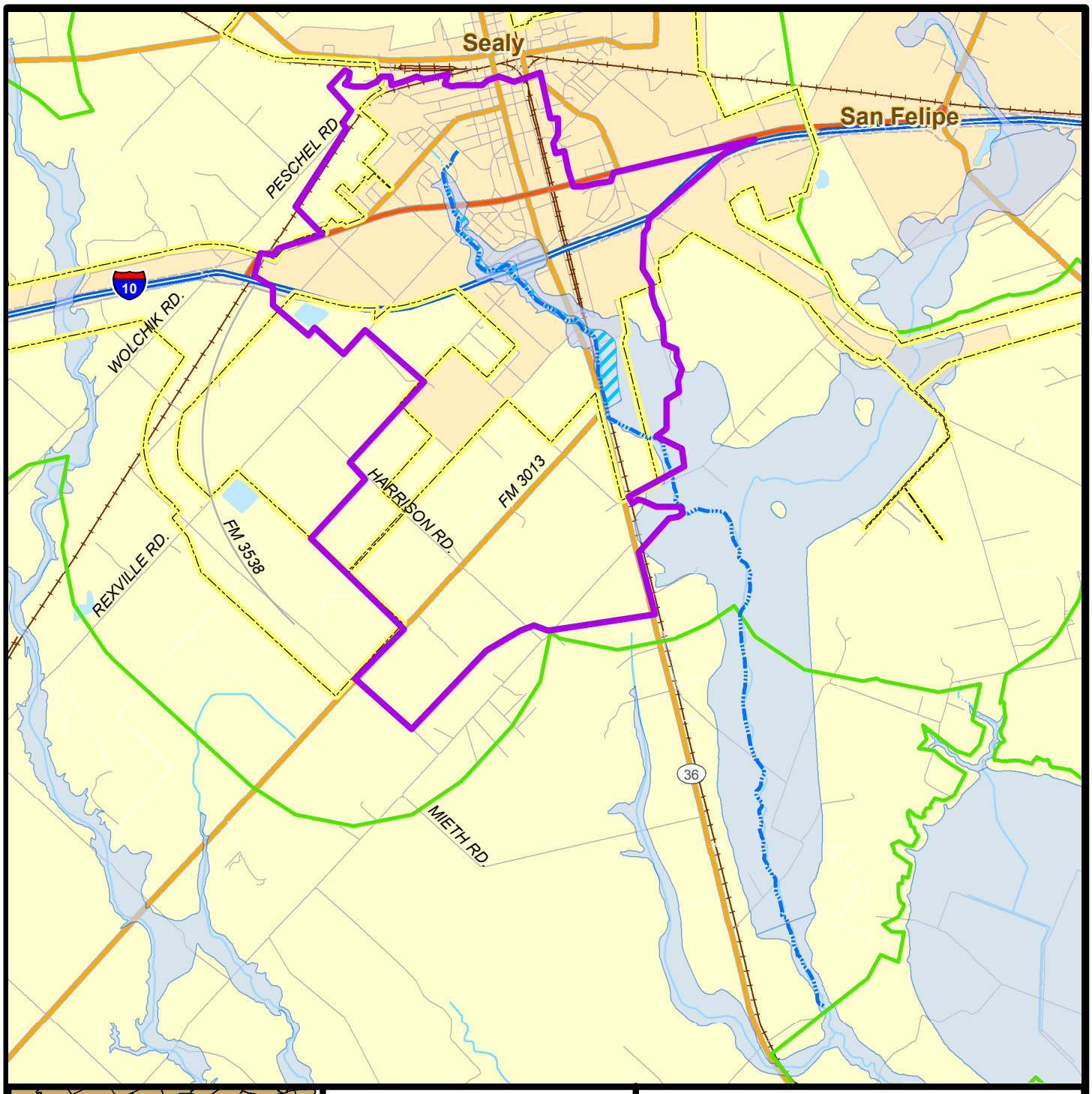
City of Sealy Master Drainage Plan - Allens Creek

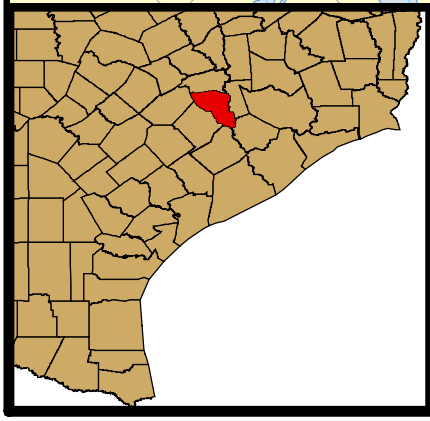
CHANNEL	LOCATION	STATION NUMBER (SEE PROFILES)	100-YR FLOW	EXISTING DESCRIPTION	CAPACITY	AREA	REQUIRED AREA	REC LENGTH	RECOMMENDED
ALLEN'S CREEK	STOCKHOLD RD	120+13		CULVERTS					CONSTRUCT BRIDGE
	RAILROAD	191+45	2346 CFS	BRIDGE	600 CFS	300 SF	600 SF		REPLACE BRIDGE W DEEPER AND WIDER OPENING OF 650 SF OR DEEPEN BRIDGE AND SLOPE PAVE
	SH 36	195+43	2035 CFS	6 - 6'X6'	1080 CFS	216 SF	407 SF	70'	ADD 2-10'X10'S
	WAL MART	198+93	1923 CFS	EX PERCHED BRIDGE	2,000 CFS				MODIFY PIERS FOR DEEPER CHANNEL
	GEBHARDT RD	215+88	1727 CFS	5 - 6' X 5'	750 CFS	150 SF	345 SF	145'	ADD 2-12'X12'S AND CONNECT TO IH-10 EB RAMP
	IH-10 EB RAMP	217+16	1727 CFS	5 - 6' X 5'	750 CFS	150 SF	345 SF		ADD 2-12'X12'S AND CONNECT TO GEPHARDT
	IH-10 MAINLANES	220+04	1727 CFS	5 - 6' X 5'	750 CFS	150 SF	345 SF	173'	ADD 2 - 12'X12'S
	IH-10 WB RAMP	229+01	1727 CFS	5 - 6' X 5'	750 CFS	150 SF	345 SF	60'	ADD 2 - 12'X12'S
	REXVILLE RD	249+48	1226 CFS	4 - 10'X7'	1120 CFS	280 SF	245 SF	43'	NO CHANGES
	US 90	258+20	1119 CFS	3 - 6'X6'	540 CFS	108 SF	224 SF	80'	ADD 2 - 8' X 8'S
WEST TRIB 1	RAILROAD	0+98	1068 CFS	BRIDGE	3000 CFS	800 SF			NO CHANGES
	SH 36	1+98	1068 CFS	5-6' X 4'S	600 CFS	120 SF	214 SF	70'	ADD 2-6'X6'S
	FM 3013	4+60	1068 CFS	5 - 48"	315 CFS	63 SF	214 SF	70'	ADD 2-6'X6'S
	SCHMIDT RD	41+87	1068 CFS	4 - 48"	250 CFS	50 SF	214 SF	50'	4-7'X7'S
	GEBHARDT RD	68+33	900 CFS	3 - 36"	105 CFS	21 SF	180 SF	50'	4-7'X7'S
	IH-10	94+38	463 CFS	3-5'X2'S	150 CFS	30 SF	93 SF	175'	2-7'X7'S
W TRIB 2	RAILROAD	19+12	1073 CFS	BRIDGE	450 CFS	150 SF	357 SF		DEEPEN BRIDGE BY 1.5' AND SLOPE PAVE
	SH 36	20+12	1073 CFS	4 6'X4'S	480 CFS	96 SF	215 SF	70'	ADD 3-6'X5'S
	GEBHARDT	26+68	980 CFS	1 - 36"	35 CFS	7 SF	196 SF	40'	REPLACE W 4-8'X6'S
	FM 3013	61+42	786 CFS	6 - 36"	210 CFS	42 SF	157 SF	80'	REPLACE W 3'7'X7'S
	SCHMIDT	100+88	682 CFS	NONE	N/A		136 SF	40'	PROP 2 6'X6'S
W TRIB 3	RAILROAD	19+11	1424 CFS	BRIDGE	800 CFS	400 SF	475 SF		DEEPEN BRIDGE BY 1.5' AND SLOPE PAVE
	SH 36	20+11	1424 CFS	4 6'X4'S	480 CFS	96 SF	285 SF	70'	ADD 4 7'X7'S
	PRIVATE	56+19	1100 CFS	NONE	N/A		220 SF	20'	PROP 4 7'X7'S
	HARRISON	73+89	848 CFS	NONE	N/A		170 SF	40'	PROP 2 7'X7'S
	FM3013	126+24	489 CFS	NONE*	N/A		98 SF	80'	PROP 2 7'X7'S

* THERE ARE TWO EXISTING CROSSINGS OF FM 3013 IN THE W TRIB 3 AREA - NORTH AND SOUTH OF PROPOSED W TRIB 3

NORTH OF WAL MART DISTRIBUTION DRIVE	5 - 24"	80 CFS	15 SF			
SOUTH OF WAL MART DISTRIBUTION DRIVE	5 - 42"	240 CFS	48 SF			

NOTE: ALL CAPACITIES LISTED ABOVE ARE BASED ON A FLOW-FULL VELOCITY OF 6 FPS





Legend

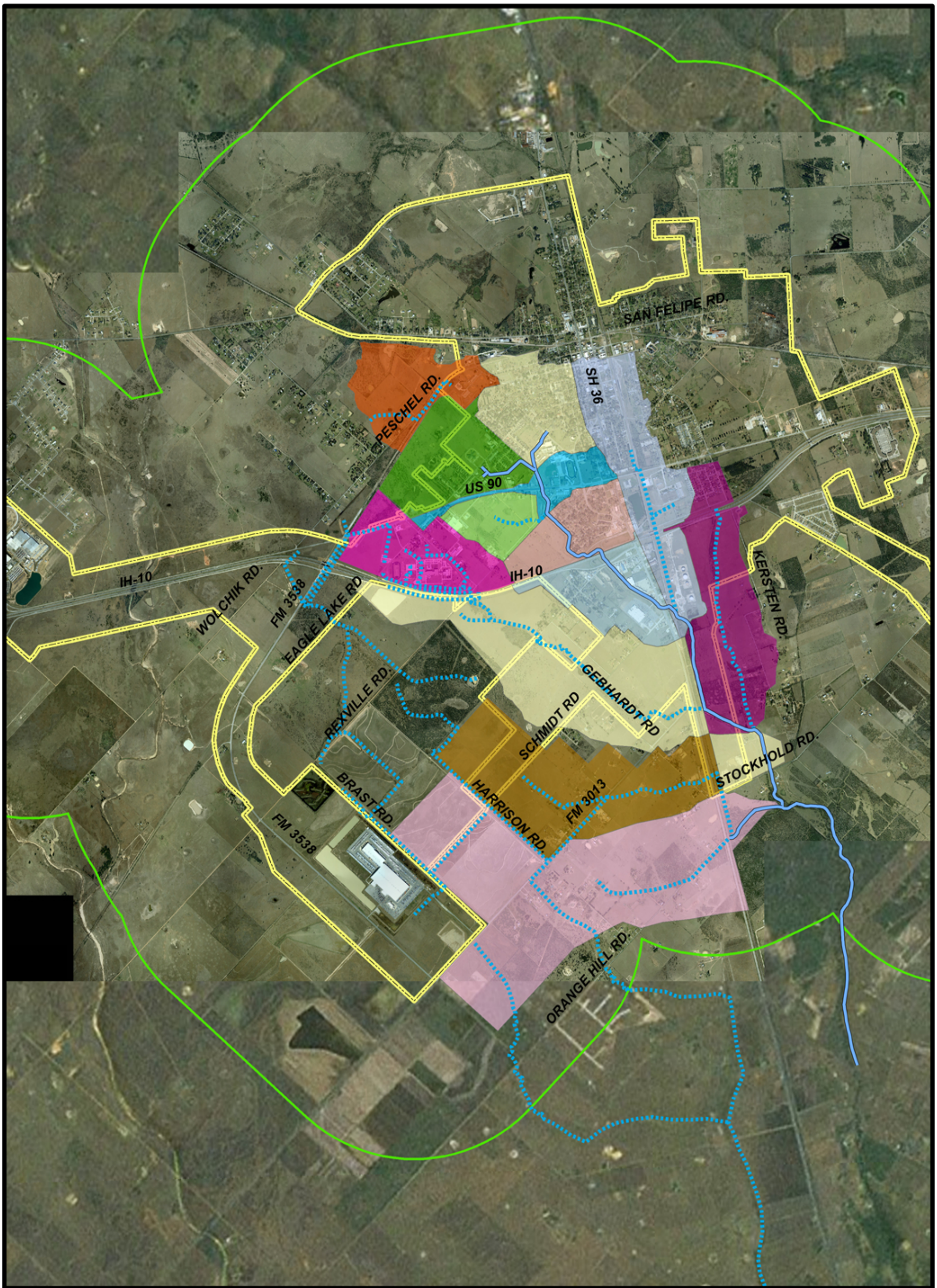
- Allen's Creek
- City Limits
- ETJ
- Project Area
- Floodway
- 100-year Floodplain

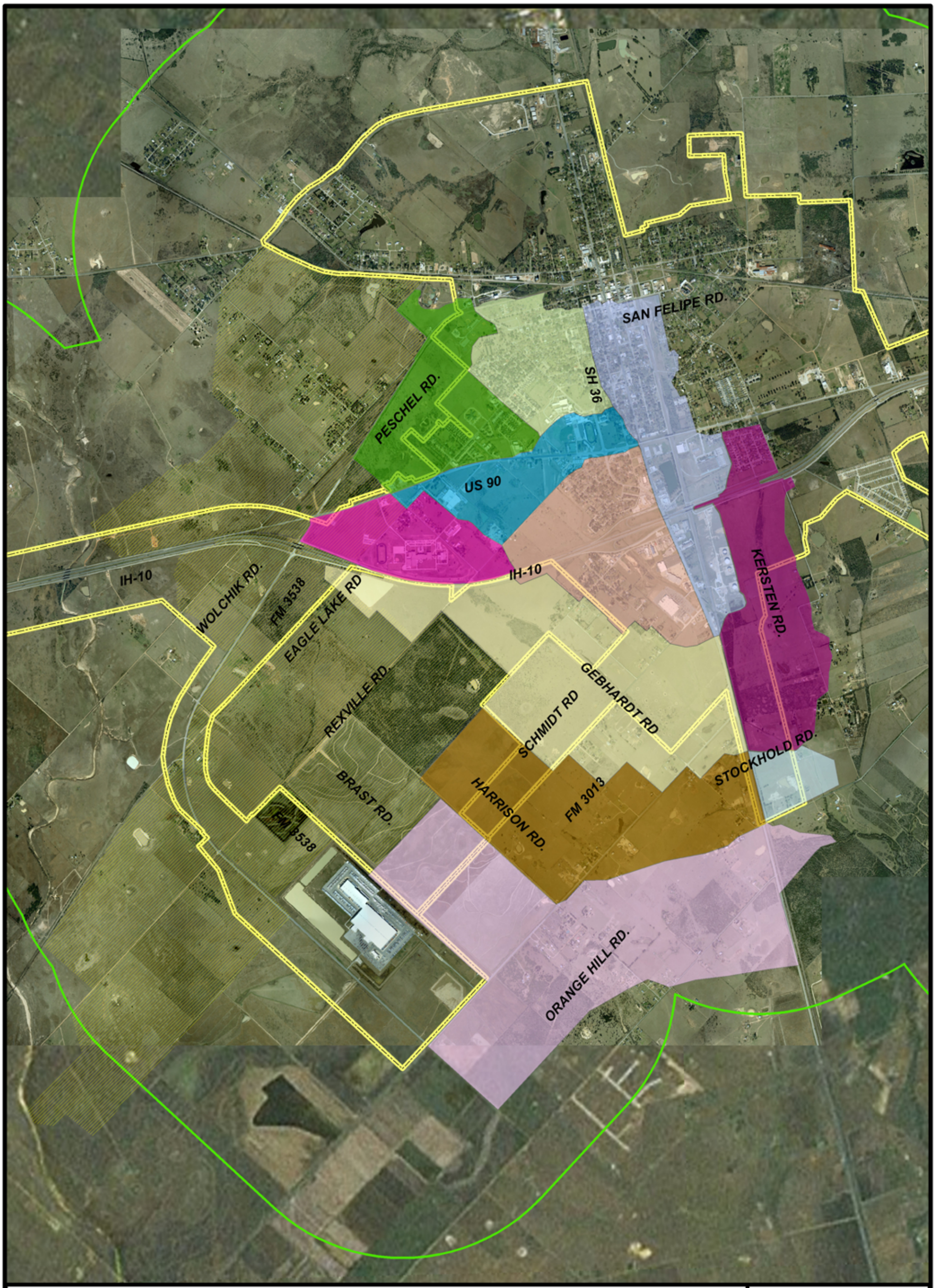
0 2,500 5,000 Feet

SPI

Exhibit 1
Project Area
Allen's Creek Watershed

Job No: 1003011	Scale: 1"= 5000'
File: Figure1.mxd	Date: AUGUST 2010


SAN FELIPE RD.
PESCHEL RD.
SH 36
US 90
IH-10
IH-10
WOLCHIK RD.
FM 3538
EAGLE LAKE RD
REXVILLE RD.
BRAST RD.
FM 3538
GEBHARDT RD
SCHMIDT RD
HARRISON RD.
FM 3013
KERSTEN RD.
STOCKHOLD RD.
ORANGE HILL RD.
Legend
AC 100A
AC 100B
AC 100C
AC 100D
N TRIB
W TRIB 1A
W TRIB 1B
W TRIB 2
W TRIB 3
E TRIB
FRONT ST
MILLER DETENTION
PARK DETENTION
City Limits
ETJ
Existing Channel
Existing Swale
0 1,000 2,000
Feet
SPI
Exhibit 2
Existing Service Areas
Allen's Creek Watershed
Job No: 1003011
Scale: 1"= 5000'
File: DrainageAreas.mxd
Date: JUNE 2010



Legend

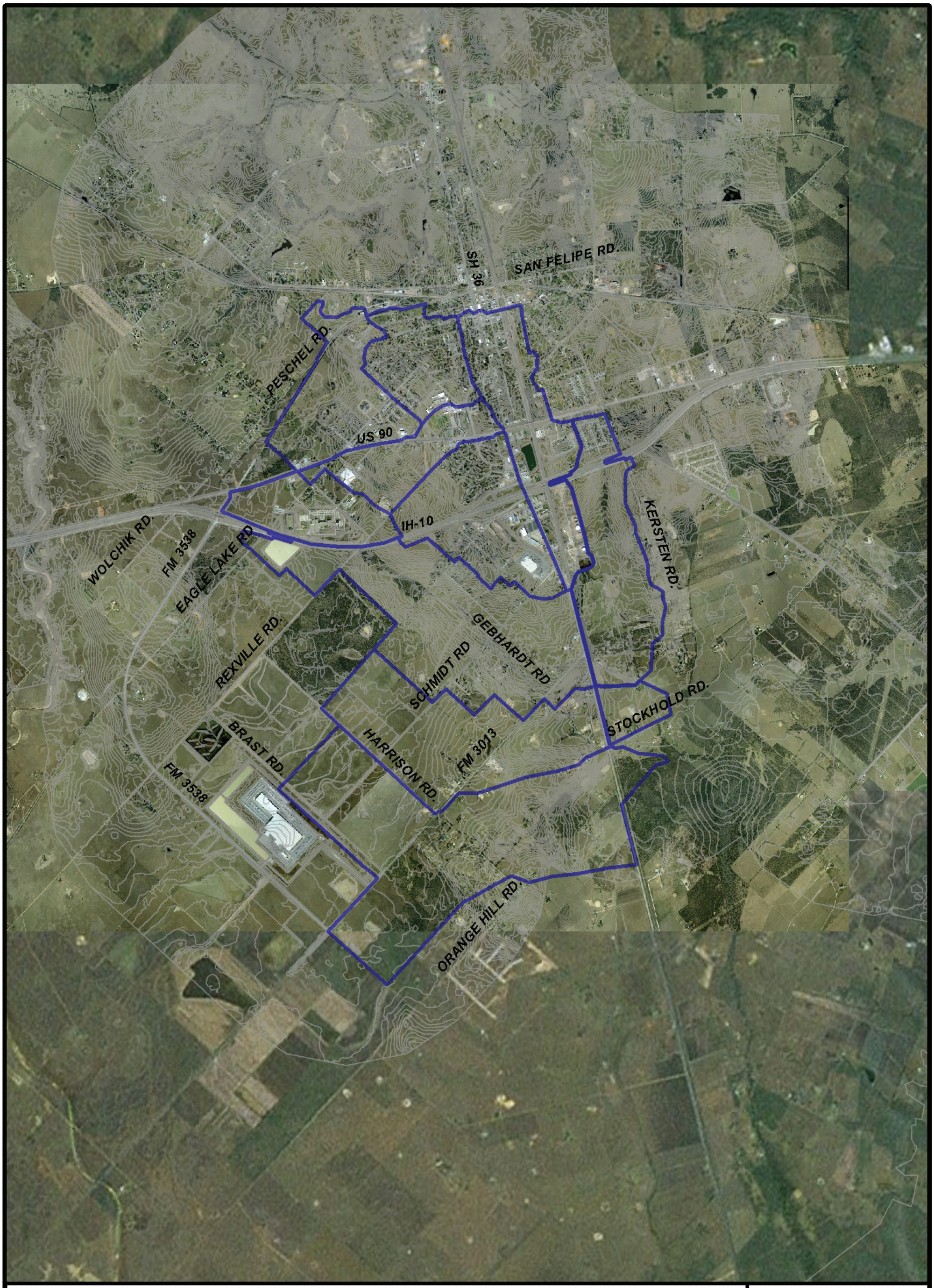
AC100A	N TRIB	W TRIB 3	Little Bernard Creek Service Area	
AC100B	W TRIB 1A	FRONT ST	City Limits	
AC100C	W TRIB 1B	E TRIB	ETJ	
AC100D	W TRIB 2			

0 1,000 2,000 Feet

SPI

Exhibit 3
Proposed Service Areas
Allen's Creek Watershed

Job No: 1003011	Scale: 1"= 5000'
File: DrainageAreas.mxd	Date: JUNE 2010



Legend

Contours

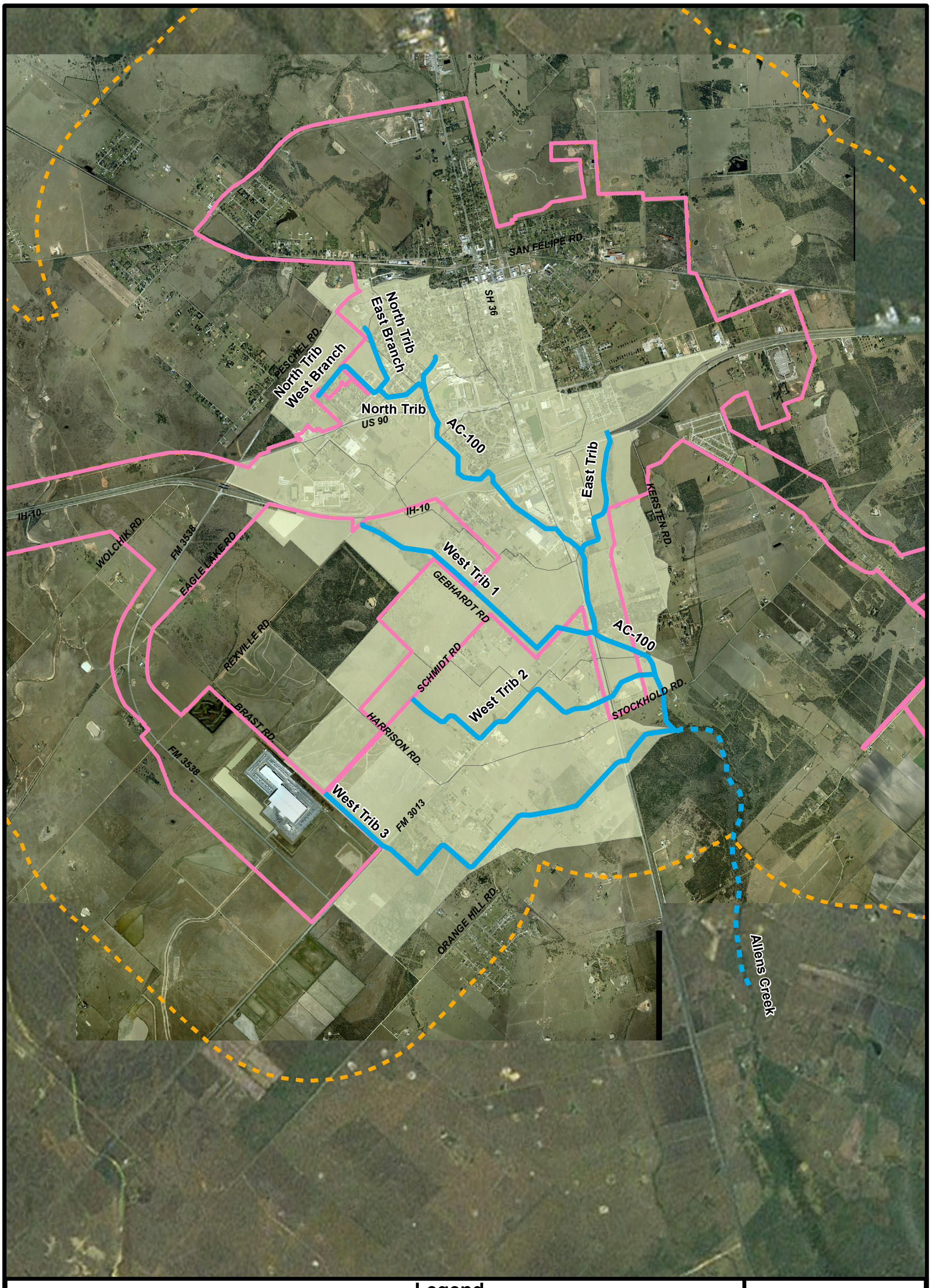
Drainage Subareas

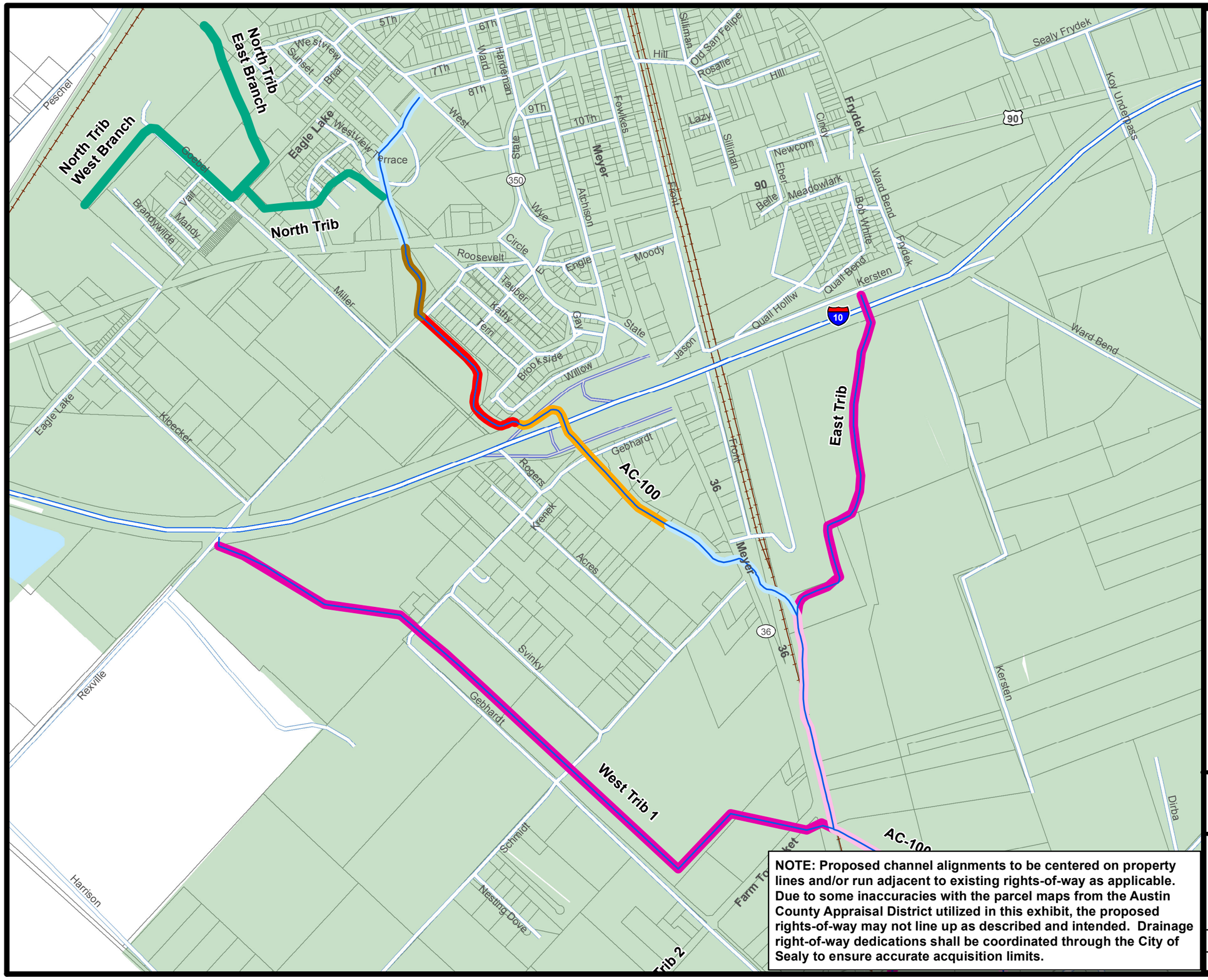
0 1,500 3,000 Feet

SPI

Exhibit 4
Topographic Data
with 1-foot Contours
Allen's Creek Watershed

Job No: 1003011	Scale: 1"= 3000'
File: Figure4.mxd	Date: AUGUST 2010


SAN FELIPE RD.
SH 36
PESCHEL RD.
North Trib
West Branch
North Trib
East Branch
North Trib
US 90
AC-100
East Trib
KERSTEN RD.
IH-10
IH-10
WOLCHIK RD.
FM 3538
EAGLE LAKE RD.
GEBHARDT RD
West Trib 1
AC-100
REXVILLE RD.
SCHMIDT RD
West Trib 2
STOCKHOLD RD.
BRAST RD.
HARRISON RD.
FM 3538
West Trib 3
FM 3013
ORANGE HILL RD.
Allens Creek
Legend
City Limits
Ex Subareas
ETJ
Proposed Channels
0 1,000 2,000
Feet
SPI
Exhibit 5
Proposed Channel Network
Allen's Creek Watershed
Job No: 1003011
Scale: 1"= 2000'
File: Figure5.mxd
Date: AUGUST 2010



Legend

- Proposed Channels

ROW Width (Feet)

- 90
- 105
- 120
- 130
- 150
- 180
- 190
- Project Area
- Parcels

Note – See Section 6.1.2 for a detailed description of various considerations taken in determining the ROW width requirements.

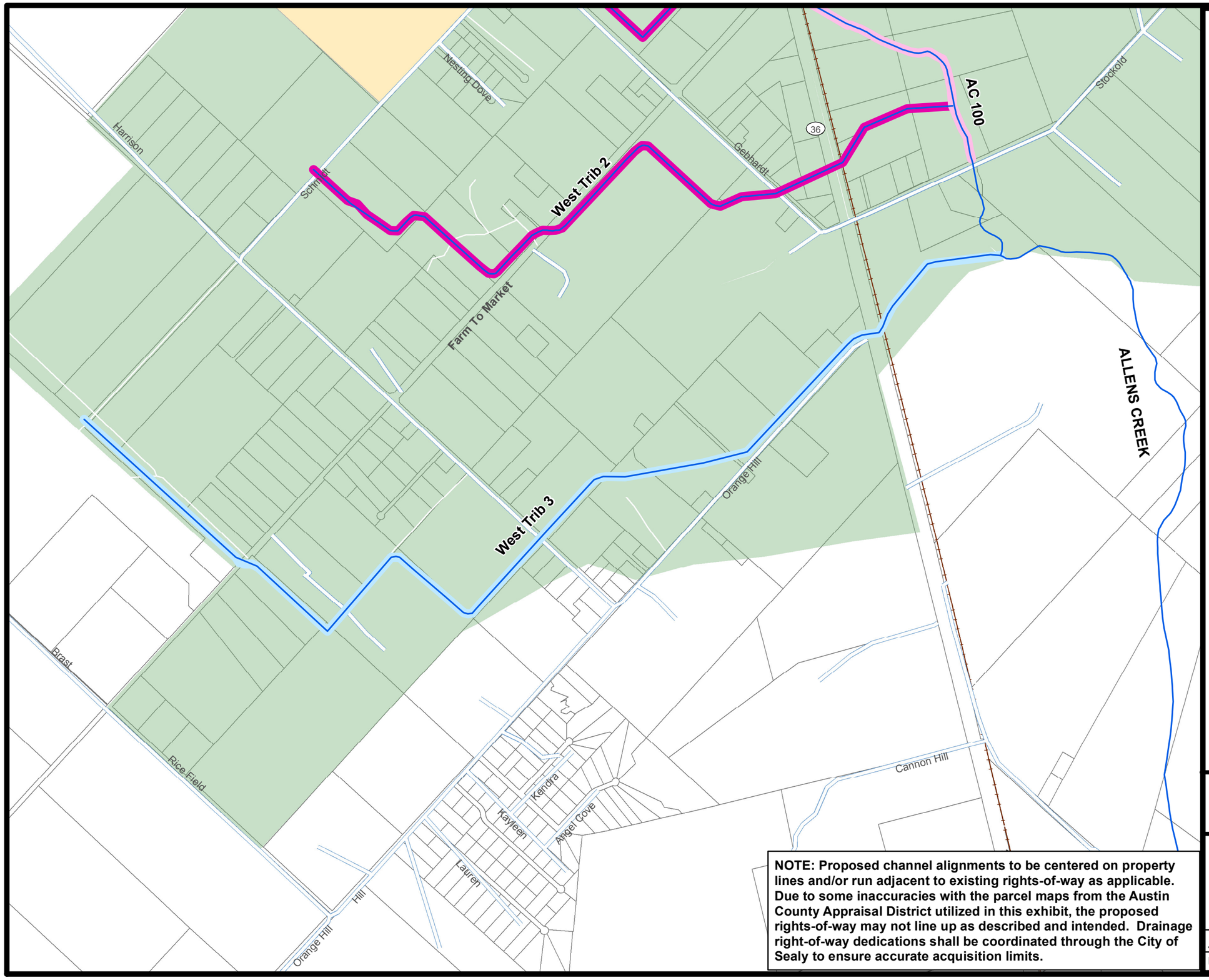
0 600 1,200 Feet

NOTE: Proposed channel alignments to be centered on property lines and/or run adjacent to existing rights-of-way as applicable. Due to some inaccuracies with the parcel maps from the Austin County Appraisal District utilized in this exhibit, the proposed rights-of-way may not line up as described and intended. Drainage right-of-way dedications shall be coordinated through the City of Sealy to ensure accurate acquisition limits.

SPI

Exhibit 6
Required Channel ROW
Allen's Creek Watershed

Job No: 1003011	Scale: 1"= 1200'
File: Figure6.mxd	Date: AUGUST 2010



Legend

- Proposed Channels

ROW Width (Feet)

- 130
- 150
- 180
- 190
- Project Area
- Parcels

0 600 1,200 Feet

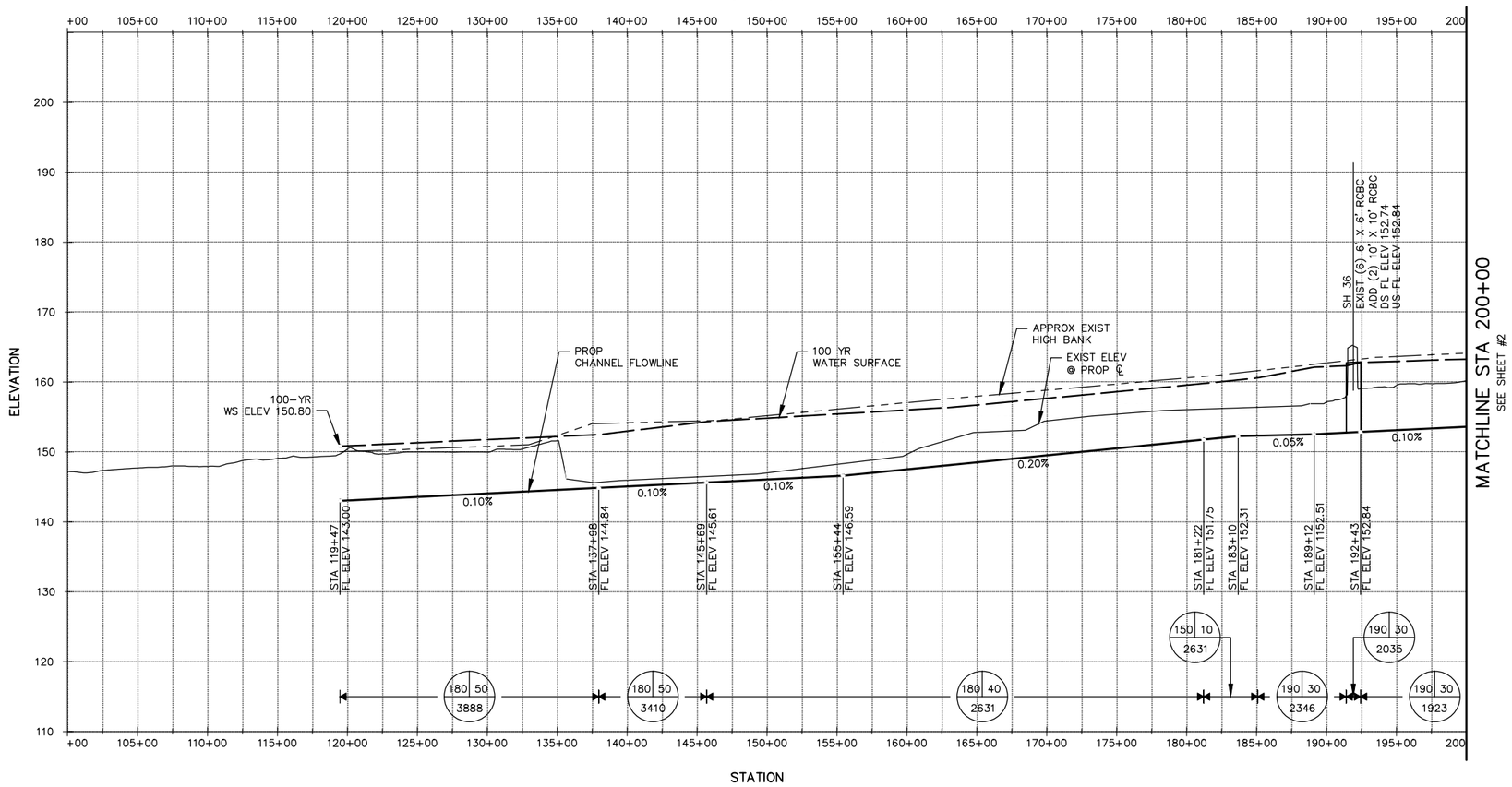
NOTE: Proposed channel alignments to be centered on property lines and/or run adjacent to existing rights-of-way as applicable. Due to some inaccuracies with the parcel maps from the Austin County Appraisal District utilized in this exhibit, the proposed rights-of-way may not line up as described and intended. Drainage right-of-way dedications shall be coordinated through the City of Sealy to ensure accurate acquisition limits.

SPI

Exhibit 7
Required Channel ROW
Allen's Creek Watershed

Job No: 1003011	Scale: 1"= 1200'
File: Figure6.mxd	Date: AUGUST 2010

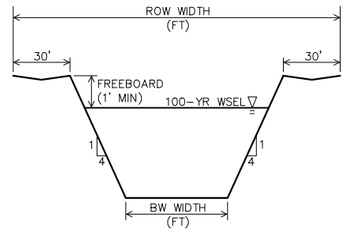
AC–100



0 500' 1000'
HORIZONTAL SCALE 1"=1000'

VERTICAL SCALE 1"=200' 0 100' 200'

TYPICAL CHANNEL SECTION



ROW (FT) | BW (FT)
Q100 (CFS)

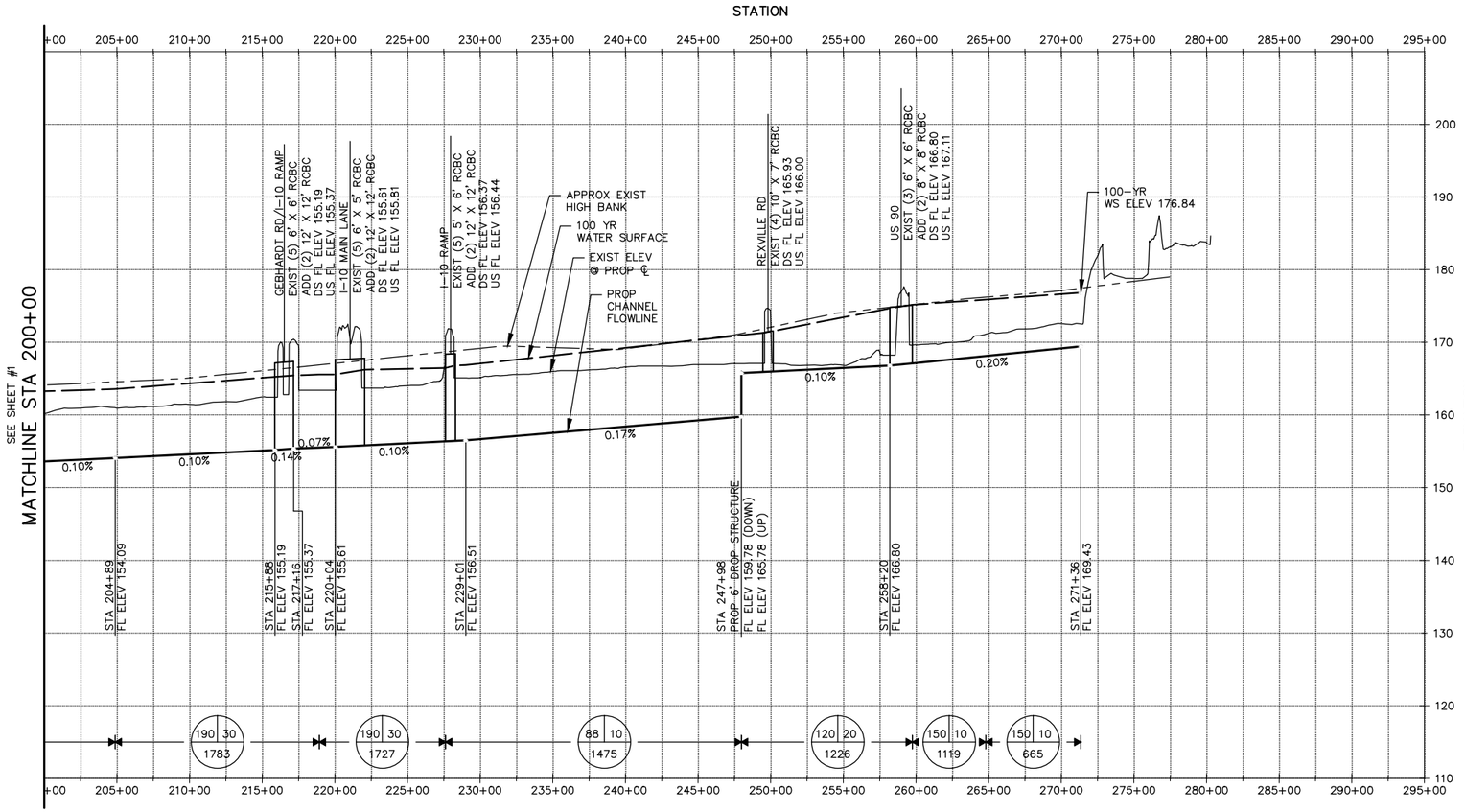
CITY OF SEALY TEXAS 1879

SCHAUMBURG & POLK, INC.
BEAUMONT ★ HOUSTON ★ TYLER
11767 KATY FREEWAY, SUITE 900
HOUSTON, TEXAS 77079-1779
281 . 920 . 0487
FIRM REGISTRATION No F–520

EXHIBIT 8
CHANNEL PROFILE
AC–100

SCALE	PROJECT NUMBER
AS NOTED	301401.00
DATE	SHEET
SEPTEMBER 2010	1 OF 2

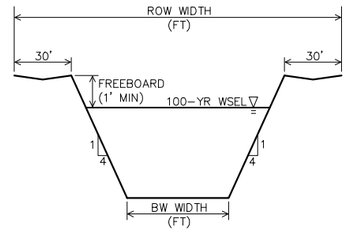
AC–100



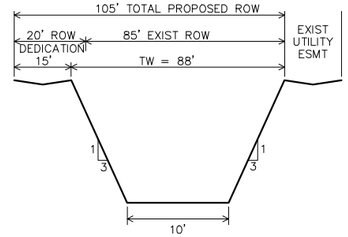
0 500' 1000'
HORIZONTAL SCALE 1"=1000'

VERTICAL SCALE 1"=200' 200' 100' 0

TYPICAL CHANNEL SECTION



SECTION BETWEEN IH–10 & REXVILLE RD



ROW (FT)	BW (FT)
Q100 (CFS)	

CITY OF SEALY TEXAS 1879

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281 . 920 . 0487
FIRM REGISTRATION No F–520

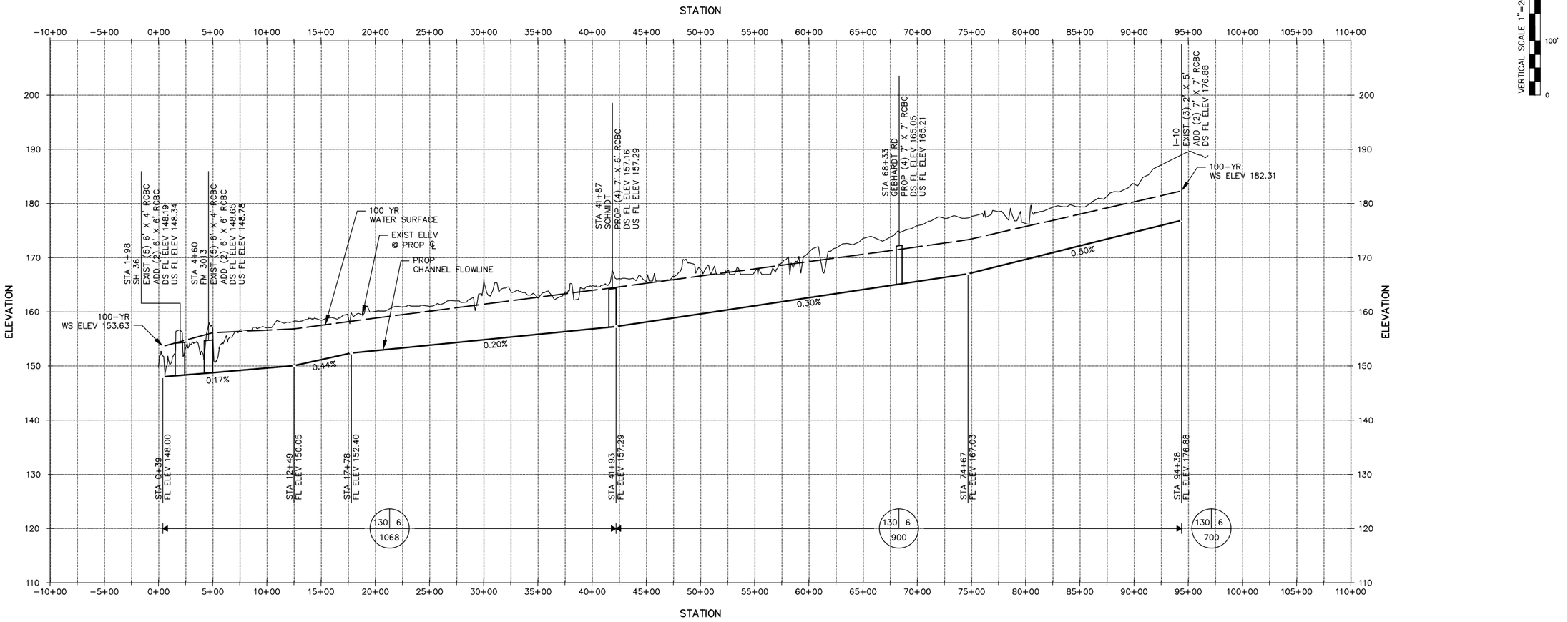
EXHIBIT 8
CHANNEL PROFILE
AC–100

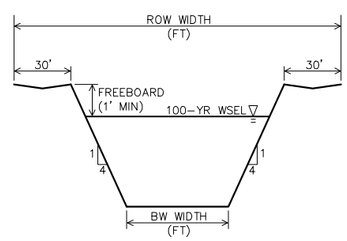
SCALE	PROJECT NUMBER
AS NOTED	301401.00
DATE	SHEET
SEPTEMBER 2010	2 OF 2

W TRIB 1

HORIZONTAL SCALE 1"=1000'

VERTICAL SCALE 1"=200'





ROW (FT) | BW (FT)

Q100 (CFS)

CITY OF SEALY TEXAS 1879

SCHAUMBURG & POLK, INC.
BEAUMONT ★ HOUSTON ★ TYLER

11767 KATY FREEWAY, SUITE 900
HOUSTON, TEXAS 77079-1779
281 . 920 . 0487
FIRM REGISTRATION No F-520

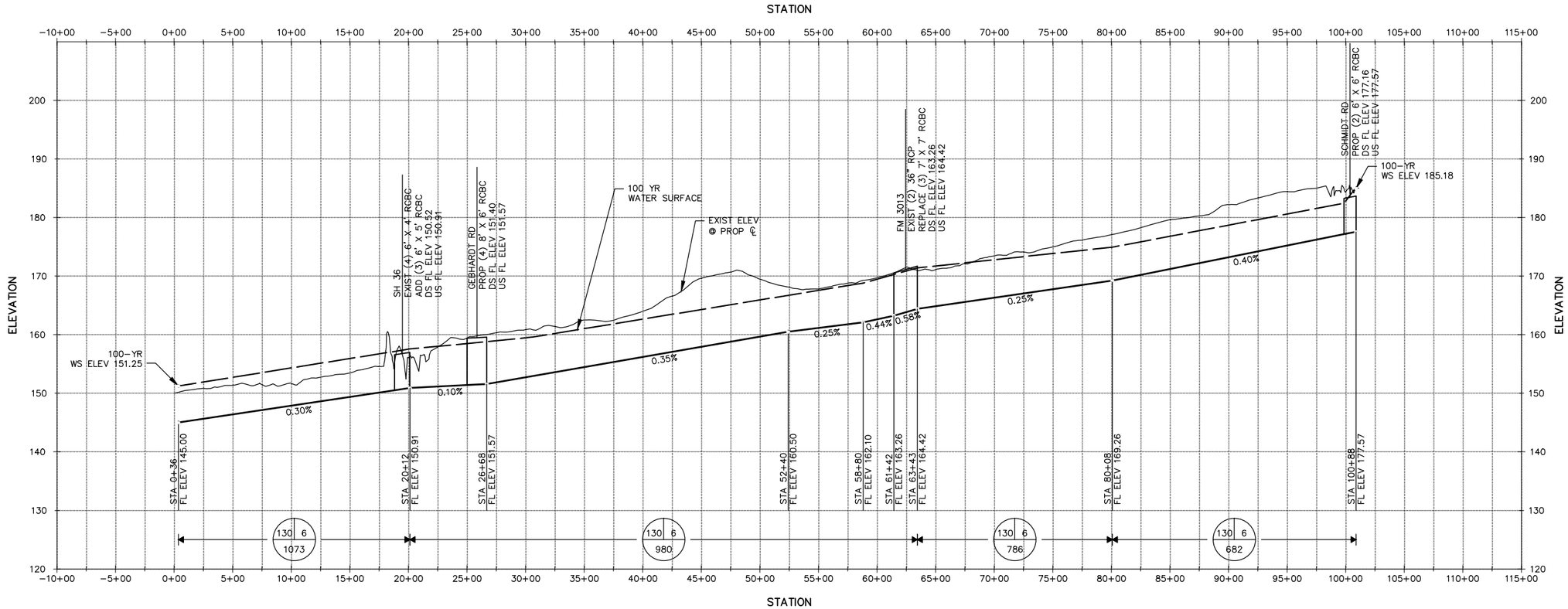
EXHIBIT 9
CHANNEL PROFILE
W TRIB 1

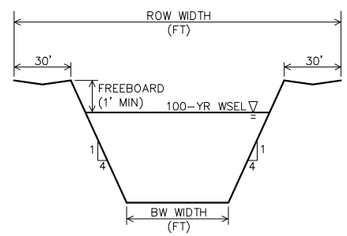
SCALE	PROJECT NUMBER
AS NOTED	301401.00
DATE	SHEET
SEPTEMBER 2010	1 OF 1

HORIZONTAL SCALE 1"=1000'

VERTICAL SCALE 1"=200'

W TRIB 2





ROW (FT) | BW (FT)

Q100 (CFS)

CITY OF SEALY TEXAS 1879

SCHAUMBURG & POLK, INC.
BEAUMONT ★ HOUSTON ★ TYLER
11767 KATY FREEWAY, SUITE 900
HOUSTON, TEXAS 77079-1779
281.920.0487
FIRM REGISTRATION No F-520

EXHIBIT 10
CHANNEL PROFILE
W TRIB 2

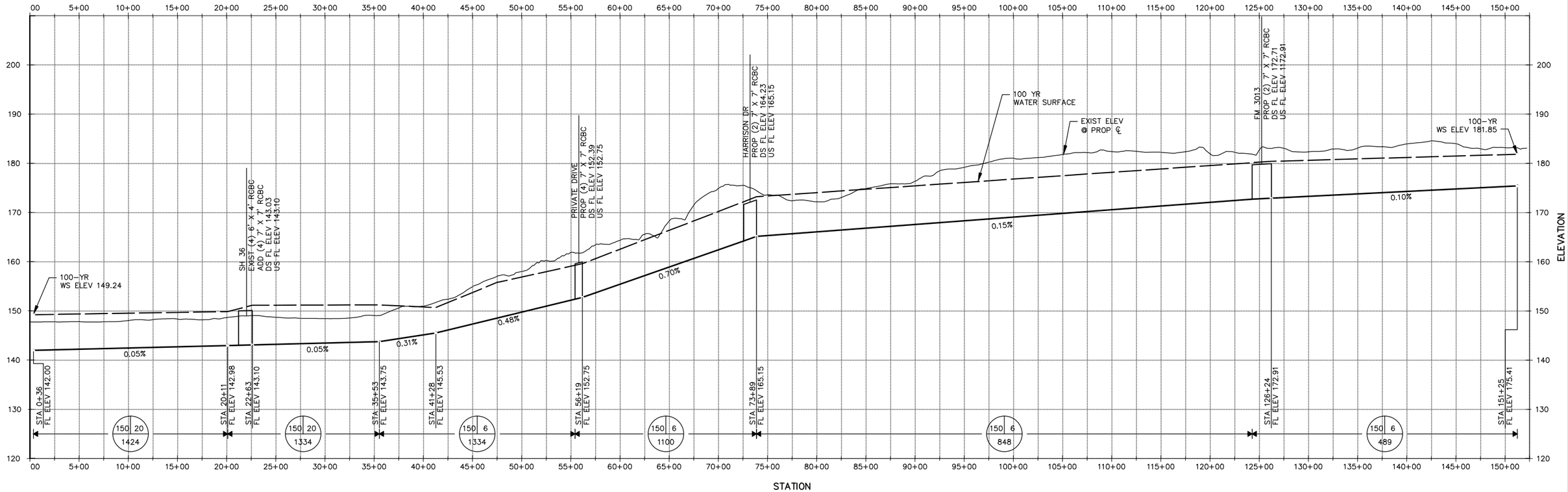
SCALE	PROJECT NUMBER
AS NOTED	301401.00
DATE	SHEET
SEPTEMBER 2010	1 OF 1

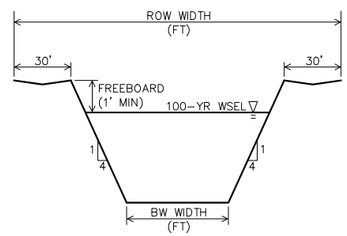
HORIZONTAL SCALE 1"=1000'

VERTICAL SCALE 1"=200'

W TRIB 3

STATION





ROW (FT) | BW (FT)
Q100 (CFS)

CITY OF SEALY, TEXAS 1879

SCHAUMBURG & POLK, INC.
BEAUMONT ★ HOUSTON ★ TYLER
11767 KATY FREEWAY, SUITE 900
HOUSTON, TEXAS 77079-1779
281.920.0487
FIRM REGISTRATION No F-520

EXHIBIT 11
CHANNEL PROFILE
W TRIB 3

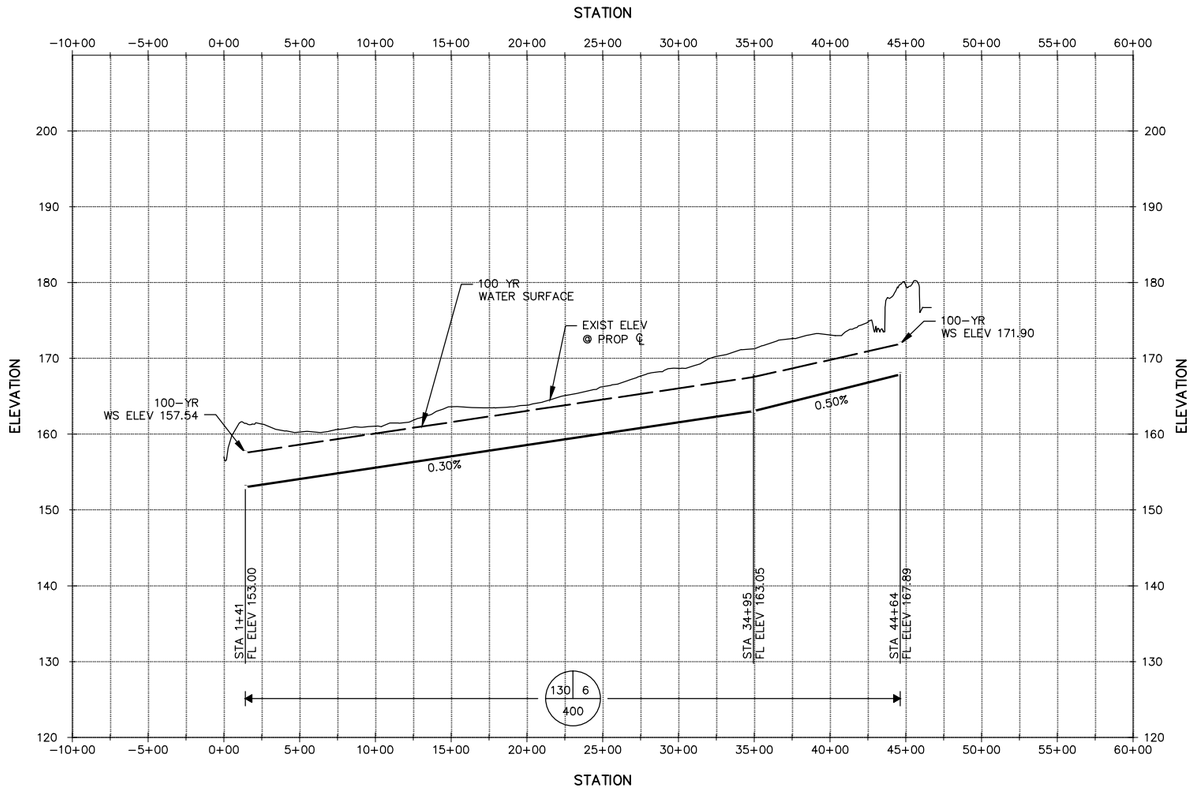
SCALE	PROJECT NUMBER
AS NOTED	301401.00
DATE	SHEET
SEPTEMBER 2010	1 OF 1

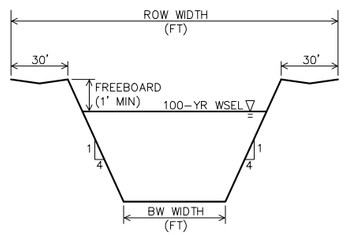
Jan 26, 2011 – 10:00am T:\2_Projects\301401.00 City of Sealy Regional Watershed\Project Work\Allen's Creek\DWG\Profile Allen's Creek.dwg W Trib 3

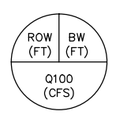
0 500' 1000'
HORIZONTAL SCALE 1"=1000'

VERTICAL SCALE 1"=200' 200' 100' 0

E TRIB







CITY OF SEALY, TEXAS 1879

SCHAUMBURG & POLK, INC.
BEAUMONT ★ HOUSTON ★ TYLER

11767 KATY FREEWAY, SUITE 900
HOUSTON, TEXAS 77079-1779
281.920.0487
FIRM REGISTRATION No F-520

EXHIBIT 12
CHANNEL PROFILE
E TRIB

SCALE	PROJECT NUMBER
AS NOTED	301401.00
DATE	SHEET
SEPTEMBER 2010	1 OF 1

Jan 26, 2011 - 9:57am T:\2_Projects\301401.00 City of Sealy Regional Watershed\Project Work\Allen's Creek\DWG\Profile Allen's Creek.dwg E Trib 1

National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

480017

LIMIT OF DETAILED STUDY

Allens Creek

ZONE AE

Culvert

AX0054

AX0055

Bridge

LIMIT OF STUDY

LIMIT OF FLOODWAY

AUSTIN COUNTY UNINCORPORATED AREAS 480704

CITY OF SEALY 480017

2870000 FT

2875000 FT

JOINS PANEL 0400

179 178 175 174 173 172 171 169 168 167 164 162 161 160 158 156 154 152

ROOSEVELT STR

TAUBER LN

KATHY

TAUBER LANE

CIRCLE DR

GAY STR

TERRI AVE

BROOKSIDE

WILLOW STREET

ENGLE-KING STREET

JASON ROAD

GEBHARDT ROAD

ROGERS LANE

ACERS LANE

ACERS ROAD

GEBHARDT ROAD

SVINKY ROAD

SCHMIDT ROAD

KERSTEN ROAD

WARD BEND ROAD

SEALY-WARD BEND ROAD

LUCHAN ROAD

DIRBA LANE

STOCKOLD

SHADOW LAKE CT

SHADOW LAKE CIR

SHADOWLAKE DRIVE

N CIRCLE STR

N WYE STR

HARDEMAN STREET

9TH STR

10TH STR

RAILROAD

FRONT STREET

LAZY LANE

GILLIMAN STREET

NEWCOM LANE

CINDY LANE

WENZEL LANE

ROBIN ROAD

BELLE MOCKINGBIRD BEND

QUAIL BEND

TIGER LANE

90 10 36

NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0320E

FIRM

FLOOD INSURANCE RATE MAP

AUSTIN COUNTY, TEXAS AND INCORPORATED AREAS

PANEL 320 OF 475

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
AUSTIN COUNTY	480704	0320	E
SAN FELIPE, TOWN OF	480705	0320	E
SEALY, CITY OF	480017	0320	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER 48015C0320E

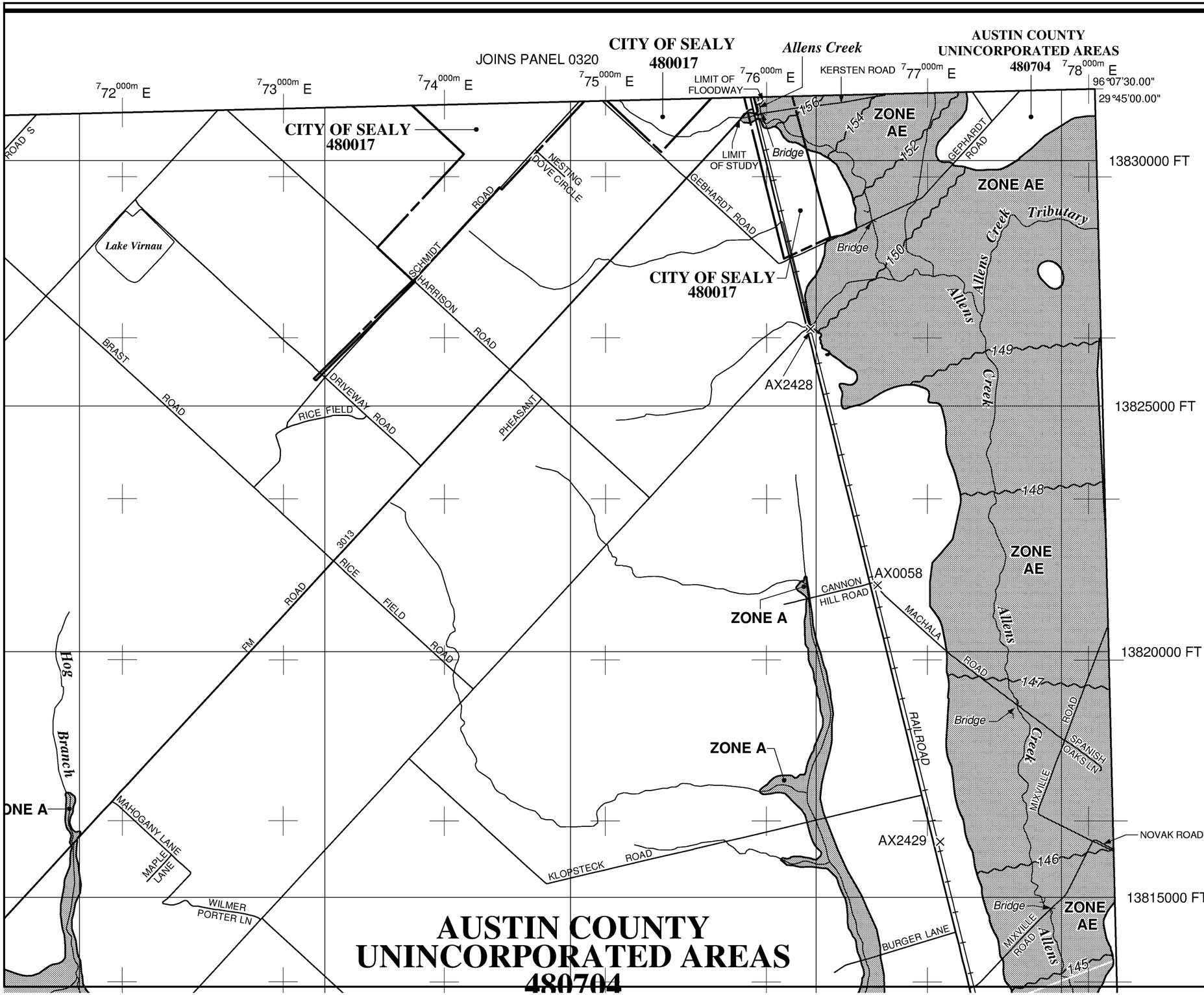
MAP REVISED SEPTEMBER 3, 2010

Federal Emergency Management Agency

e National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 2000'

1000 0 2000 4000 FEET



AUSTIN COUNTY UNINCORPORATED AREAS 480704

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0400E

FIRM

FLOOD INSURANCE RATE MAP

AUSTIN COUNTY, TEXAS AND INCORPORATED AREAS

PANEL 400 OF 475

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
AUSTIN COUNTY	480704	0400	E
SEALY, CITY OF	480017	0400	E

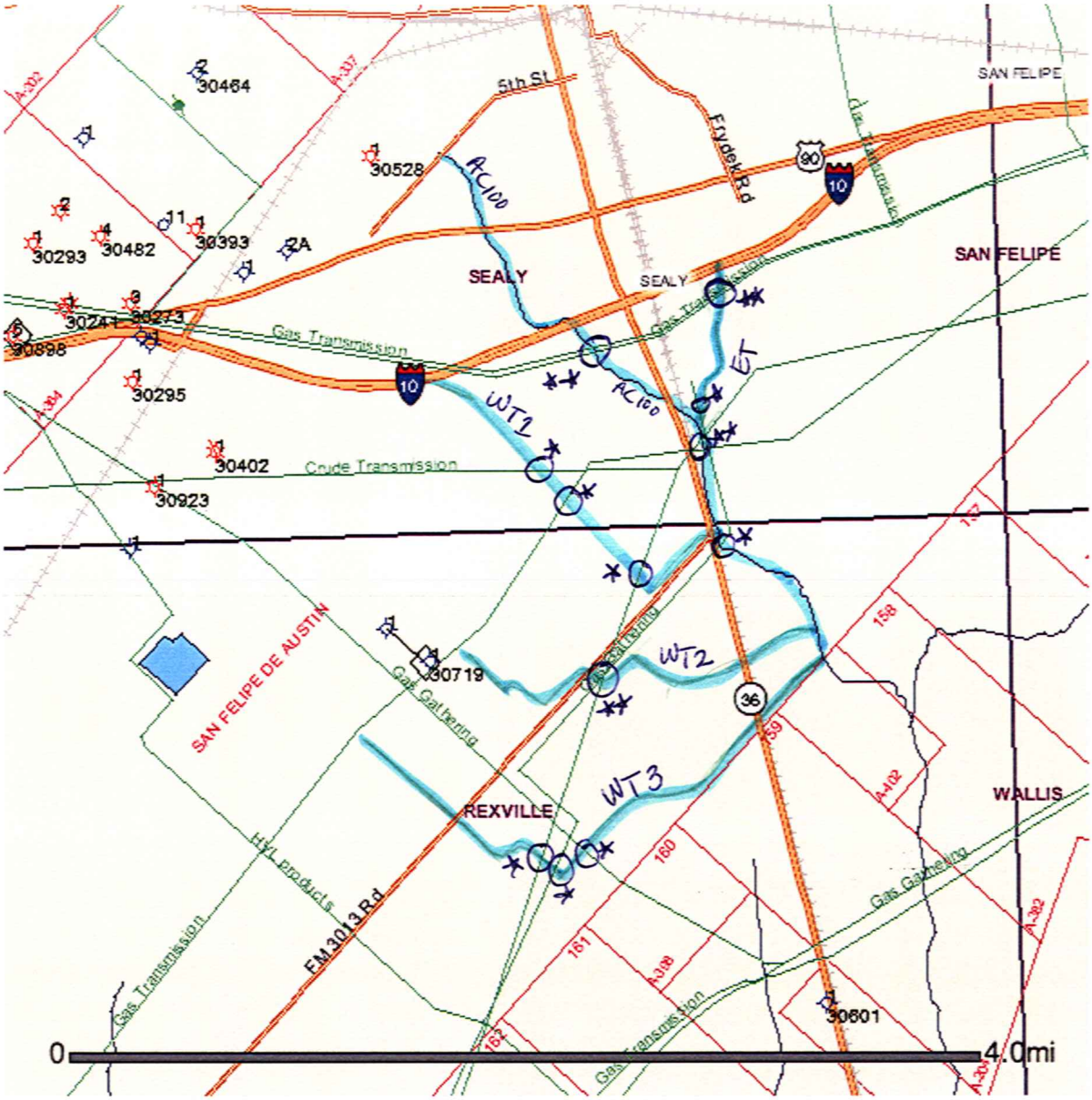
Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
48015C0400E

MAP REVISED
SEPTEMBER 3, 2010

Federal Emergency Management Agency

APPENDIX B – PIPELINE CONFLICTS
ALLENS CREEK MASTER DRAINAGE PLAN



http://gis2.rrc.state.tx.us/public/viewer2.htm