CITY OF KYLE

Planning and Zoning Commission Workshop Meeting

https://www.cityofkyle.com/kyletv/kyle-10-live OR Spectrum10
SPECIAL NOTE: Pursuant to the March 16, 2020 proclamation issued by Governor Abbott, this meeting will be held by videoconference in order to advance the public health goal of limiting face-to-face meetings (also called 'social distancing') to slow the spread of COVID-19. City Council members will attend the meeting via videoconferencing. This meeting can be viewed live online at https://www.cityofkyle.com/kyletv/kyle-10-live OR Spectrum10.

Notice is hereby given that Planning and Zoning Commission of the City of Kyle, Texas will meet at 6:30 PM on September 22, 2020, at https://www.cityofkyle.com/kyletv/kyle-10-live OR Spectrum10, for the purpose of discussing the following agenda.

NOTE: There may be a quorum of the City Council of Kyle, Texas present at the meeting who may participate in the discussion. No official action will be taken by the City Council members in attendance.

Posted this 18th day of September, 2020, prior to 7:30 P.M.

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1. Call meeting to order

2. Roll Call

3. Citizen Comments

4. General Discussion

A. Discussion of re-appointments.

B. Update to the 2010 Comprehensive Plan Future Land Use Map: discussion of constraints and opportunity, and how they affect the mapping process.

5. Adjournment

*Per Texas Attorney General Opinion No. JC-0169; Open Meeting & Agenda Requirements, Dated January 24, 2000: The permissible responses to a general member communication at the meeting are limited by 551.042, as follows: "SEC. 551.042. Inquiry Made at Meeting. (a) If, at a meeting of a government body, a member of the public or of the governmental body inquires about a subject for which notice has not been given as required by the subchapter, the notice provisions of this subchapter, do not apply to:(1) a statement of specific factual information given in response to the inquiry; or (2) a recitation of existing policy in response to the inquiry. (b) Any deliberation of or decision about the subject of the inquiry shall be limited to a proposal to place the subject on the agenda for a subsequent meeting."

CITY OF KYLE, TEXAS

Discussion of re-appointments

Meeting Date: 9/22/2020
Date time:6:30 PM

Subject/Recommendation: Discussion of re-appointments.

Other Information: N/A

Legal Notes: N/A

Budget Information: N/A

ATTACHMENTS:

Description

No Attachments Available

CITY OF KYLE, TEXAS

2010 Comprehensive Plan Future Land Use Map

Meeting Date: 9/22/2020
Date time:6:30 PM

Subject/Recommendation: Update to the 2010 Comprehensive Plan Future Land Use Map: discussion of constraints and opportunity, and how they affect the mapping process.

Other Information: See attached.

Legal Notes: N/A

Budget Information: N/A

ATTACHMENTS:

Description

- Staff Memo
- Landuse and CCN's
- Landuse and ETJ
- Landuse and Floodplain
- Landuse and Transportation
- Blanco Basin Wastewater Treatment Plant Feasibility Study Report

September 22, 2020

To: Kyle Planning & Zoning Commission
From: Howard J. Koontz, AICP
Director, Planning & Community Development
Re: 2010 Future Land Use Map amendment

Dear Commissioners:

It's the last regularly scheduled meeting in September and at this time we will continue to explore the process and schedule for completing an update to the city's Future Land Use Map that is a part of the 2010 Comprehensive Plan for the City of Kyle. Additionally, staff would encourage exploration into both the character area designations indicated on the map, and the externalities that affect the assignment of those designations.

Some of those externalities are the provisions for utility services. Staff and the Commissioners need to discuss at length concepts like the availability of water, and waste water services, as well as the city's future transportation network. These are utilities that the city itself either constructs, or operates, or both. Additionally, there are other utilities and their providers like electricity and telecommunications that have to be considered when deciding upon a character area designation. Lastly future capital projects can both create and constrain the availability of services based on their location and the landscape of the areas they are designed to serve. Kyle's City Engineer Leon Barba is present at tonight's meeting to help answer questions with future planning and options for Kyle's wet and dry utility services.

Following the discussion on utility corridors, the process can move to physical development planning, as business and industry tends to locate both where their clients can each them, and where they can physically operate.

Lastly, in an update to the brief discussion that was touched on at the September 8th meeting, tonight's session should conclude on what remains to be determined in this process, and the schedule for completing those items.

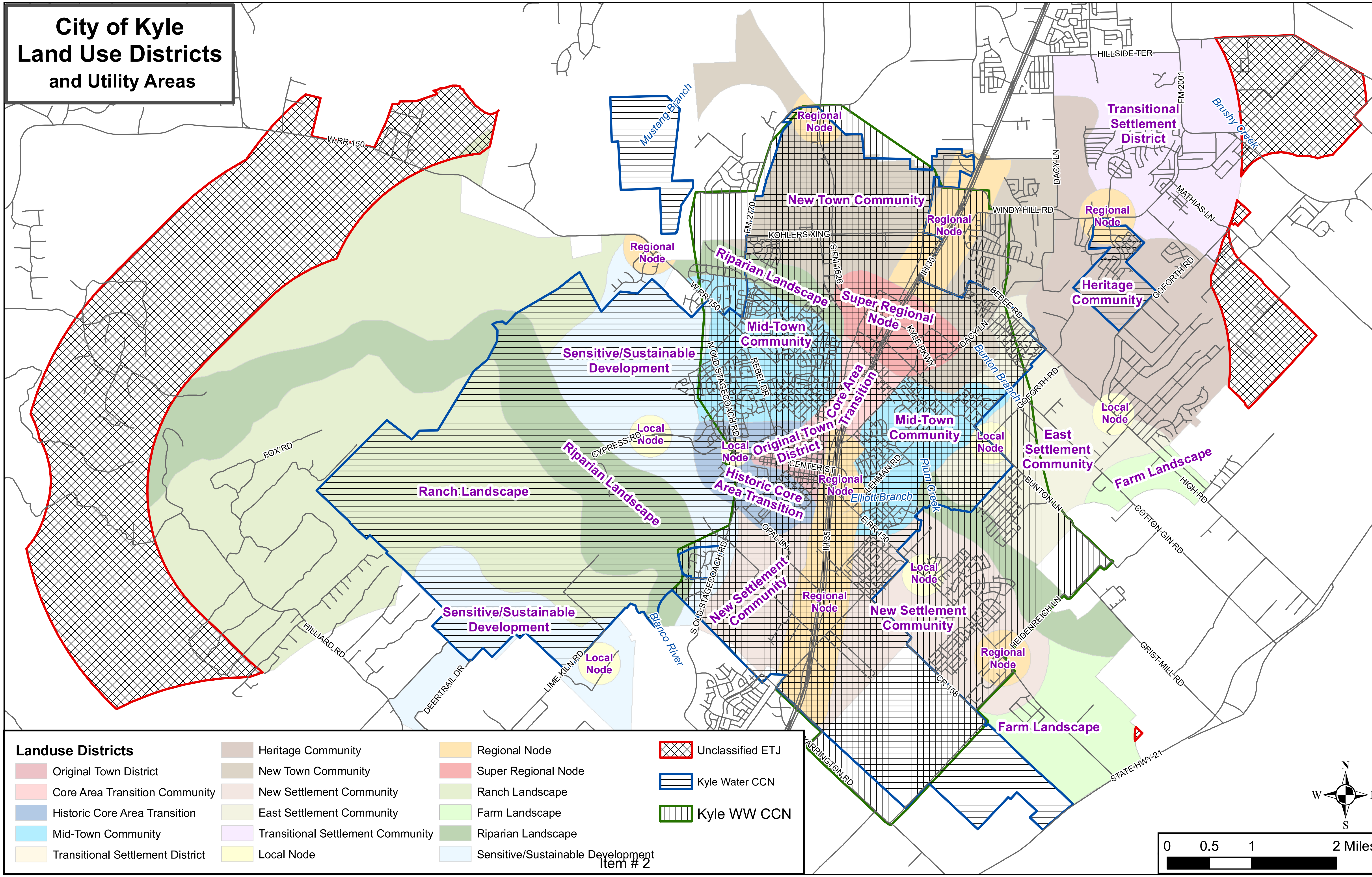
Some reference links for this meeting:

Kyle's current Comprehensive Plan and associated updates:
https://www.cityofkyle.com/planning/2017-comprehensive-plan-july-2-2019-comprehensive-plan-september-3-2019-comprehensive-plan

Kyle's 2015 Transportation Master Plan:
https://www.cityofkyle.com/cityengineer/kyle-connected-city-kyle-2015-transportation-master-plan

Kyle's 2015 Economic Development Strategic Plan
https://www.kyleed.com/sites/default/files/files/Resources/Kyle%20Economic%20Development%20Strategic%20Plan%20(9-10-15)%20FINAL.pdf

ARWA Blanco Basin Wastewater Treatment Plant Feasibility Study Report, 2020 (attached)


City of Kyle
Land Use Districts
and Utility Areas
W RR 150
Mustang Branch
Regional Node
New Town Community
Regional Node
HILLSIDE TER
FM 2001
Transitional Settlement District
Brushy Creek
DACY LN
WINDY HILL RD
MATHIAS LN
Regional Node
FM 2770
KOHLERS XING
S FM 1626
Regional Node
Riparian Landscape
IH 35
Super Regional Node
BEBEE RD
Heritage Community
GOFORTH RD
W RR 150
Mid-Town Community
KYLE PKWY
DACY LN
Sensitive/Sustainable Development
N OLD STAGECOACH RD
REBEL DR
Core Area Transition
Bunton Branch
GOFORTH RD
Local Node
Local Node
CYPRESS RD
Mid-Town Community
Original Town District
Local Node
East Settlement Community
FOX RD
Riparian Landscape
Local Node
CENTER ST
Farm Landscape
Regional Node
LEHMAN RD
Plum Creek
BUNTON LN
HIGH RD
Ranch Landscape
Historic Core Area Transition
Elliott Branch
COTTON GIN RD
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Local Node
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Sensitive/Sustainable Development
S OLD STAGECOACH RD
HEIDENREICH LN
HILLIARD RD
Blanco River
Local Node
Regional Node
GRIST MILL RD
LIME KILN RD
DEERTRAIL DR
CR 158
Farm Landscape
YARRINGTON RD
STATE HWY 21
Landuse Districts
Original Town District
Core Area Transition Community
Historic Core Area Transition
Mid-Town Community
Transitional Settlement District
Heritage Community
New Town Community
New Settlement Community
East Settlement Community
Transitional Settlement Community
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Regional Node
Super Regional Node
Ranch Landscape
Farm Landscape
Riparian Landscape
Sensitive/Sustainable Development
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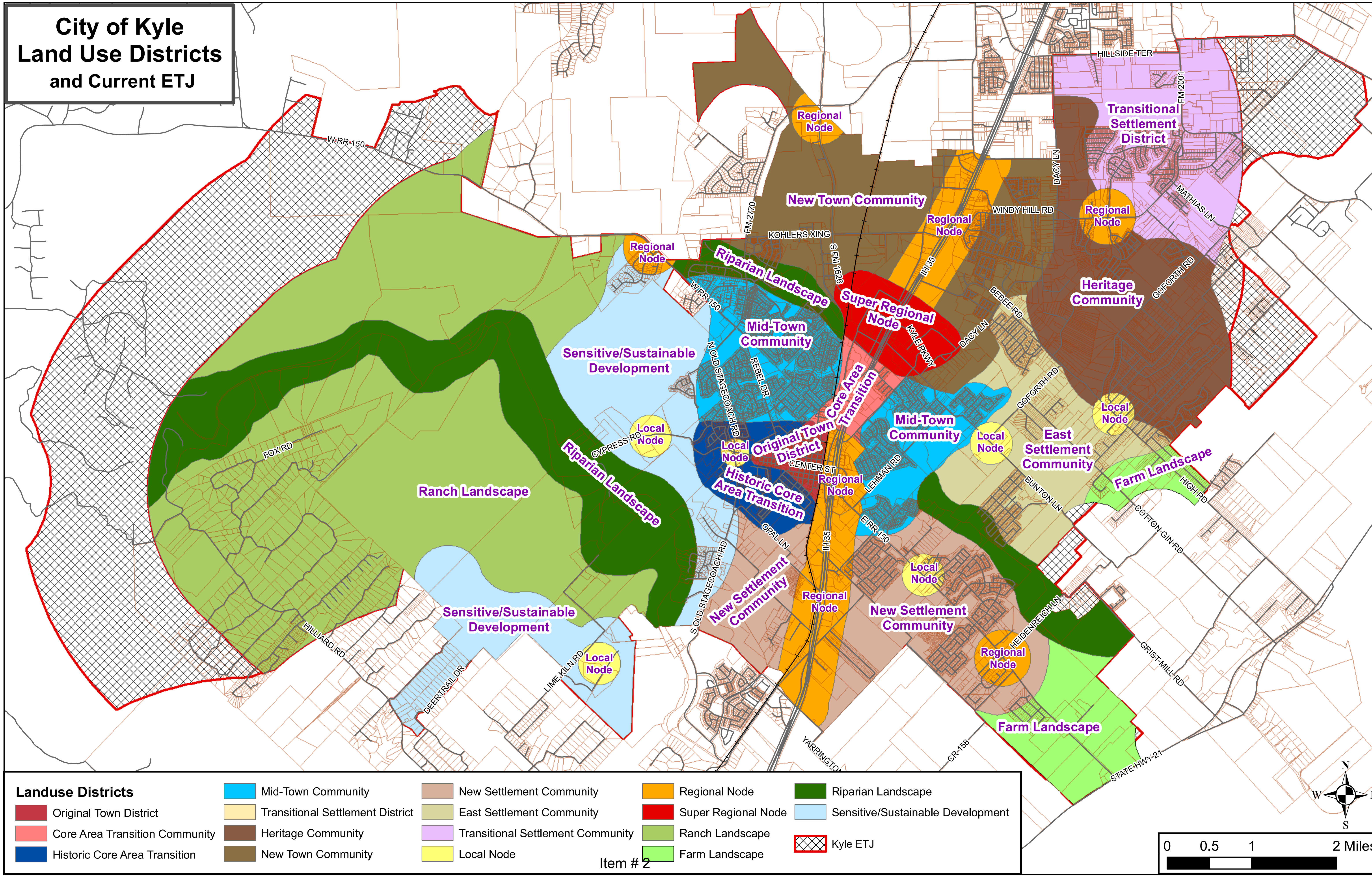
City of Kyle Land Use Districts and Current ETJ



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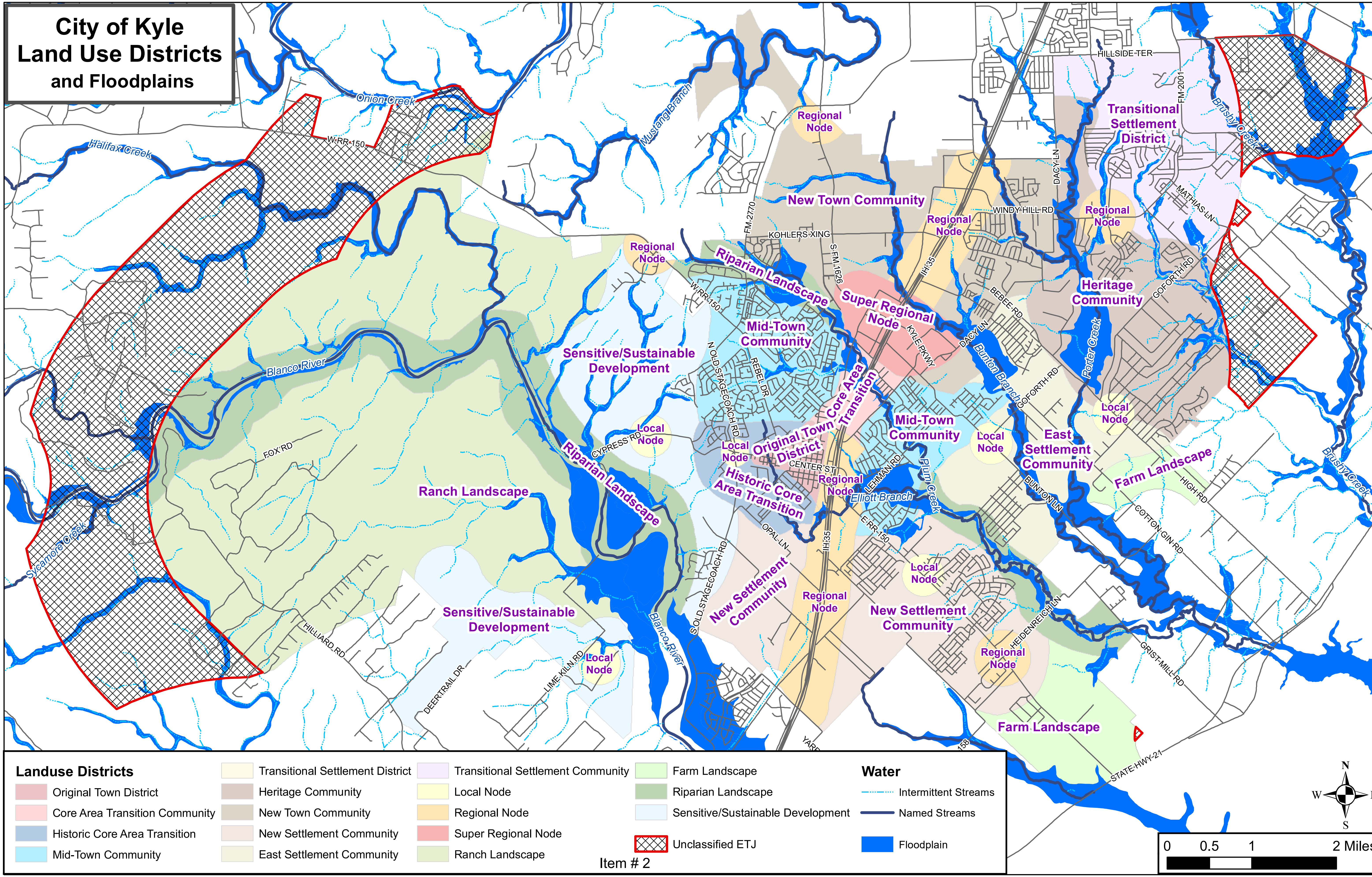
City of Kyle
Land Use Districts
and Floodplains
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Mustang Branch
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Regional Node
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Brushy Creek
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WINDY HILL RD
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FM 2770
KOHLERS XING
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IH 35
Riparian Landscape
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Core Area Transition
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Sycamore Creek
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Landuse Districts
Original Town District
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Local Node
Regional Node
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Sensitive/Sustainable Development
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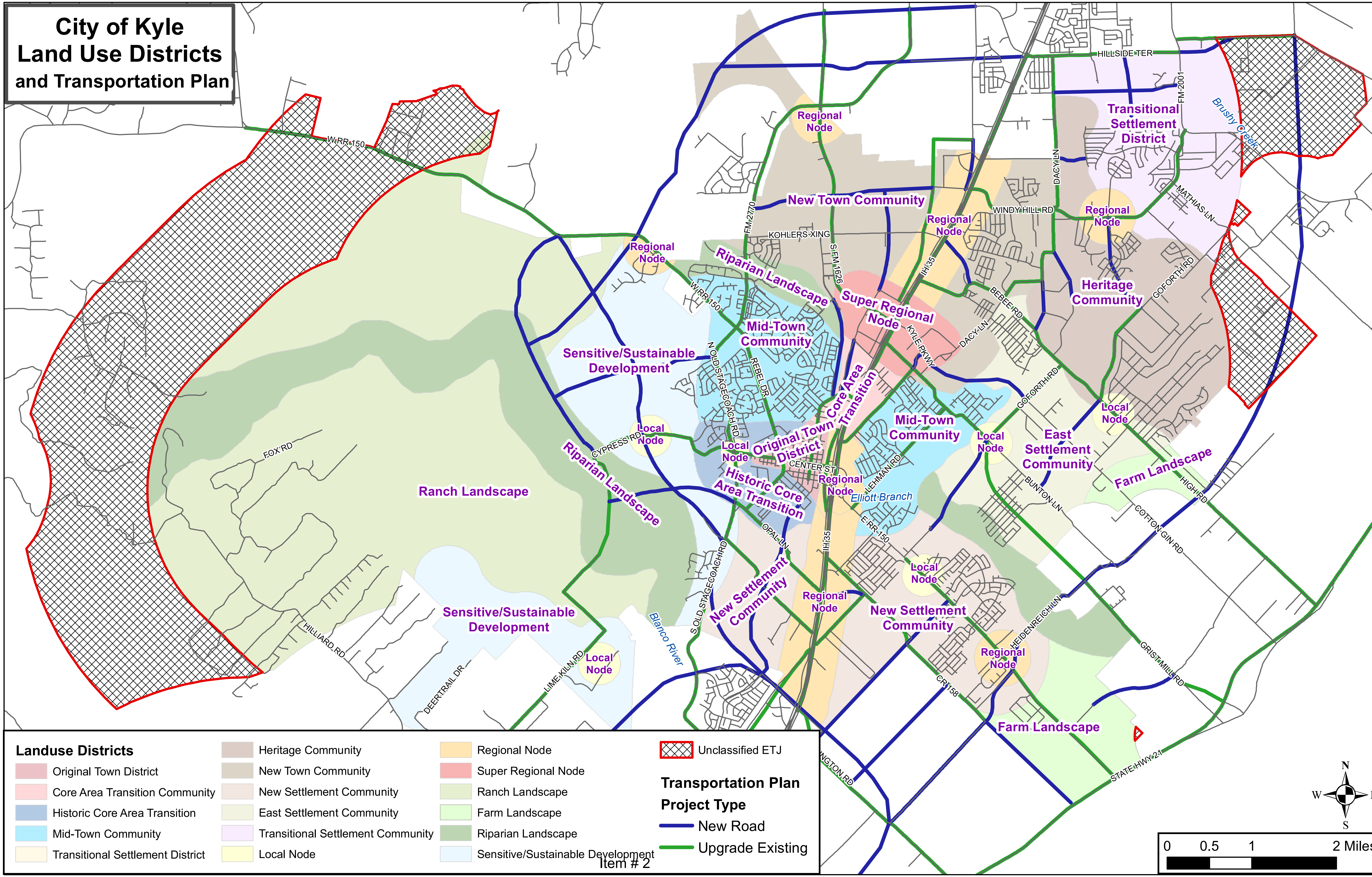

City of Kyle
Land Use Districts
and Transportation Plan
Landuse Districts
Original Town District
Core Area Transition Community
Historic Core Area Transition
Mid-Town Community
Transitional Settlement District
Heritage Community
New Town Community
New Settlement Community
East Settlement Community
Transitional Settlement Community
Local Node
Regional Node
Super Regional Node
Ranch Landscape
Farm Landscape
Riparian Landscape
Sensitive/Sustainable Development
Unclassified ETJ
Transportation Plan
Project Type
New Road
Upgrade Existing
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Ranch Landscape
Riparian Landscape
Sensitive/Sustainable Development
Regional Node
Local Node
Super Regional Node
New Town Community
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Original Town District
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KOHLERS XING
WINDY HILL RD
HILLSIDE TER
FM 2001
MATHIAS LN

Item # 2

AECOM

Submitted by
AECOM
9400 Amberglen Blvd
Austin, TX 78729
Texas Firm #3580

Blanco Basin Wastewater Treatment Plant Feasibility Study Report

Prepared For:

Alliance Regional Water Authority

Prepared By:

AECOM

Job No. 60537115

September 2017

STATE OF TEXAS
CASEY G. WAUTERS
93889
LICENSED
PROFESSIONAL ENGINEER
9/7/17

STATE OF TEXAS
MARTIN RUMBAUGH
83388
LICENSED
PROFESSIONAL ENGINEER
9/7/17

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1 Introduction

The Alliance Regional Water Authority (Alliance Water), consisting of the Cities of San Marcos, Kyle, and Buda, and the Canyon Regional Water Authority, was formed to jointly develop new water supplies from the Carrizo-Wilcox aquifers. Alliance Water has leased groundwater rights in Caldwell and Gonzales Counties, and has initiated permitting and planning studies for a proposed water supply system to provide up to 35,000 acre-feet per year of new water supplies from these groundwater sources.

In addition to these groundwater sources, Alliance Water is investigating the feasibility of direct potable reuse (DPR) as a potential alternative source of new potable water supply. This source is potentially from reuse of the wastewater effluent from the cities of San Marcos, Kyle and Buda. Evaluation of this issue identified an area between San Marcos and Kyle that is currently unserved by a wastewater collection and treatment system. Pursuant and subject to the Master Service Agreement between Alliance Water and AECOM Technical Services, Inc., Alliance Water has requested AECOM to review this area to evaluate the feasibility of locating a wastewater treatment plant (WWTP) to serve this currently unserved and developing area.

The proposed service area, referred to as the Blanco Basin, is generally located from the southwest portion of the City of Kyle to north of the City of San Marcos. The Blanco Basin extends along the IH-35 corridor between the two cities and east to an area generally north of the City of Martindale. This evaluation performed the following tasks:

- Evaluated the Blanco Basin and defined geographic limits for the potential wastewater service area.
- Evaluated existing population, anticipated development, and projected growth of population within the defined area of the Blanco Basin.
- Flow projections were applied to the growth projections to estimate wastewater flow, plant capacity, and plant phasing requirements.
- Evaluated potential sites for the proposed wastewater treatment plant and the advantages / disadvantages of co-locating the proposed WWTP with Alliance Water's proposed Direct Potable Reuse facilities.
- Evaluated potential wastewater treatment plant effluent discharge locations, including conceptual evaluation of potential permitting issues.
- Developed conceptual planning level cost estimates.
- Compared planning level costs estimates to the expansion costs of nearby cities existing WWTPs.

This feasibility report concludes with recommendations for additional steps to be taken if Alliance Water elects to move forward with development of wastewater treatment facilities.

2 Service Area Boundary

2.1 General Study Area

As stated previously, the wastewater study area is defined as the Blanco Basin. A general definition of this area was provided by Alliance Water and is shown on **Exhibit No. 2-1**. In preparation for the project initiation meeting held on February 24, 2017, several exhibits of the Blanco Basin area were developed for review and discussion during the meeting. These exhibits consisted of the following:

- Watershed Map – **Exhibit No. 2-2**
- Jurisdiction Map – **Exhibit No. 2-3**
- Wastewater CCN Map – **Exhibit No. 2-4**

These exhibits were reviewed during the meeting and Alliance Water attendees confirmed that they were aware the Blanco Basin overlapped various watersheds, city extra-territorial jurisdictions (ETJs), and multiple wastewater certificates of convenience and necessity (CCNs). It was also stated that some of the areas currently served by the cities of San Marcos and Kyle may be more appropriately served by Blanco Basin facilities. Alliance Water attendees stated that they wanted the Blanco Basin service area defined by "good engineering judgement" and to not be inhibited by existing CCNs or service areas.

In addition, a discussion was held concerning the planning period to be used for the Feasibility Study. The Blanco Basin is located between the cities of Kyle and San Marcos, and both cities have performed population and wastewater flow projections for their service areas and used different planning periods. After discussion, it was agreed to use a planning period of 30 years, from 2020 through 2050, for this study.

2.2 Identification of Base Area and Rationale

Based on the direction provided during the project initiation meeting, the evaluation of the Blanco Basin was performed. The basis for the evaluation was to maximize gravity flow within the collection system and minimize crossings of the Interstate Highway 35 (IH-35) on the western edge of the service area and river crossings on the south edge of the service area. This concept was used to define a base area to be served.

A review of topographic drawings indicated the area east of IH-35 and north of the Blanco/San Marcos River generally slopes to the southeast at a grade of about 0.2%. Additionally, there is a slight low area that follows this same direction. The topography increases in elevation to the north of this low area and also increases slightly in elevation to the south. It is anticipated a gravity interceptor, following natural grade and installed at a 0.2% slope, could be installed on this general path. Based on this general interceptor alignment, elevations and distances were checked to confirm how far north wastewater collector pipes could be installed to serve the area.

On the north side, this limit was generally the watershed dividing line between Plum Creek watershed and the Lower Blanco River/Upper San Marcos River watershed. On the south side, elevations and distances indicated the area could be served to nearby the Blanco/San Marcos River with areas immediately adjacent to the river being too low in elevation. These areas, if requiring wastewater service, will require a lift station. On the eastern edge of the area, near the City of Martindale, some existing drainages transect the area, flowing north to south, and limit the eastern edge of the service area to maintain gravity flow within the collection system. On the northwest side of this base area, west of IH-35, the natural topography is consistent with the base area. The elevation is adequate to flow wastewater to the southeast with the only problem being the crossing of IH-35. To minimize this problem, this northwest area was evaluated to consider one crossing of IH-35 and it was determined gravity flow from this area is possible which resulted in the base area extended northwest of IH-35.

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Based on this evaluation, a Base Area was developed and is shown on **Exhibit 2-5**. Effectively, this Base Area can be served by a wastewater interceptor, located near the center of the area, between the Blanco River and Hemphill Creek, and flowing from the northwest to the southeast. Wastewater service collectors would extend north and south of the interceptor to receive wastewater flow. Low topographic areas along the Blanco River may require lift stations to pump wastewater to the interceptor, if service is provided to these areas. This suggests a potential wastewater treatment plant located in the lower half of the Base Area, west of Hemphill Creek. A tentative location for the proposed wastewater interceptor within the Base Area is shown on **Exhibit No. 2-6**. The conceptual alignment in **Exhibit 2-6** was based on maximizing gravity flow to the service area and would need to be refined during Final Design to avoid conflicting uses such as the San Marcos Airport. This tentative interceptor location was used to support the evaluation of potential sites for a wastewater treatment plant.

2.3 Identification of Alternate Areas and Rationale

In addition to the Base Area, some of the surrounding areas were evaluated for topography that generally flows toward the Base Area and could potentially be included in this service area. The following paragraphs address each of these surrounding areas and each area is identified as an alternative. Additionally, each Alternative area is also shown on **Exhibit No. 2-5**.

Alternative A incorporates an area south of the Blanco/San Marcos River and is bounded by high topographic elevations to the south and west. The east end of Alternative A is limited by the topographic elevation that can easily drain back to the Alternative A area. Wastewater collection within this area would be accomplished by a wastewater interceptor routed roughly parallel to the San Marcos River and located on the south side of the river. Wastewater collectors would extend south to serve the area and convey flow to the interceptor. This concept provides service to this Alternative A area but will require a river crossing to convey wastewater to the Base Area. It is anticipated a lift station would be located in the northeast corner of the Alternative A area to pump wastewater across the San Marcos River to the Base Area.

Alternative B incorporates an area southeast of the Base Area and is bounded by high topographic elevations on the east side. The south end of Alternative B is limited by the topography and State Highway 80. The north edge of Alternative B was established to match the northeast limit of the JDB Turner Crest Wastewater LLC (JDB Turner Crest) CCN area. Subsequent discussion with Alliance Water clarified the JDB Turner Crest CCN area must be excluded from this Alternative B area and the area definition was modified accordingly. Wastewater collection within this area would be accomplished with a wastewater interceptor routed on the east side of Morrison Creek and following the drainage to the south. Wastewater collectors would extend east to serve the area and convey flow to the interceptor. This concept provides service to the Alternative B area but will require a crossing of Morrison Creek to convey wastewater to the Base Area. It is anticipated a lift station would be located in the south end of this Alternative B area to pump wastewater across Morrison Creek to the Base Area.

Alternative C incorporates an area east of the Base Area and is bounded by high topographic elevations of the Base Area on the west side, high topographic elevations on the east and north side, and the JDB Turner Crest CCN area on the south side. This area effectively includes the upper watershed of Morrison Creek. Wastewater collection within this area would be accomplished with a wastewater interceptor routed on the east side of Morrison Creek and following the natural drainage to the south. Wastewater collectors would extend east and west to serve the area and convey flow to the interceptor. Each of the wastewater collectors extended west would have to cross Morrison Creek and these multiple drainage crossings will require additional survey and evaluation to define the most cost effective method of accomplishing this service. The wastewater interceptor will convey flow to the south end of this Alternative C area where a lift station would be installed to pump wastewater across Morrison Creek to the Base Area. Alternatively, the interceptor may be extended into the Alternative B area and connect to the Alternative B interceptor, thus eliminating the lift station for Alternative C. However, it appears extension of this interceptor will require crossing of the JDB Turner Crest CCN area.

Alternative D incorporates an area northeast of the Base Area and is bounded by high topographic elevations of the Base Area on the west and southwest sides. The Alternative D area slopes to the northeast with Hemphill Creek bisecting the area in a roughly north to south drainage path. The north and east sides of the area are limited by gravity flow to the interceptor. Wastewater collection within this area would be accomplished with a wastewater interceptor routed on the north and east side of Hemphill Creek, with the interceptor extended to the south limit of the Alternative D area. Wastewater collectors would be extended southwest and northeast to serve the area and convey flow to the interceptor. Each of the wastewater collectors extended southwest would have to cross Hemphill Creek and these multiple drainage crossings will require additional survey and evaluation to define the most cost effective method of accomplishing this service. The wastewater interceptor will convey flow to the southwest edge of this Alternative D area, at the location where Hemphill Creek enters the Base Area. At this point, it may be possible to gravity flow beneath Hemphill Creek and into the Base Area interceptor or alternatively, a lift station can be installed to pump wastewater to the Base Area.

Alternative E incorporates an area north of the Base Area in the upper watershed of the Clear Fork Plum Creek and is bounded by high topographic elevations of the Base Area on the west and southwest sides. The Alternative E area slopes to the southeast with Clear Fork Plum Creek bisecting the area in a roughly north to southeast drainage path. The north and east sides of the area are limited by gravity flow to the interceptor. Wastewater collection within this area would be accomplished with a wastewater interceptor routed on the west and south side of Clear Fork Plum Creek, with the interceptor extended to the southeast limit of the Alternative E area. Potentially, this interceptor could extend into the Alternative D area and connect with that interceptor. Within the Alternative E area, wastewater collectors would be extended northeast and south/southwest to serve the area and convey flow to the interceptor. Wastewater collectors extended to the northeast would have to cross Clear Fork Plum Creek and these multiple drainage crossings will require additional survey and evaluation to define the most cost effective method of accomplishing this service.

Following a progress meeting with Alliance Water on June 7, 2017, an additional Alternative F area was proposed by the City of Kyle. This area includes three developments that have agreements in place with the City of Kyle.

Alternative F incorporates an area northwest of the Base Area and is bisected by the Blanco River. The topography, on both sides of the Blanco River, is varied with significant increases in elevation away from the river. Wastewater service to the Base Area would be accomplished with a gravity interceptor sloping to the southeast. The northwest end of the Base Area interceptor can be extended into the southeast end of the Alternative F area, however, this extension requires crossing of the Blanco River. This river crossing may potentially be accomplished by maintaining gravity flow in the interceptor and adjusting upstream and downstream slopes to pass beneath the river. Additional field survey information will be obtained during final design to evaluate this concept. Alternatively, the crossing may be accomplished by either a siphon or a lift station. Within Alternative F, the terrain requires the interceptor to be split into two (2) separate interceptors, one routed west and the other routed to the northwest. The west interceptor would follow terrain westerly to a point where it splits again to serve areas south and west of the interceptor. The northwest interceptor would be routed northerly to the Blanco River, crosses the river, and continues northwesterly along the northern edge of the Blanco River delta, then splits to serve an area to the west and to the north. The west interceptor would follow terrain to serve the westerly area. The north interceptor would follow terrain and provide service to this north area. Although this north segment can be incorporated into the Alternative F area, it should be noted that much of this service area terrain slopes toward the City of Kyle. Consequently, this service area may be more conveniently served by the existing collection system of the City of Kyle or, alternatively, an interceptor from the Base Area may be extended into this area to provide gravity flow into the Blanco Basin collection system. To do so, requires the Base Area interceptor to extend beyond the currently defined service area of either the Base Area or the Alternative F area. A potential benefit of this Base Area interceptor extension is the elimination of the second Blanco River crossing and the installation of a smaller lift station in the northwest area of the Alternative F area. This alternative concept is shown on **Exhibit No. 2-6**.

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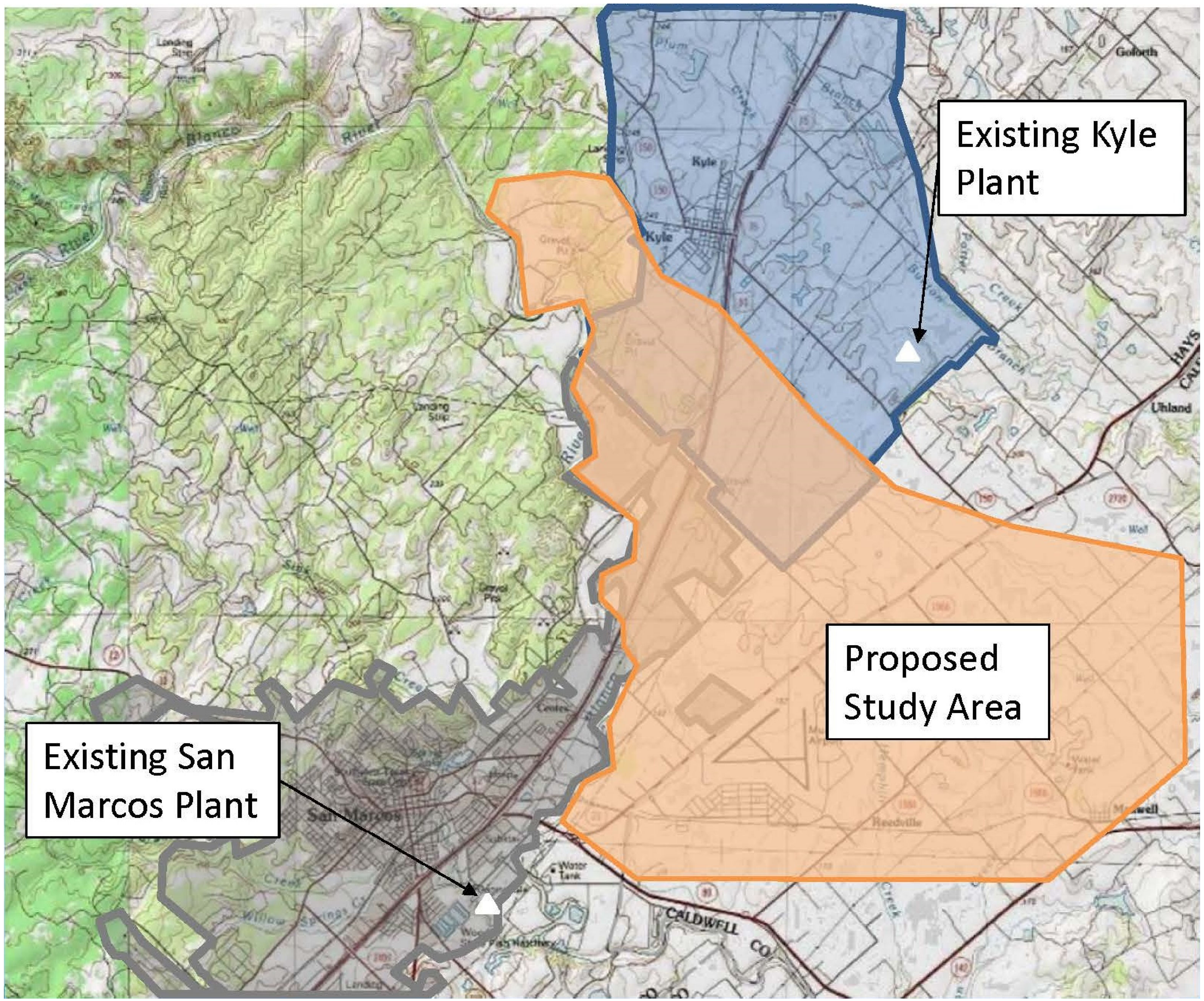
In addition, the City of Kyle has an agreement in place with another development that currently overlaps the Base Area, Alternative D, Alternative E, and some area outside the initially defined service boundary. Based on direction received from the City of Kyle, the entire development should be included in this feasibility study area even if it requires a lift station to provide service to the area. This additional area is defined as Alternative G.

Alternative G is located northeast and adjacent to the Alternative D and E areas and is effectively in the Clear Fork Plum Creek watershed. Consequently, the terrain slopes to the east. Wastewater collection in this area will require installation of an interceptor along the northeast edge of the Alternative G area with the interceptor sloping generally to the southeast. Wastewater collectors will extend southwest from the interceptor to convey flow to the interceptor. The southeast end of the interceptor will require a lift station to pump wastewater to the Alternative D interceptor for ultimate conveyance to the Blanco Basin wastewater treatment plant.

Other areas exist outside of the Base Area and these identified alternatives with no defined wastewater service. It is certainly possible to include additional areas but to do so would require additional pumping and conveyance of the wastewater to deliver it to the Base Area. The additional construction cost of this pumping and conveyance resulted in limiting the wastewater service area to the Base Area and the defined Alternatives. In the future, if there is expressed interest in providing wastewater service to these other areas, it will be evaluated at that time. The defined study area in this Feasibility Study does not preclude Alliance Water from providing additional service area outside of the area shown, if desired in the future.

In summary, the definition of the Base Area and the Alternative areas was based on maximizing gravity flow, to the extent possible, and minimizing lift stations/river crossings, while also serving specific planned development.

Attachment B
Map of Blanco Basin
Blanco Basin Wastewater Treatment and Direct Potable Reuse Feasibility Study



ALLIANCE WATER
WWTP FEASIBILITY STUDY
PROPOSED STUDY AREA FROM ALLIANCE WATER

AECOM

Date: SEP 2017	Job No.: 60537115	Exhibit 2-1

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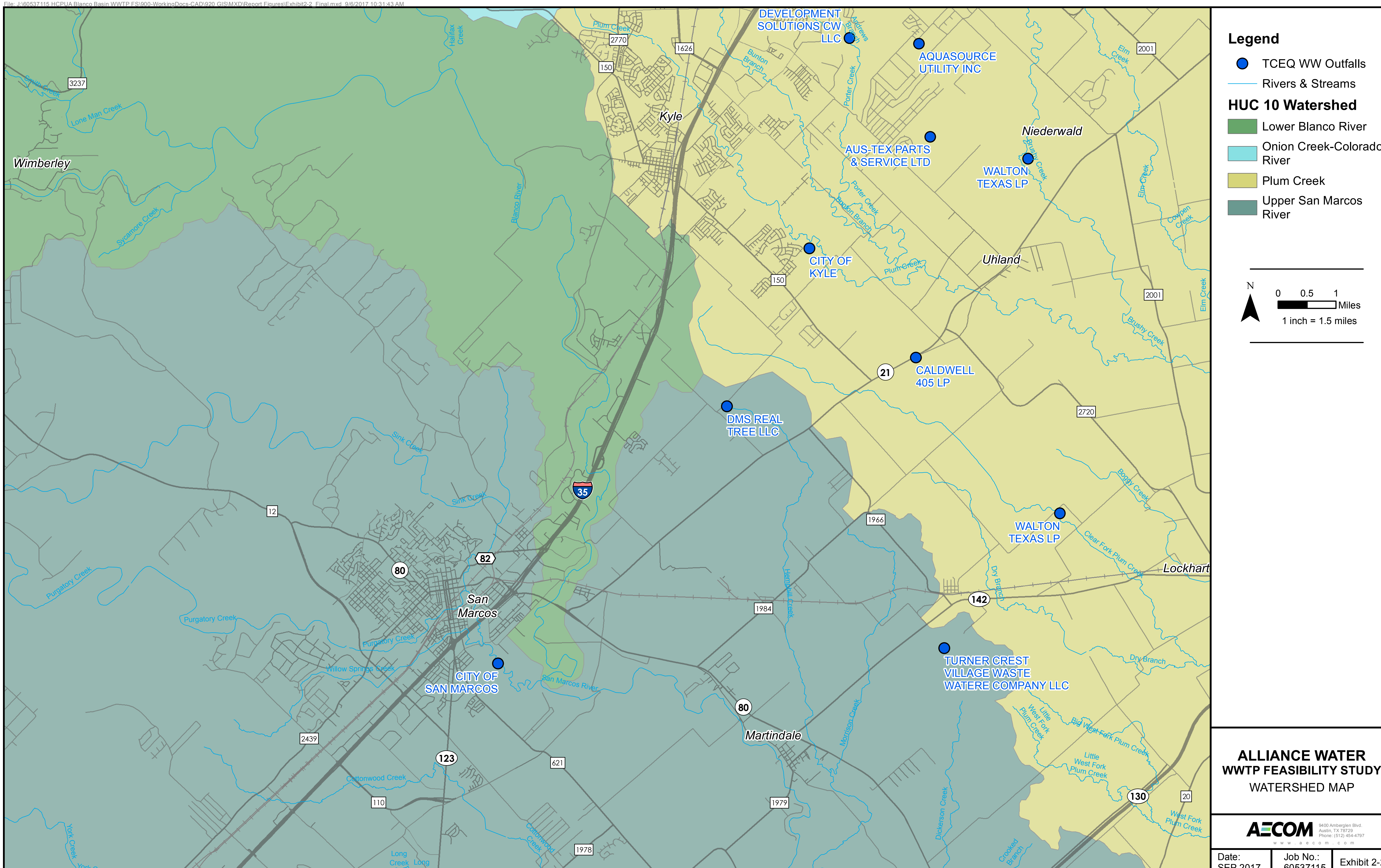

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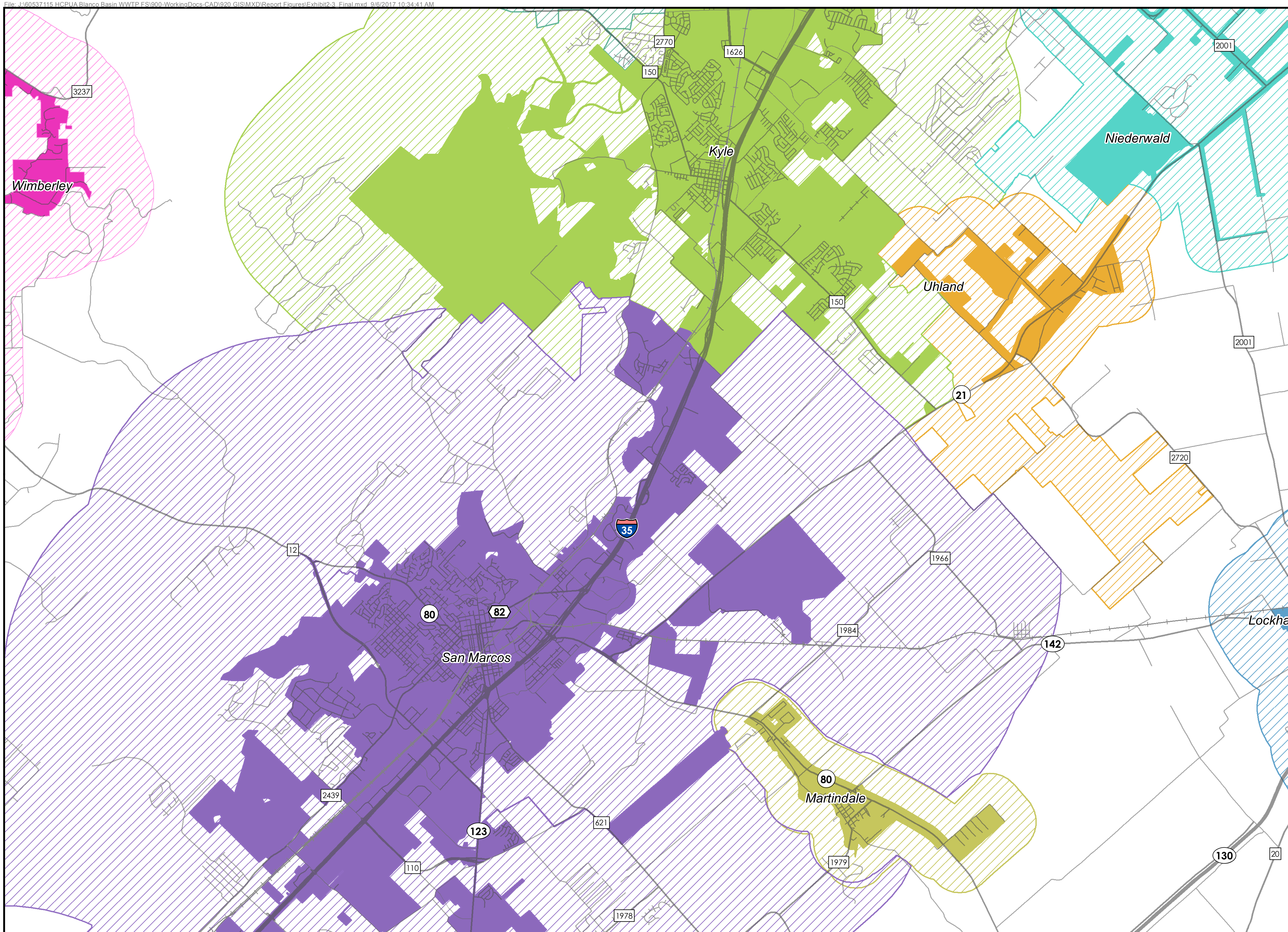

Legend

Jurisdiction

- KYLE
- KYLE ETJ
- LOCKHART
- LOCKHART ETJ
- MARTINDALE
- MARTINDALE ETJ
- MOUNTAIN CITY ETJ
- NIEDERWALD
- NIEDERWALD ETJ
- SAN MARCOS
- SAN MARCOS ETJ
- UHLAND
- UHLAND ETJ
- WIMBERLEY
- WIMBERLEY ETJ

N

0 0.5 1 Miles

1 inch = 1.5 miles

ALLIANCE WATER
WWTP FEASIBILITY STUDY
JURISDICTION MAP

AECOM
9400 Amberglen Blvd.
Austin, TX 78729
Phone: (512) 454-4797
www.aecom.com

Date: SEP 2017	Job No.: 60537115	Exhibit 2-3

Item # 2

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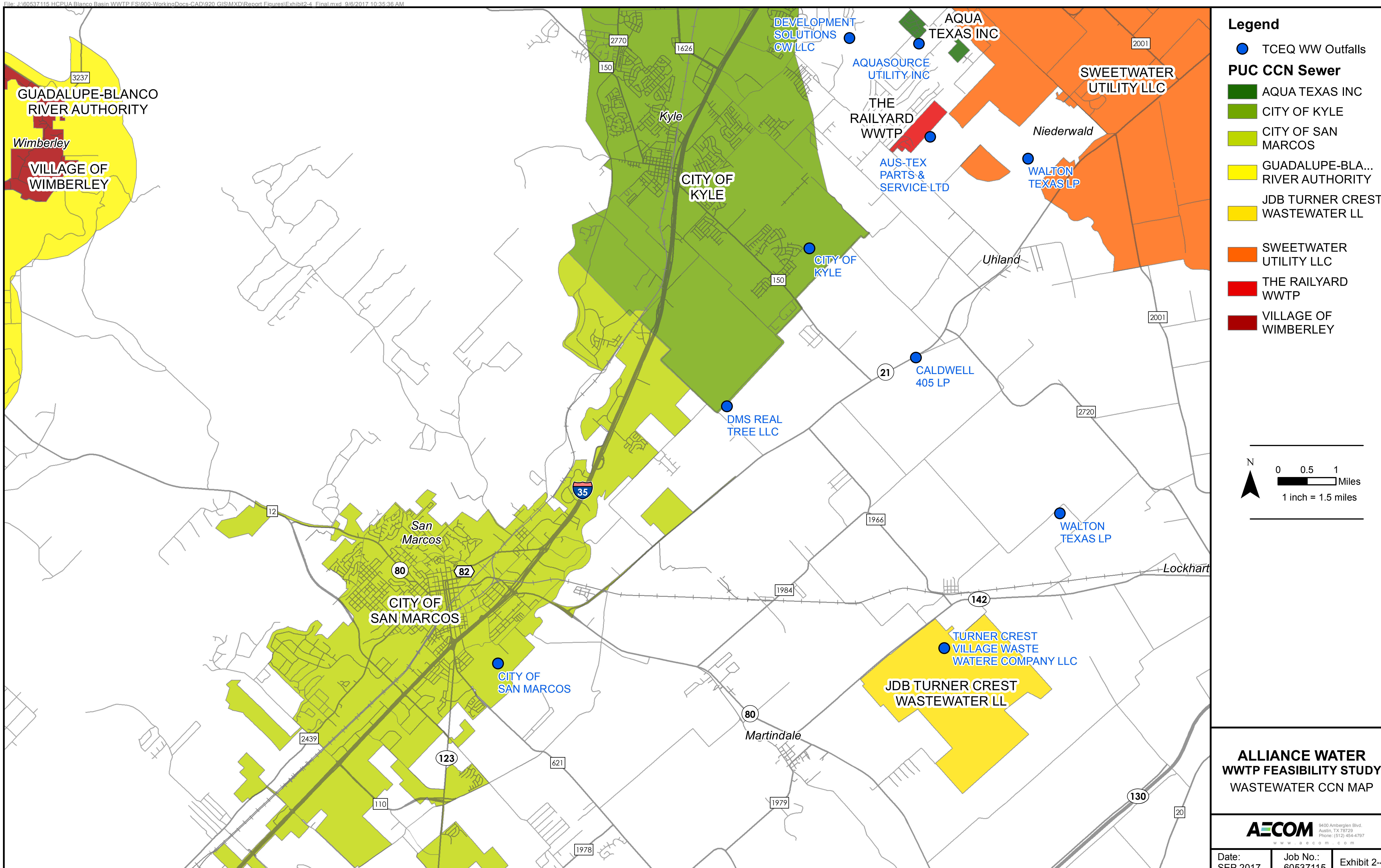

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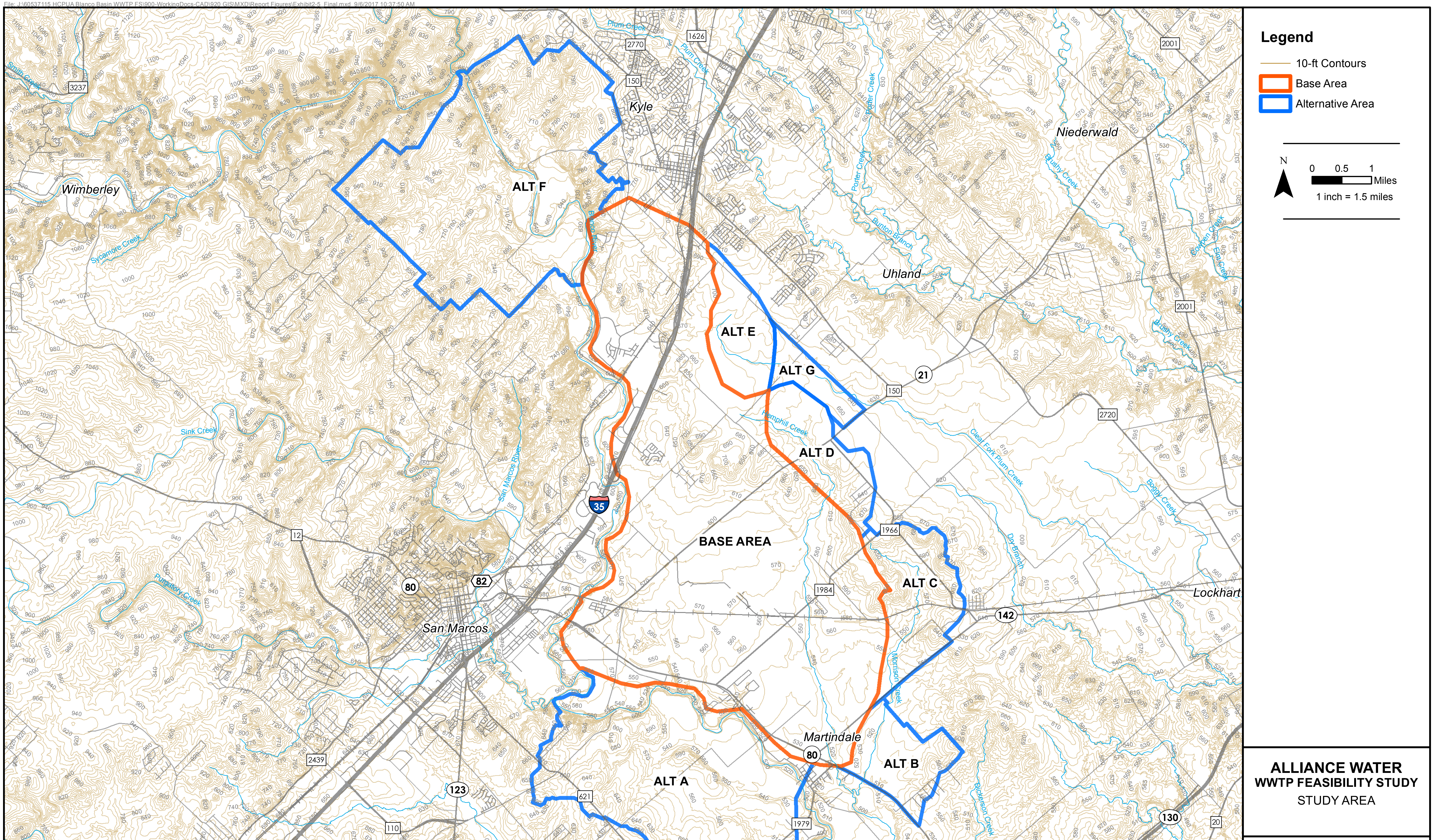

ALLIANCE WATER
WWTP FEASIBILITY STUDY
STUDY AREA

AECOM
9400 Amberglen Blvd.
Austin, TX 78729
Phone: (512) 454-4797
www.aecom.com

Date: SEP 2017	Job No.: 60537115	Exhibit 2-5

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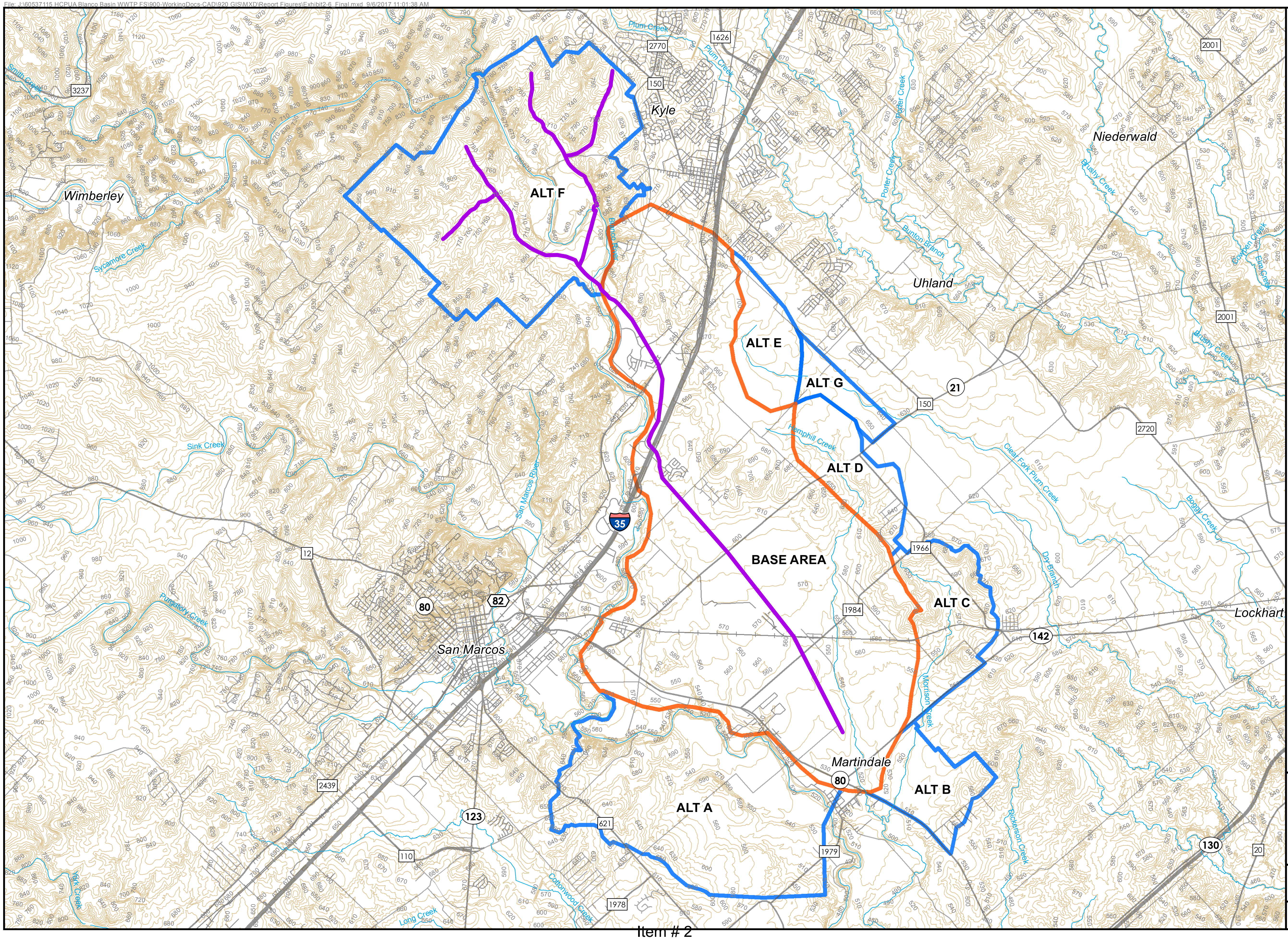

Legend

- Proposed WW Interceptor
- 10-ft Contours
- Base Area
- Alternative Area

N

0 0.5 1 Miles

1 inch = 1.5 miles

Note:
1. Proposed alignment for the wastewater interceptor is conceptual based on maximizing gravity flow to the service area. Further analysis and preliminary engineering will be required to optimize alignment to avoid conflicting uses such as the San Marcos Airport.

ALLIANCE WATER
WWTP FEASIBILITY STUDY
CONCEPTUAL INTERCEPTOR ALIGNMENT

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Date: SEP 2017	Job No.: 60537115	Exhibit 2-6

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3 Population Projections

The following sections describe the data sources and methods used to estimate population throughout the planning period for the Base and Alternative areas. These population projections were then used to estimate the capacity and phasing of the proposed Blanco Basin WWTP to serve the Blanco Basin area.

3.1 Initial Population Projections

Initial population projections for the study area were developed by reviewing the following sources:

- 2010 U. S. Census population data available from TNRIS for Hays, Caldwell, and Guadalupe Counties.
- Population estimates from the *Draft 2022 South Central Texas Regional Water Plan* (South Central Texas Regional Water Planning Group).
- Texas Demographic Center.

The population estimates from the Texas Demographic Center included yearly, county-wide basis data from 2010 through 2050. The tabular data was not presented with density or population centers identified within each county. Descriptive, historical tables (i.e. 2000, 1990, etc.) of population by metropolitan status were also available. After a review of the data, it was decided that the tabular estimates were too broad to assist in this feasibility study and that the spatial data provided by the 2010 U.S. Census and Regional Water Plan were better suited for incorporation into this study.

3.1.1 2010 U.S. Census Data

The population per the smallest census division, the census block, was estimated by intersecting the census area with the Alliance Water feasibility study area using ArcGIS. The census block population was provided by density of population per acre. The clipped census area population was then estimated using the census block density multiplied by the corresponding area. The 2010 US Census population data was then summed for the feasibility study base area and alternative areas to serve as a starting point from 2010.

3.1.2 Water User Group Growth Rates

In order to project population growth through the planning period (2020 to 2050), growth rates utilized by the Texas Water Development Board (TWDB) for the *Draft 2021 South Central Texas Regional Water Plan* (South Central Texas Regional Water Planning Group) were reviewed. This document provides the population per Water User Group (WUG) area through the year 2070. The WUG areas appear to generally align with the Public Utility Commission of Texas Water Certificates of Convenience and Necessity (CCN) boundaries, and multiple WUGs intersect the feasibility study area. These include the City of San Marcos, the City of Kyle, Maxwell Water Supply Corporation (WSC), Martindale WSC, Crystal Clear Special Utility District (SUD), and County Line SUD.

Using the population data developed for the *Draft 2021 Plan*, the annual growth rate was extracted for each period (i.e. 2020 to 2030, etc.) for each WUG. The WUG data was then intersected with the Alliance Water feasibility study area. If multiple WUGs intersected the Base Area or the Alternative areas, then the average growth rate (not weighted average) of all intersecting WUGs was applied. The growth rates and corresponding WUGs used in this evaluation are provided in **Table 3-1**.

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Table 3-1: TWDB 2021Water User Group Population Growth Rates Applied to Feasibility Study Area

Study Area	WUGs Intersecting Feasibility Study Area by County	2020 to 2030	2030 to 2040	2040 to 2050
		Growth Rates per Year		
Base Area	*Caldwell:* Martindale WSC, Maxwell WSC, San Marcos; *Hays:* County Line SUD, Kyle, Maxwell WSC, San Marcos	2.87%	1.68%	1.30%
Alternative A	*Caldwell:* Maxwell WSC and Martindale WSC; *Guadalupe:* Crystal Clear SUD and Martindale WSC; *Hays:* Crystal Clear SUD	1.91%	1.65%	1.47%
Alternative B	*Caldwell:* Martindale WSC	2.04%	1.67%	1.42%
Alternative C	*Caldwell:* Maxwell WSC	2.05%	1.67%	1.42%
Alternative D	*Caldwell:* Maxwell WSC; *Hays:* County Line SUD, Maxwell WSC	1.84%	1.66%	1.58%
Alternative E	*Hays:* County Line SUD and Kyle	3.70%	2.08%	1.12%

Note: Alternative Areas F and G were added after this initial analysis and population projections for these alternative areas are described later in this section.

As described previously, the WUG areas generally align with Water CCNs and the growth rates are applied to large areas that include developed and undeveloped areas. Much of the feasibility study area covers currently undeveloped areas to the east of IH-35 which are primed for development due to their proximity to the cities of San Marcos and Kyle. In order to avoid underrepresenting the potential growth for this area, requests were made to the cities of San Marcos and Kyle for information on proposed developments under consideration for these areas. The information provided is summarized in the following sections.

3.2 Incorporation of San Marcos Wastewater Master Plan Basins

The City of San Marcos provided their Wastewater Master Plan (WWMP) (December 2014) to incorporate developments into the population projection. *Figure 2-2* from the plan provides population projection information by Wastewater Basin through 2035. Two (2) basins, Blanco Basin and Hemphill Basin, intersect the feasibility study area and the population estimates from the WWMP were considered to supersede the population projections estimated from the 2010 US Census data with WUG growth rates in these areas. Since over 97% of the Hemphill Basin area lies within the Alliance Water Feasibility Study Area, the entire population projection was included and was applied to the Base Area. Since 64% of the Blanco Basin lies within the Alliance Water Feasibility Study Area, the population projection information from the WWMP was weighted by this area percentage. These two (2) basins are identified in **Exhibit 3-1**.

The San Marcos WWMP included projections for 2020, 2025, and 2035. Using this data, the compound annual growth rates for 2020 to 2025 and from 2025 to 2035 were estimated for each basin. The average of these two (2) growth rates was applied to project the 2020 population to 2030 for these two (2) basins. To project from 2030 to 2040 and 2050, the compound annual growth rate as utilized in the San Marcos WWMP from 2025 to 2035 was applied to the entire 20-year period. The resulting population growth rates used for the Blanco Basin and Hemphill Basin are provided in **Table 3-2**.

Table 3-2: San Marcos WWMP Population Growth Rates by Wastewater Basin

Wastewater Basin	Compound Annual Growth Rate Extracted from WWMP Population Data			Applied Growth Rate to Population Projection for Feasibility Study	
	2013 -2020	2020 -2025	2025 -2035	2020 -2030	2030 -2050
Blanco Basin	4.42%	1.13%	0.94%	1.04%	0.94%
Hemphill Basin	3.81%	4.23%	2.25%	3.24%	2.25%

3.3 Incorporation of Identified Developments

Alliance Water provided AECOM with information on four (4) future development areas within the feasibility study area. These developments are:

- Cotton Center
- Mayan
- Waterstone (LaSalle)
- Whisper North and South

The Whisper North and South development overlaps with the Blanco Basin area identified in the San Marcos WWMP. Since the San Marcos WWMP already incorporated potential residential development in their evaluation, the population projections from Whisper North and South were assumed to already be accounted for. This development was therefore excluded from this evaluation.

For each development, living unit equivalents (LUE) counts at full build-out were provided. A LUE is defined as the typical flow that would be produced by a small single family residence. A LUE is assumed to represent three (3) people living in a residence.

Per **Exhibit 3-1,** the Cotton Center, Mayan, and Waterstone (LaSalle) development areas were incorporated directly into this feasibility study since they did not overlap with any areas identified in the San Marcos WWMP. **Table 3-3** provides a summary of the population projections developed from the provided development LUEs.

Table 3-3: Identified Development Areas Population Projections

Development Name	Acres	Approx. LUE Count	Total Population at Completion
Cotton Center	2,477	8,800	26,400
Mayan	563	2,250	6,750
Waterstone (LaSalle)	2,204	9,389	28,167

Following the project status meeting on June 7, 2017, the City of Kyle provided additional future developments to be included in the feasibility study. These developments are:

- Blanco River Ranch
- Blanco River Investments
- McCoy

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- Nance
- Bradshaw

The City of Kyle provided LUE data for these developments for ultimate build-out. The McCoy development was consolidated with Blanco River Investments and all the Nance properties were consolidated to match the LUE data. It was assumed that ultimate build-out projections would be complete by 2050. For simplicity, the full LUE build-out as provided by the City of Kyle was used rather than removing two (2) locations that indicated 500 LUEs to be diverted to the existing Kyle wastewater system. As shown in **Exhibit 3-1**, these developments are incorporated into Alternative F. **Table 3-4** provides a summary of the population projections developed from the provided development LUEs.

Table 3-4: Alternative F Development Areas Population Projections

Development Name	Acres	Approx. LUE Count	Total Population at Completion
Blanco River Ranch	2,167	4,500	13,500
Blanco River Investments/McCoy	2,539	8,000	24,000
Nance/Bradshaw/BRI	3,510	9,000	27,000

3.4 Density for Non-Development Areas

In addition to the future developments provided at the June 7, 2017 project status meeting, Alliance Water provided feedback on the projected growth rates being applied to the feasibility study areas that are not associated with a planned development as discussed in **Section 3.1.2**. It was suggested that the WUG growth rates were too low in comparison to the growth seen in the cities of Kyle and San Marcos in the last 10 years.

The City of Kyle provided information on projected LUE densities for an area overlapping the northeast end of the Base Area that is not part of a planned development. The average density of this area is projected to be between 4 to 5 LUEs/acre. Based on these projections and feedback from Alliance Water, a density of 4 LUEs/acre was used for the ultimate build-out projection of areas within the feasibility study area that are not part of a planned development. In addition, this density was only applied to areas within the study area that are outside the 100-year floodplain.

3.5 Planning Period Projections

Based on the LUE projections for planned developments and LUE density for remaining areas, the population projections were distributed to cover the planning period for this feasibility study.

For planned developments, generally only full build-out projections were provided. For developments that have not started yet, population projections were pro-rated over the planning period with 0% for 2020, 25% of ultimate for 2030, 63% of ultimate for 2040, and total build-out for 2050. For developments that have some existing population, population projections were pro-rated over the planning period with 50% of ultimate for 2030, 75% of ultimate for 2040, and total build-out for 2050. For Non-Development area, the ultimate build-out population projections were pro-rated over the planning period with 50% of ultimate for 2030, 75% for 2040, and total build-out for 2050.

The populations resulting from these projections are summarized in **Table 3-5**.

Table 3-5: Feasibility Study Area Population through 2050

Study Area	LUE Ultimate	Ultimate Density (LUE/Ac)	Population Projections			
			2020	2030	2040	2050
Base Area		**Population Subtotal**	**16,143**	**72,435**	**108,331**	**143,215**
Waterstone (Partial)	1,941	4.3	859	4,656	5,822	5,822
Blanco Basin (WWMP)	4,045	2.1	9,073	10,059	11,049	12,135
Hemphill Basin (WWMP)	467	0.2	652	897	1,121	1,400
Cotton Center (Partial)	6,808	4.3	0	5,106	12,766	20,425
Open Area	34,478	4.0	5,559	51,716	77,575	103,433
Alternative A		**Population Subtotal**	**1,210**	**27,689**	**43,221**	**58,752**
Mayan	2,250	5.3	0	1,688	4,219	6,750
Open Area	17,334	4.0	1,210	26,001	39,002	52,002
Alternative B		**Population Subtotal**	**200**	**5,253**	**7,879**	**10,505**
Open Area	3,502	4.0	200	5,253	7,879	10,505
Alternative C		**Population Subtotal**	**152**	**8,859**	**14,782**	**20,704**
Cotton Center (Partial)	1,992	4.2	0	1,494	3,734	5,975
Open Area	4,910	4.0	152	7,365	11,047	14,730
Alternative D		**Population Subtotal**	**907**	**9,456**	**13,374**	**16,478**
Waterstone (Partial)	1,354	4.3	599	3,249	4,063	4,063
Open Area	4,138	4.0	308	6,207	9,311	12,415
Alternative E		**Population Subtotal**	**1,934**	**10,696**	**13,939**	**15,069**
Waterstone (Partial)	3,516	4.4	1,556	8,436	10,548	10,548
Open Area	1,507	4.0	378	2,260	3,391	4,521
Alternative F		**Population Subtotal**	**4,578**	**25,500**	**45,000**	**64,500**
Blanco River Ranch	4,500	2.4	3,078	6,750	10,125	13,500
BRI/McCoy	8,000	4.1	1,500	12,000	18,000	24,000
Nance/Bradshaw/BRI	9,000	2.8	0	6,750	16,875	27,000
Alternative G		**Population Subtotal**	**1,141**	**6,186**	**7,734**	**7,734**
Waterstone (Partial)	2,578	6.0	1,141	6,186	7,734	7,734
TOTAL STUDY AREA			**26,265**	**166,073**	**254,260**	**336,958**

Geographically these populations are also represented on **Exhibit 3-2**. **Exhibit 3-2** shows the populations for the planned developments as a whole without breaking them up by the multiple feasibility study areas that they overlap. The only exception to this is Waterstone which is summed as a total except for the area in Alternative G.

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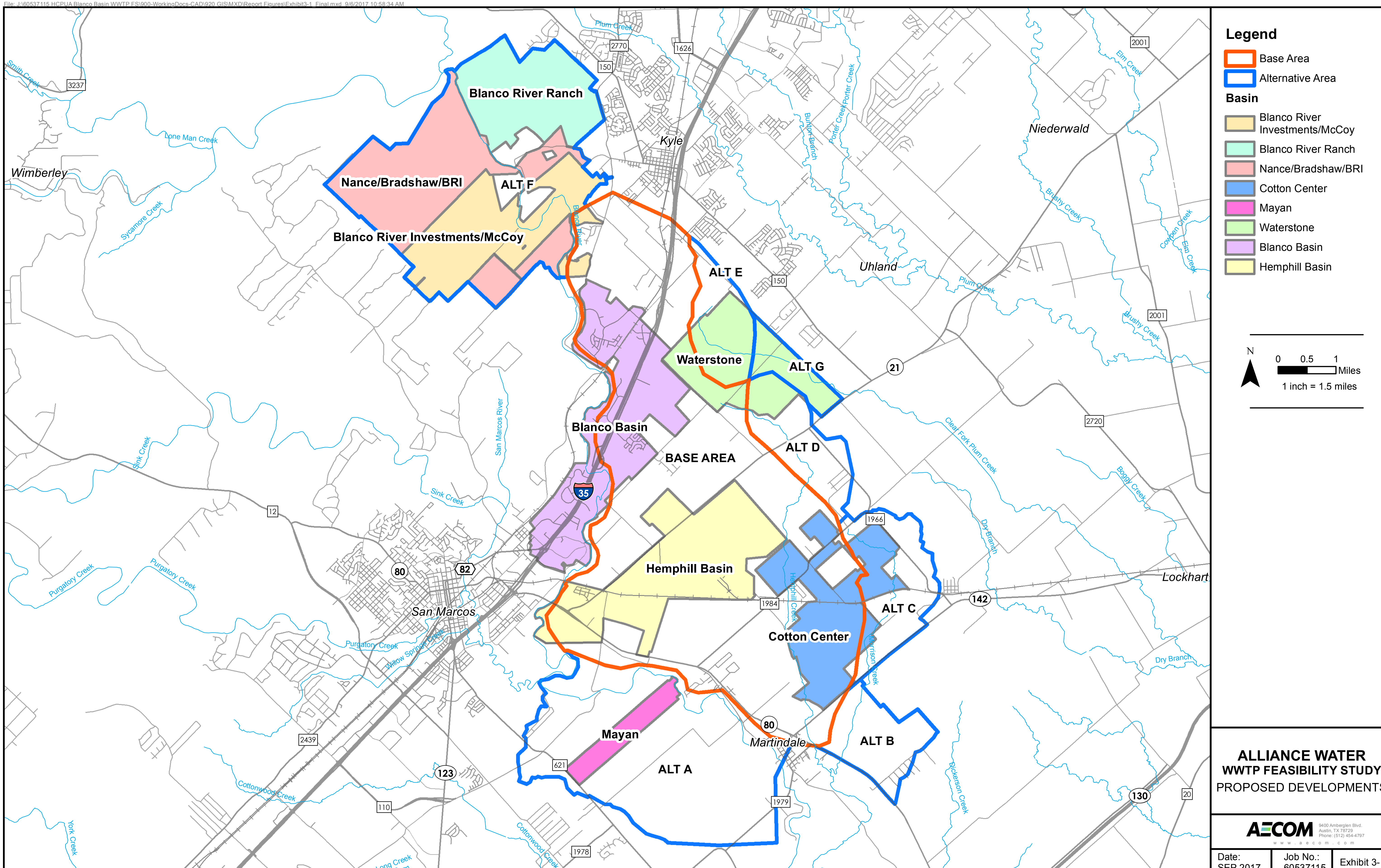

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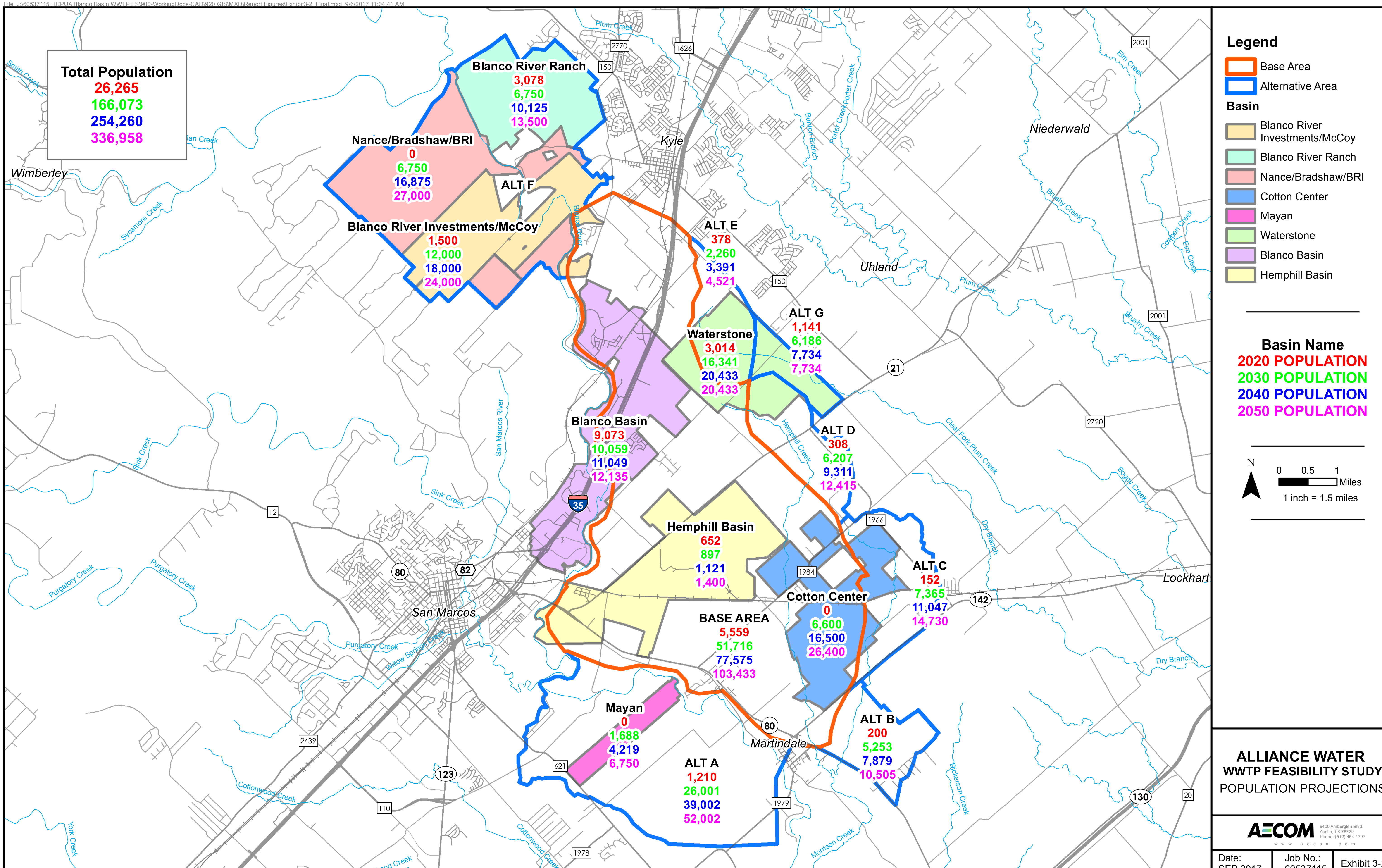


Item # 2

4 Wastewater Treatment Facilities Capacity and Siting

Using the population projections discussed in **Section 3**, the capacity and phasing of the Blanco Basin WWTP is described in the following section.

4.1 Wastewater Treatment Facilities Capacity and Phasing

4.1.1 Capacity

The capacity of a WWTP is generally defined by the millions of gallons per day (MGD) of wastewater treated. This quantity of flow may be composed of residential, commercial, industrial and/or other flow. The composition of this wastewater flow can have an impact on the wastewater treatment process selected for the plant but generally does not impact the identified capacity.

Previous sections of this report defined the potential LUEs that may exist within the defined Feasibility Study area. The LUE values were defined by known developments, in some cases, and approximated for the remaining areas of the Feasibility Study area. These approximate values anticipated some variation in development to account for varying residential densities and the commercial, industrial, and/or other flows. The LUE values were then converted to population with the assumption that one (1) LUE equals three (3) people.

Once the population was defined, wastewater flow was calculated based on an approximation of the wastewater gallons per capita per day (gpcd). The City of San Marcos Wastewater Master Plan identified a total per capita flow that ranges from 120-122 gpcd for future planning years. A wastewater master plan for the City of Kyle was not available but it is understood water conservation efforts by the City of Kyle have resulted in an average water usage per person of less than 100 gpcd and wastewater usage is typically about 80% of the water usage, which equates to about 80 gpcd. Based on this variation between the Cities and in recognition of the conceptual level of this study, a value of 100 gpcd is used for projection of wastewater treatment plant capacity.

Based on this projected wastewater usage rate and the population projections developed in **Section 3**, **Table 4-1** below provides the projected wastewater flow for each development area and a total wastewater flow for the Feasibility Study area for each planning period.

Table 4-1: Wastewater Flow Projection through 2050

Study Area		Wastewater Flow Projections (MGD)			
		2020	2030	2040	2050
Base Area	**MGD Subtotal**	**1.61**	**7.24**	**10.83**	**14.32**
Waterstone (Partial)		0.09	0.47	0.58	0.58
Blanco Basin (WWMP)		0.91	1.01	1.10	1.21
Hemphill Basin (WWMP)		0.07	0.09	0.11	0.14
Cotton Center (Partial)		0.00	0.51	1.28	2.04
Open Area		0.56	5.17	7.76	10.34
Alternative A	**MGD Subtotal**	**0.12**	**2.77**	**4.32**	**5.88**
Mayan		0.00	0.17	0.42	0.68
Open Area		0.12	2.60	3.90	5.20
Alternative B	**MGD Subtotal**	**0.02**	**0.53**	**0.79**	**1.05**
Open Area		0.02	0.53	0.79	1.05
Alternative C	**MGD Subtotal**	**0.02**	**0.89**	**1.48**	**2.07**
Cotton Center (Partial)		0.00	0.15	0.37	0.60
Open Area		0.02	0.74	1.10	1.47
Alternative D	**MGD Subtotal**	**0.09**	**0.95**	**1.34**	**1.65**
Waterstone (Partial)		0.06	0.32	0.41	0.41
Open Area		0.03	0.62	0.93	1.24
Alternative E	**MGD Subtotal**	**0.19**	**1.07**	**1.39**	**1.51**
Waterstone (Partial)		0.16	0.84	1.05	1.05
Open Area		0.04	0.23	0.34	0.45
Alternative F	**MGD Subtotal**	**0.46**	**2.55**	**4.50**	**6.45**
Blanco River Ranch		0.31	0.68	1.01	1.35
BRI/McCoy		0.15	1.20	1.80	2.40
Nance/Bradshaw/BRI		0.00	0.68	1.69	2.70
Alternative G	**MGD Subtotal**	**0.11**	**0.62**	**0.77**	**0.77**
Waterstone (Partial)		0.11	0.62	0.77	0.77
TOTAL STUDY AREA		**2.63**	**16.61**	**25.43**	**33.70**

These projections provide an approximation of potential plant capacity requirements but these values also can be used to identify requirements for the collection system. The size of the Feasibility Study area makes the collection system an item for consideration in terms of capacity and phasing.

4.1.2 Phasing of the Wastewater Treatment Plant

The wastewater flow projections, defined by study area, provide not only a quantity of flow but also a general location for that flow. As shown in **Table 4-1**, the wastewater flows for 2020 predominately originate from the north end of the Base Area while flows for future planning years are spread across the Feasibility Study area. Additionally, the rate at which flows are projected to increase is of significance and indicates the wastewater flow may increase at a rate of approximately 1 MGD per year between 2020 and 2030. Conversely, the wastewater flows for planning year 2020 have approximately 50% of projected flows from open space areas and residential developments that are not currently in construction.

The engineering, bid and construction of a WWTP and collection system can be performed in three (3) years on an aggressive schedule, assuming easement acquisition and permitting can also be accomplished. This suggests planning for wastewater flows in excess of the planning year 2020 projected flows would be prudent. Based on a 1 MGD per year increase in flow, planning for anticipated flows in 2025 suggests a WWTP capacity of approximately 6 to 8 MGD. These flow projections are based on an aggressive rate of growth, however, the cities of Kyle and San Marcos have seen these high growth rates in recent years. Based on the flow projections in **Table 4-1**, the phasing for additional WWTP capacity is projected as shown in **Table 4-2**.

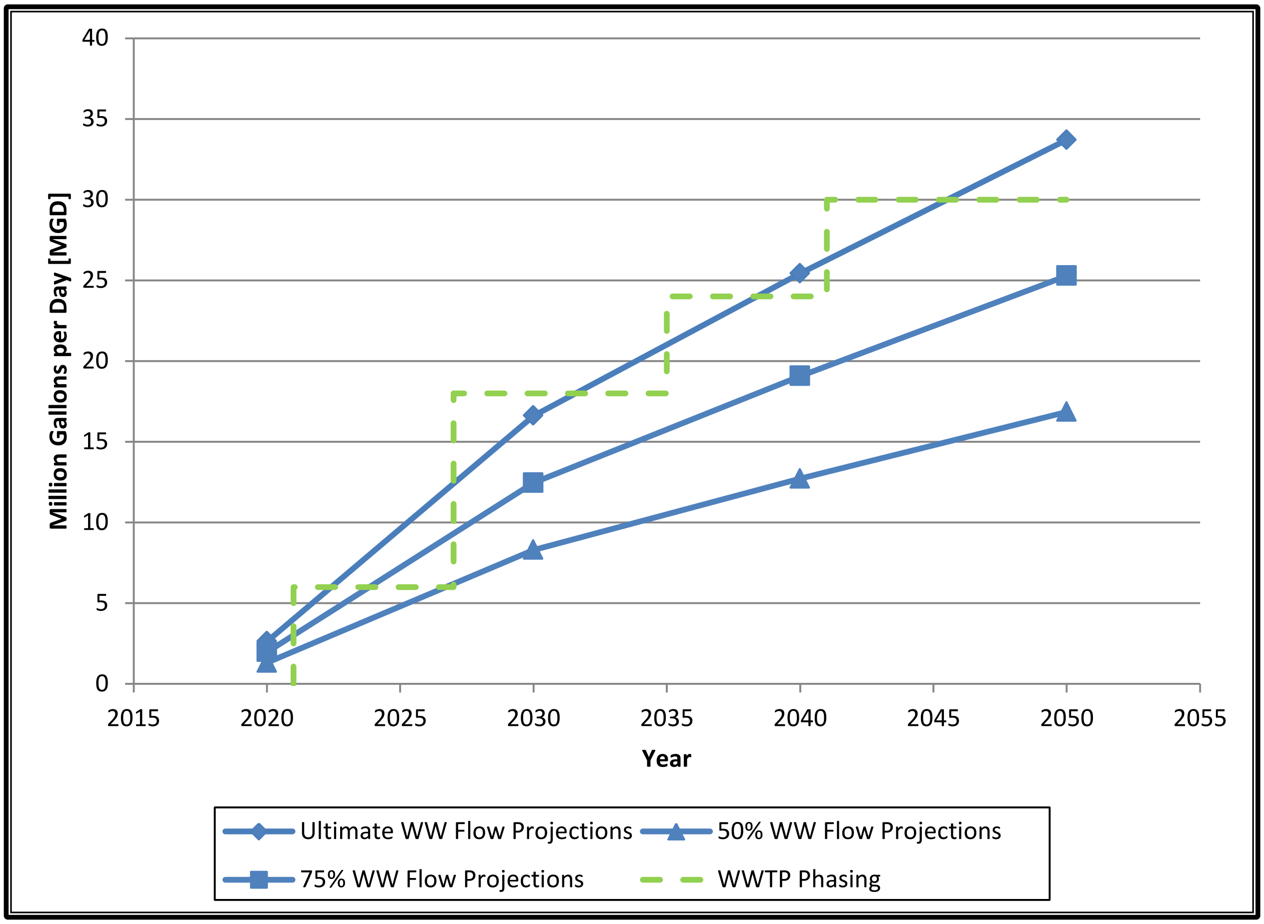
Table 4-2: Wastewater Treatment Plant Phasing

Initiate Design (Year)	Complete Construction (Year)	Additional Capacity (MGD)	Cumulative Capacity (MGD)	Requirement	Trigger for Initiation of Next Phase
2018	2021	6	6	2025 Projected Flow	Development Construction Initiation
2023	2027	12	18	2030 Projected Flow	Achieving 2020 Flow Projection
2031	2035	6	24	2035 Projected Flow	Achieving 2030 Flow Projection
2037	2041	6	30	2050 Projected Flow	Achieving 2035 Flow Projection

Although planning for a WWTP capacity of 6 MGD for the 2020 planning year is larger than the initial 2020 flow projections, it would not result in underloading of the treatment process as the 2020 flow projections would allow the WWTP to run at approximately 30% capacity. The treatment structures could be designed such that the flow could be compartmentalized in smaller basins to aid treatability and operations in case the growth rate slows. However based on the flow projections, the design of the next expansion could occur soon after the completion of the initial WWTP. Additionally, if the ultimate flow projections are correct, it will provide the opportunity to expand the original WWTP in multiple symmetrical increments.

The phasing for additional WWTP capacity as projected in **Table 4-2** is shown in **Figure 4-1**. Three (3) options are shown for wastewater flow projections: 1) the projected wastewater flow per **Table 4-1** based on build-out by 2050; and if development is not as rapid as predicted by some of the planned developments, 2) a 50% wastewater flow projection, and 3) a 75% wastewater flow projection. Based on the growth rate observed in future years, the years that the WWTP expansion triggers are initiated can be adjusted by Alliance Water to better accommodate observed growth.

Figure 4-1: Wastewater Treatment Plant Phasing



The wastewater flows previously defined are average daily flows. In order to size the interceptor, these flows must be converted to peak flows and the interceptor sized to accommodate both the average daily flows and the peak flows. Peak flows generally occur during wet weather events. For the basis of this Feasibility Study Report, a peak flow factor of 4 is used for planning year 2020 flows with the peak factor reducing to 3 by planning year 2050.

An additional alternative is to defer the construction of the initial phase of the Blanco Basin WWTP until year 2023. This alternative would require, based on flow projections, a lift station constructed to pump approximately 24 MGD (6 MGD times a peaking factor of 4). For purposes of this Feasibility Study Report, it is assumed the lift station would pump to the San Marcos WWTP, since the Kyle WWTP may have capacity limitations. The lift station would require four (4) pumps, each with a capacity of 8 MGD, and a force main approximately 42-inch diameter and five (5) miles long. Additionally, this will require construction of 6 MGD of additional treatment capacity at the San Marcos WWTP.

An additional alternative is to not build the Blanco Basin WWTP at any point and to pump all future wastewater flows to either the San Marcos WWTP or the Kyle WWTP. For the purpose of this study, it is suggested this pumping facility must be centralized within the Feasibility Study Area to some degree. There may be more than one (1) pumping facility, but in any event, a wastewater collection system is required. Therefore, the wastewater collection system defined in this Feasibility Study will be included whether flows are treated at the Blanco Basin WWTP or at an existing WWTP. Additionally, the previously defined WWTP phasing will be used to define the required pumping, conveyance, and treatment facilities. The following paragraphs define requirements for each phase.

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The second phase to the lift station described above would require construction to pump approximately 36 MGD (12 MGD times a peak factor of 3) and a forcemain approximately 48-inch diameter and approximately five (5) miles long. Additionally, this will require construction of 12 MGD of additional treatment capacity at the San Marcos WWTP.

The third phase would require a lift station constructed to pump approximately 18 MGD (6 MGD times a peaking factor of 3) and a forcemain approximately 36-inch diameter and approximately five (5) miles long. Additionally, this will require construction of 6 MGD of additional treatment capacity at the San Marcos WWTP.

The fourth phase would require a lift station constructed to pump approximately 18 MGD (6 MGD times a peaking factor of 3) and a forcemain approximately 36-inch diameter and approximately five (5) miles long. Additionally, this will require construction of 6 MGD of additional treatment capacity at the San Marcos WWTP.

4.1.3 Phasing of Collection System

The wastewater collection system, for the purposes of this Feasibility Study Report, would consist of an interceptor extending from the southeast to the northwest end of the Base Area, then into the Alternative F area. The interceptor would split in the Alternative F area and is shown to convey the concept of gravity flow collection within this area. These split interceptors and the collection system within the other Alternative areas will be considered a component of the area development and are not evaluated further in this Feasibility Study Report.

The interceptor must be installed to convey flows to the wastewater treatment plant. As stated previously, initial wastewater flows for planning year 2020 are anticipated to be primarily in the northwest with ultimate flows for planning year 2050 produced from the entire Feasibility Study area. This variation in wastewater flow suggests an opportunity to phase the construction of the interceptor. Based on these conditions, multiple alternatives were identified and evaluated.

For Alternative 1, the interceptor was sized initially to convey the ultimate flows to the wastewater treatment plant. **Exhibit 4-1** provides a conceptual size of the ultimate interceptor and **Appendix A** provides the calculations to support this sizing. The interceptor size varies from 54-inch diameter on the upstream end to 60-inch diameter on the downstream end for ultimate flows. This sizing is based on a minimum depth of 8 feet at the upstream end and a maximum depth of 20 feet at the downstream end. Flow velocity is maintained between 2 and 10 feet per second per TCEQ (at both average flow and peak flow condition, all years). Wastewater from Alternative A, B, and C areas will be pumped or conveyed directly to the Blanco Basin WWTP by separate gravity lines and flows from these areas are not included in the ultimate interceptor sizing. The interceptor would be constructed with the initial facilities and complete by 2021.

For Alternative 2, the construction of the interceptor may be phased to minimize initial construction costs and to provide an opportunity to monitor the development of the area before construction of infrastructure for ultimate flows. There are an infinite number of variations of interceptor phasing so this alternative is based on conveying flow in the initial phase through planning year 2025, to parallel the concept used for the phasing of the wastewater treatment plant. **Exhibit 4-1** provides a conceptual size of the phased interceptor and **Appendix A** provides the calculations to support this sizing. The initial phase interceptor size would be 30-inch diameter on the upstream end to 39-inch diameter on the downstream end for 6 MGD average day flow. The interceptor would be constructed with the initial facilities and complete by 2021. The second phase of the interceptor would consist of 42-inch diameter on the upstream end to 54-inch diameter on the downstream end for the remainder of the ultimate flow. This sizing is based on a minimum depth of 8 feet at the upstream end and a maximum depth of 20 feet at the downstream end. Flow velocity is maintained between 2 and 10 feet per second. Wastewater from Alternative A, B, and C areas will be pumped or conveyed directly to the Blanco Basin WWTP by separate gravity lines and flows from these areas are not

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included in the phased interceptor sizing. The second phase of the interceptor would be constructed at the same time the 12 MGD WWTP expansion is constructed.

Alternative 3 evaluated the concept of constructing the interceptor in two (2) equally-sized phases with each phase conveying half of the ultimate flow (excluding Alternative A, B, and C areas). Each phase of the interceptor would convey 12 MGD average day (peak flow of 36 MGD) at build-out. **Exhibit 4-1** provides a conceptual size of the phased interceptor and **Appendix A** provides the calculations to support this sizing. Each phase of the interceptor would be 36-inch diameter on the upstream end to 48-inch diameter on the downstream end. The first phase of the interceptor would be constructed with the initial facilities and complete by 2021. However, year 2030 projected flows indicate 12 MGD of interceptor capacity will be required. Consequently, consistent with the WWTP phasing, the second phase of this interceptor must be completed by 2027 to convey projected flows and ultimate capacity. This sizing is based on a minimum depth of 8 feet at the upstream end and a maximum depth of 20 feet at the downstream end. Flow velocity is maintained between 2 and 10 feet per second. Wastewater from Alternative A, B, and C areas will be pumped or conveyed by separate gravity lines and flows from these areas are not included in the phased interceptor sizing.

Construction of any of these alternatives will require acquisition of easements for the interceptor. A review of tax parcels indicated there are approximately 50+ parcels that the interceptor would cross and each would require an easement. This number of parcels is based on a conceptual routing of the interceptor through the middle of the Feasibility Study Area. Final routing of the interceptor, with a refined alignment to avoid the San Marcos Airport, may modify the number of parcels requiring an easement. If phasing of the interceptor is selected, which would result in the installation of two (2) interceptors, it is anticipated that an easement width of 40 feet would be required. This width will also allow construction access and maintenance access.

Each of these interceptor alternatives assumes an interceptor installation in parallel with the completion of the Blanco Basin WWTP in late 2020 or 2021. Between now and that completion date, wastewater flows are anticipated to be pumped to either the existing wastewater treatment plant in San Marcos or Kyle. It is anticipated this flow will be generated by developments that are currently underway and may not achieve the aggressive flow projections in **Table 4-1**. For purposes of developing an approximate cost, an average day flow of 1 MGD (peak of 4 MGD) will be used and will require a lift station with a capacity of 2,800 gpm and a 16-inch diameter forcemain approximately five (5) miles long to convey flow to an existing WWTP.

4.2 WWTP Siting

4.2.1 Criteria

The criteria used to evaluate sites for the wastewater treatment plant included the following factors.

- The site must be large enough to accommodate the ultimate plant capacity. This would require a tract with an area of 20 acres or more.
- The site must be out of the 100-year floodplain. Additionally, each potential site was reviewed for the 500-year floodplain. Where Federal Emergency Management Agency (FEMA) Flood Maps did not provide definition of the 500-year floodplain, a value of 3 feet above the 100-year floodplain was used for evaluation.
- The site must have suitable dimensions to allow process units to maintain a buffer zone of 150 feet from the property line.
- The site must accommodate gravity flow in the interceptor to the plant location and minimize crossing of rivers/drainages.
- The site must be accessible without the need for significant roadway construction.
- Availability of power to the site was considered.

- The site must be adjacent or near an acceptable discharge point for plant effluent.
- To the extent possible, utilities such as potable water need to be available.
- A location in the southeast end of the Base Area.

4.2.2 Potential Sites

Based on the above criteria, a search of the tax parcels in Hays and Caldwell Counties was performed for the study area. This search resulted in the identification of nine (9) parcels of land that generally comply with the defined criteria. These parcels are shown on **Exhibit 4-2**.

Parcel No. 9 was marginally large enough in area. Additionally, Parcel Nos. 5 through 9 were east of the Hemphill Creek and Morrison Creek drainages. Crossing these drainages would certainly deepen the interceptor. Consequently, these parcels were eliminated from consideration.

Parcel No. 4 includes flood plain area and is east of Hemphill Creek, making this parcel less desirable. In addition, this parcel overlaps with the Cotton Center development and may not be updated to reflect new ownership and subdivided boundaries. Parcel No. 1 is adequate but the more northern location will allow gravity flow in the interceptor to this point but may require pumping of flows from southeast of this location. Parcel No. 2 is adequate but currently located adjacent to an existing residential development. Parcel No. 3 was selected as the preferred site for this Feasibility Study Report.

Parcel No. 3 is accessible from State Highway 80 and Quail Run Road (County Road 240) along the northwest side of the parcel and has utilities along this highway. Bluebonnet Electric Cooperative has three-phase and two-phase overhead power lines adjacent to the site. The site is approximately 1,100 feet wide and 5,000 feet long with a total of 136 acres of land. There are small areas on the southwest end and the northeast end that are within the 100 and 500-year floodplain, but more than adequate area remains for the ultimate plant capacity. This location will accept gravity flow from the interceptor without any major drainage crossings. Plant effluent discharge locations are available either into Hemphill Creek on the northeast end of the site or the San Marcos River to the south.

A conceptual site plan of the wastewater treatment plant, located on Parcel No. 3, is shown on **Exhibit 4-3**. This site plan is based on the wastewater treatment plant phasing mentioned previously and assumes an activated sludge process layout, to confirm adequate space is available for plant construction. Additional treatment process options are available that can provide advanced treatment, optimize plant footprint, and reduce construction cost and these can be evaluated during the design of the wastewater treatment system. As shown on **Exhibit 4-3**, approximately one-third of this parcel is required for the ultimate treatment plant capacity.

4.2.3 Outfall Location

Based on the location of the potential WWTP sites and the corresponding adjacent streams, AECOM coordinated with the modeling staff of the Texas Commission on Environmental Quality's (TCEQ) Water Quality Assessment Team to evaluate potential locations and preliminary effluent limitations for discharge to receiving streams. In preliminary discussions, TCEQ staff indicated the following with respect to selection of an effluent discharge location:

- Stream characteristics and receiving water uses will dictate available capacity at potential discharge locations. There did not appear to be a constraint on capacity as a result of existing discharge permits in the southern end of the Feasibility Study area.
- The most favorable outfall locations would be to a discharge path that is not a perennial stream and does not include perennial pools. Perennial stream capacity in this area tends to be limited to 4-5 million gallons per day (MGD) with TCEQ's standard effluent sets and applicable stream quality standards. The presence of ponds can be an even greater constraint than a perennial stream.

- Discharge to an intermittent or ephemeral stream could allow for greater discharge capacity, but a run of several miles could be needed to attenuate the effluent quality before it reaches a perennial stream in order for the perennial stream constraint to not be an issue. The San Marcos River or a backwater from the river into a receiving stream would not be such a constraint – in this case "perennial stream" means a stream with naturally perennial flow independent of backwater from the river.

AECOM contacted TCEQ and requested a preliminary dissolved oxygen (DO) model be performed using the QUAL-TX model for two (2) potential discharge locations, Hemphill Creek and Morrison Creek. Preliminary modeling for each of discharge locations produced similar results. Depending on the uses and criteria assigned by TCEQ's Water Quality Standards team, potential Texas Pollutant Discharge Elimination System (TPDES) permit limits for the proposed Blanco Basin WWTP would include:

- Range from 5 to 10 mg/L $CBOD_5$
- Range from 1.7 to 3 mg/L NH_3-N
- Range from 4 to 6 mg/L DO

The results of this analysis by TCEQ are preliminary and can change when TCEQ performs final modeling in the processing of a TPDES permit application. Site specific transect data furnished with the application will help to refine the hydraulics used in the model, which in turn can help reduce changes in effluent limits over time and produce a more solid model.

In the course of processing a TPDES permit application, TCEQ will evaluate additional water quality parameters which can result in additional effluent quality limits. Within the San Marcos River Watershed and adjacent Plum Creek Watershed, TPDES permits commonly include effluent limits or monitoring requirements for parameters including total phosphorus (TP), bacteria, or total dissolved solids (TDS).

In summary, no significant feasibility constraints were identified for construction of the Blanco Basin WWTP in the southern part of the Feasibility Study Base Area based on AECOM's preliminary review of potential discharge locations and anticipated effluent quality requirements for discharge.

4.2.4 Direct Potable Reuse Considerations

Opportunities for potential Direct Potable Reuse (DPR) advanced water treatment plants in the general area of the proposed Blanco Basin WWTP have been recently investigated. As discussed previously, the siting of the proposed Blanco Basin WWTP was primarily dependent on the configuration of the upstream collection system and a suitable effluent discharge location, however, the WWTP siting may be impacted by or have an impact on a future DPR WTP due to the following reasons:

a) The delivery cost of Blanco Basin WWTP effluent to the potential DPR WTP, if the Blanco Basin WWTP effluent is used as source water for the DPR WTP;

b) The delivery cost of product water from the DPR WTP to be blended with the existing potable water system;

c) The waste (concentrate) stream from the DPR WTP might need to be co-disposed with WWTP effluent through a WWTP outfall.

Therefore, it is prudent to evaluate the siting of the proposed Blanco Basin WWTP with the consideration for future DPR WTPs. A separate DPR Feasibility Study for Alliance Water was started in 2016. This DPR Feasibility Study is currently ongoing. The original scope of this DPR Feasibility Study indicated that the potential Alliance Water DPR WTP would receive source water from one or more existing area WWTPs (i.e. Kyle WWTP, San Marcos WWTP, and Buda WWTP).

The location of the potential Alliance Water DPR WTP would be impacted by the quality and quantity of source water. Out of the three (3) existing WWTPs, the San Marcos WWTP has the largest existing and ultimate design capacities (9 and 9.5 MGD). Additionally, this plant has a tertiary treatment process, which produces better quality (lower TDS) effluent than the Kyle WWTP. There are significant benefits to locate the potential Alliance Water DPR WTP closer to larger WWTPs with better effluent quality. Although the proposed ultimate capacity of the Blanco Basin WWTP is larger than the existing San Marcos WWTP, the effluent characteristics are not known at this time and based on projections it may be a few years before it reaches a capacity higher than the San Marcos WWTP.

Thus far, the direction provided by Alliance Water is for a delivery point of the product water from the DPR WTP at a booster pump station that will be located north of the City of Maxwell. This is approximately seven (7) miles from the proposed Blanco Basin WWTP site. This is two (2) miles more than the distance from the Kyle WWTP to the booster pump station and two (2) miles less than the distance from the San Marcos WWTP to the booster pump station.

The location of the potential Alliance Water DPR WTP would also be significantly affected by the treatment process used, i.e., how the concentrate would be disposed of. The initial DPR Feasibility Study identified three (3) possible general treatment scenarios for the future DPR WTP:

a) A NF membrane process and surface discharge of concentrate stream;

b) A RO membrane process and deep well injection of concentrate stream; and

c) An ozonation-biological active filter (non-membrane) based treatment process.

For Scenario a), the concentrate from the nanofiltration (NF) process would be blended with WWTP effluent and discharged to a WWTP outfall. The feasibility of this scenario is contingent upon the available environmental capacity of the receiving stream, specifically, the ability of the receiving stream to accept high concentrations of TDS, chloride, and sulfate in the DPR concentrate while still maintaining adequate water quality. The Alliance Water DPR Feasibility Study reviewed the receiving streams of all WWTPs (Buda, Kyle, and San Marcos). The initial results indicated that Plum Creek, where the Kyle WWTP currently discharges to, has a much higher tolerance of additional TDS, chloride, and sulfate discharge. The potential outfall location of the Blanco Basin WWTP discussed previously (near the confluence of Hemphill Creek and San Marcos River), has a very large mean harmonic flow (152 cfs) but very low ambient concentrations/permit levels of TDS, chloride, and sulfate. As a result, this location is not suitable for accepting the concentrate stream from the potential Alliance Water DPR WTP. Therefore, it would be advisable to locate the potential Alliance Water DPR WTP closer to the Kyle WWTP to save costs of delivering DPR concentrate in this scenario. Co-location of the potential Alliance Water DPR WTP with the Blanco Basin WWTP would not provide any apparent benefits in this scenario.

For Scenario b), the concentrate from the reverse osmosis (RO) process would be disposed of via deep well injection. The locations of suitable injection wells have not been identified yet due to inadequate existing hydrogeological information. If this disposal method is feasible, it appears that the economically feasible location for such wells would be in western Caldwell County, an area bordered by Highway 21, State Highway 130 and the San Marcos River. Therefore, there is no major incentive to co-locate the Alliance Water DPR WTP and the Blanco Basin WWTP for this scenario either.

For Scenario c), the location of the potential Alliance Water DPR WTP would not be affected by the treatment process.

In summary, it appears that there is no apparent benefit to co-locate the potential Alliance Water DPR WTP and the proposed Blanco Basin WWTP in any of the treatment/delivery scenarios being investigated. Additional discussions on the siting of the potential Alliance Water DPR WTP can be found in the Alliance Water DPR Feasibility Study Report.

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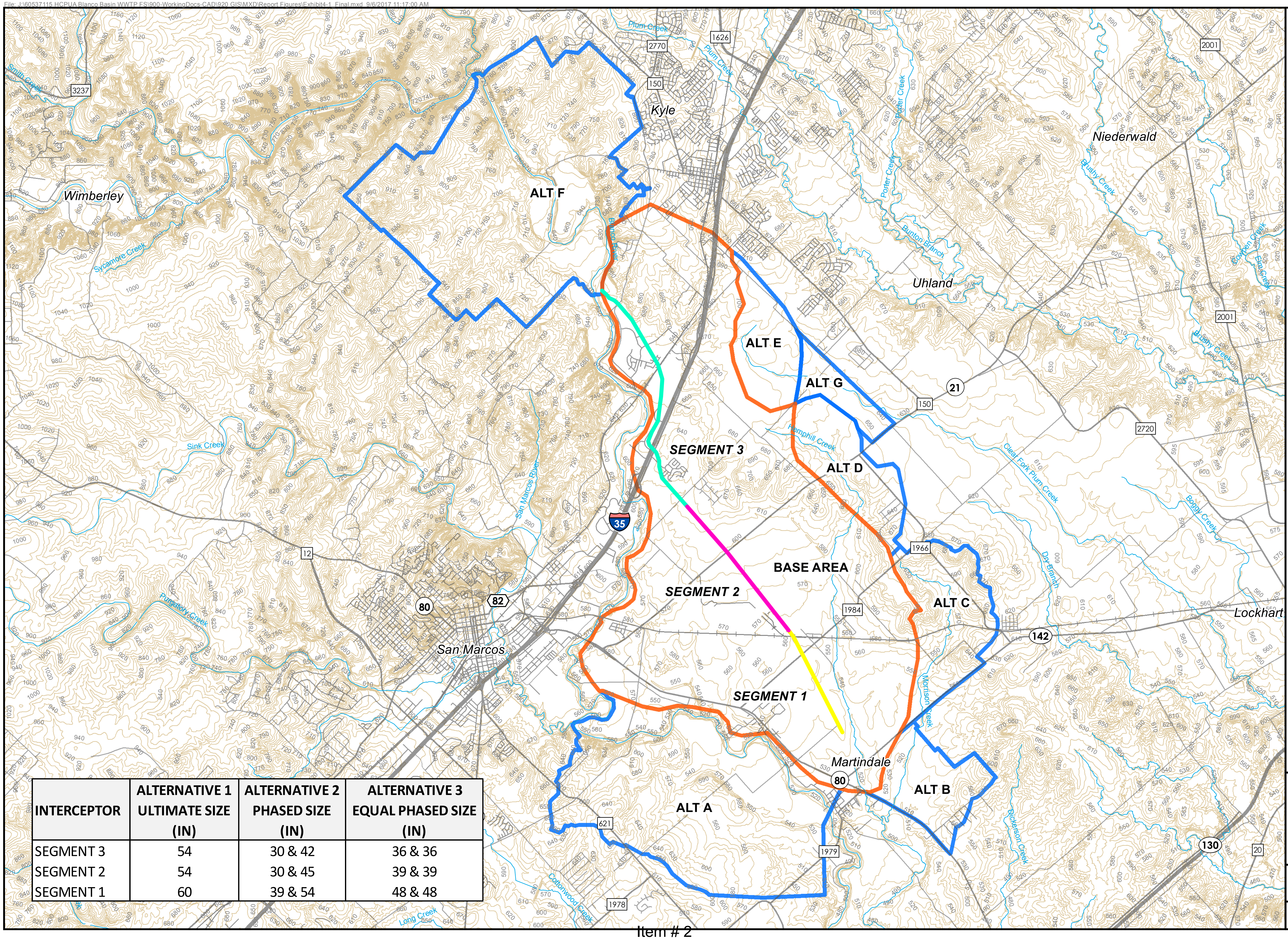

INTERCEPTOR	ALTERNATIVE 1 ULTIMATE SIZE (IN)	ALTERNATIVE 2 PHASED SIZE (IN)	ALTERNATIVE 3 EQUAL PHASED SIZE (IN)
SEGMENT 3	54	30 & 42	36 & 36
SEGMENT 2	54	30 & 45	39 & 39
SEGMENT 1	60	39 & 54	48 & 48

Legend

- Base Area
- Alternative Area
- 10-ft Contours

Proposed WW Interceptor

- Segment 1
- Segment 2
- Segment 3

N

0 0.5 1 Miles

1 inch = 1.5 miles

Note:
1. Proposed alignment for the wastewater interceptor is conceptual based on maximizing gravity flow to the service area. Further analysis and preliminary engineering will be required to optimize alignment to avoid conflicting uses such as the San Marcos Airport.

ALLIANCE WATER
WWTP FEASIBILITY STUDY
INTERCEPTOR SIZING ALTERNATIVES

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Date: SEP 2017	Job No.: 60537115	Exhibit 4-1

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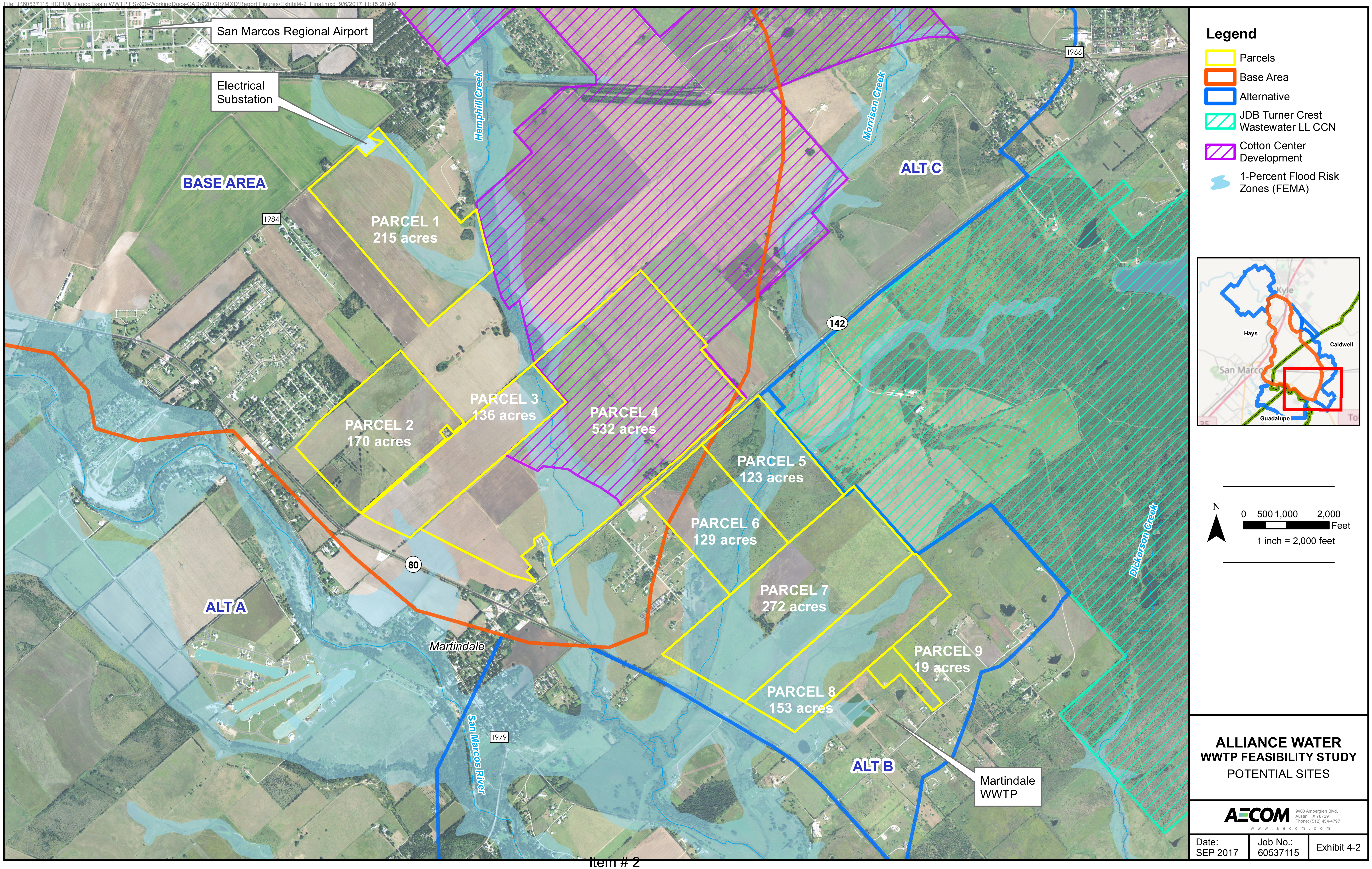

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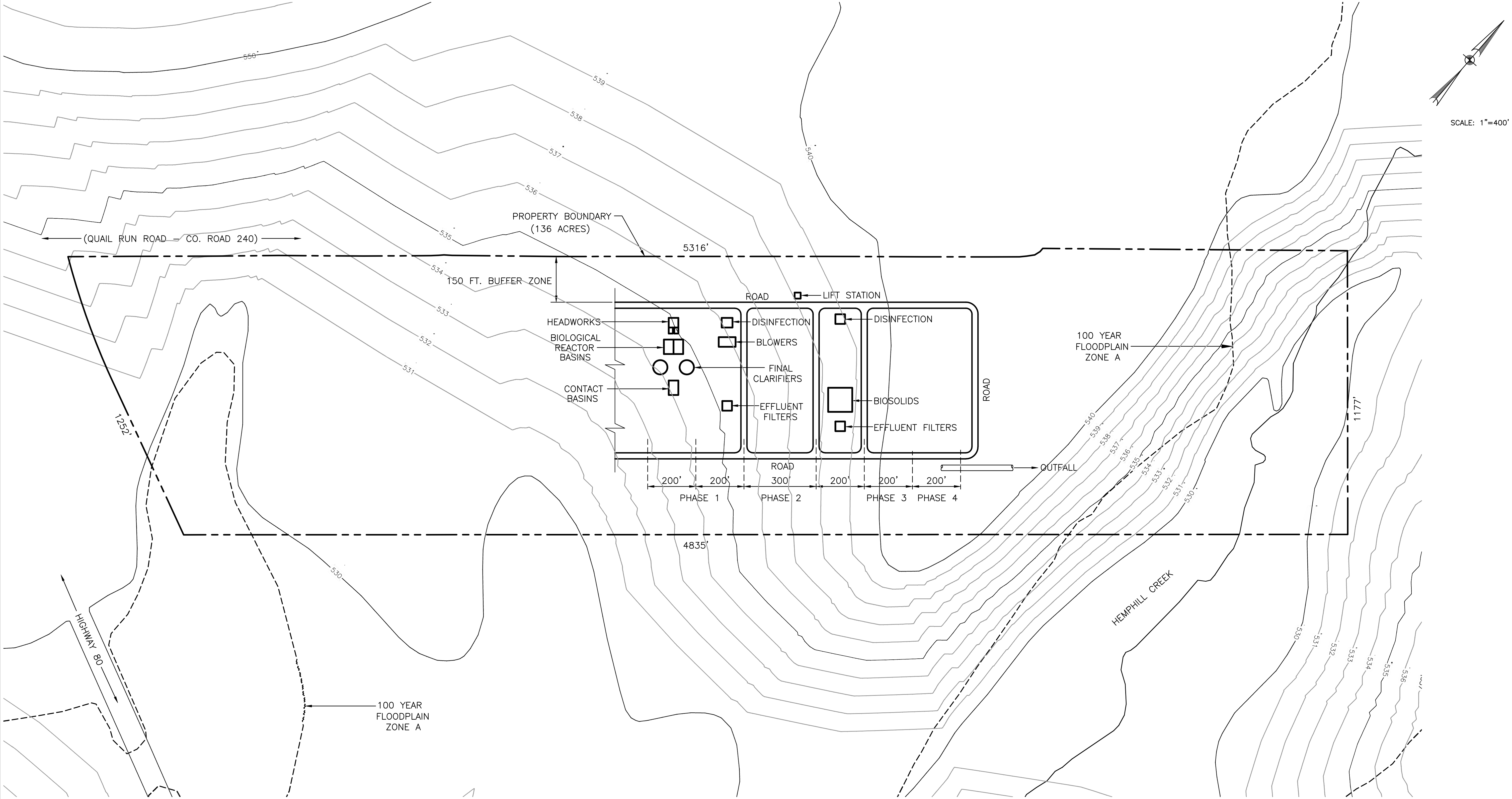

ALLIANCE WATER WWTP FEASIBLTY STUDY
BLANCO BASIN WWTP SITE PLAN

AECOM

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DATE: SEPTEMBER 2017	JOB No. 60537115	EXHIBIT No. 4-3

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5 Cost Analysis

5.1 Wastewater Treatment Facilities System Conceptual Costs

Previous sections of this Feasibility Study have defined concepts and alternatives for collecting and treating the projected wastewater flows for the Feasibility Study Area. These concepts include the components listed below:

- Interceptor
- Blanco Basin WWTP Treatment
- Pumping, Conveyance, and Treatment at San Marcos WWTP
- Interim Wastewater Facilities

The interim wastewater facilities represent potential costs to be incurred between today and the end of 2020 when permanent facilities have been constructed. The following paragraphs provide a summary of the conceptual construction costing assumptions for each component. No cost is included for property acquisition, ROW/easement acquisition, legal, or engineering/professional services.

5.1.1 Interceptor

Due to the conceptual nature of this feasibility study, the interceptor costs are approximated based on a value of $10 per inch diameter per linear foot of interceptor. Interceptor diameter sizes are based on maintaining flow velocities between 2 and 10 feet per second per TCEQ design requirements (at both average flow and peak flow condition, all years).

In addition, a cost of $5,000 per manhole was used along the interceptor alignment using manhole spacing per TCEQ design requirements based on interceptor diameter.

A 40% contingency was used to account for general alignment, unknown geologic conditions, road crossings, railroad crossings, and drainage crossings, etc.

5.1.2 Blanco Basin WWTP Treatment

For conceptual planning, WWTP costing is generally done using a cost per gallon of treatment capacity. The smaller the treatment plant the higher the cost per gallon, whereas a larger treatment plant gains some efficiencies on structure sizing. Generally values range from $2 - $10 per gallon of treatment. In addition, for planned treatment plant expansions, a lower cost per gallon of treatment can be used since some of the supplemental infrastructure is in place (i.e. plant roads, administration building, power, etc.) and some units may be set up for future expansion.

For this Feasibility Study, a value of $4 per gallon of treatment capacity was used for initial construction and $3 per gallon of treatment capacity was used for expansion construction at the Blanco Basin WWTP.

Based on cost estimates from a recent project performed by AECOM, a Blanco Basin WWTP lift station will use a cost per gallon per minute pumped value of $500.

Based on cost estimates from a recent project performed by AECOM, a Blanco Basin WWTP solids handling structure will use a cost per million gallon per day treated value of $300,000.

A 30% contingency was used to account for undetermined treatment process, unknown site conditions, road access, power connection, etc.

5.1.3 Pumping, Conveyance, and Treatment at San Marcos WWTP

As described previously, another alternative is to build a lift station at the Blanco Basin WWTP site and pump wastewater to the existing San Marcos WWTP either temporarily or permanently for treatment. As stated previously, for the purposes of this Feasibility Study Report, it was assumed the lift station would pump to the City of San Marcos. Lift station cost per gallon per minute will be the same as **Section 5.1.2**.

The forcemain cost would be similar to the interceptor and would be approximated based on a value of $10 per inch diameter per linear foot of forcemain. Forcemain diameter size is based on maintaining velocities below 5 feet per second for the peak flow condition.

As stated previously, for planned treatment plant expansions, a lower cost per gallon of treatment capacity can be used if the initial design allowed for future expansion. However, due to the age of existing infrastructure, sometimes additional cost is required for upgrades to incorporate into treatment plant expansions. Since the expansion status and age of the existing San Marcos WWTP was not investigated as part of the Feasibility Study, expansion construction at existing wastewater plants will use a value of $5 per gallon of treatment.

A 40% contingency was used to account for site conditions, road access, power connection, general forcemain alignment, crossings, etc.

5.1.4 Interim Wastewater Facilities

As described previously, to accommodate wastewater flows by developments currently underway a smaller lift station with a capacity of 1 MGD (peak of 4 MGD) and associated forcemain would be provided to pump wastewater to the existing San Marcos WWTP either temporarily or permanently for treatment. Lift station cost per gallon per minute will be the same as **Section 5.1.2**.

Forcemain sizing and cost basis would be the same as **Section 5.1.3**.

Expansion construction at existing wastewater plants will use the same value as **Section 5.1.3**.

A 40% contingency was used to account for site conditions, road access, power connection, general forcemain alignment, crossings, etc.

5.2 Cost Estimates for Infrastructure Components

As discussed previously, there are many options for phasing that provide capacity to accommodate growth but also provide flexibility to delay infrastructure costs. The associated costs of each phasing option for each component are described below.

All future phasing construction costs are presented in 2017 dollars with no adjustment for net interest and/or inflation.

5.2.1 Interceptor Costs

As discussed in **Section 4.1.3**, three (3) alternatives were proposed for construction phasing of the interceptor. Wastewater flows from Alternative A, B, and C areas were not included in the interceptor sizing. Alternative 1 proposed interceptor sizing to accommodate ultimate flows to be completed in one (1) construction phase. Alternative 2 proposed interceptor sizing to accommodate two (2) construction phases with the first phase conveying 6 MGD average day flow and the second phase conveying the remaining ultimate flow. Alternative 3 also proposed two (2) construction phases but with each phase conveying half of the ultimate flow. **Table 5-1** provides the estimated construction cost for each Interceptor Alternative in 2017 dollars. Cost calculations are provided in **Appendix B**.

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Table 5-1: Interceptor Project Costs

Component	Construction Phase	Capacity Avg Flow (MGD)	Complete Construction (Year)	Total Project Cost (2017 $)
Alternative 1	1	24.7	2021	**35,700,000**
Alternative 2	1	6	2021	20,846,000
	2	18.7	2027	29,484,000
			TOTAL	**50,330,000**
Alternative 3	1	12.35	2021	25,648,000
	2	12.35	2027	25,648,000
			TOTAL	**51,296,000**

5.2.2 Blanco Basin WWTP Treatment Costs

The Blanco Basin WWTP was assumed to be constructed in four (4) phases as discussed in **Section 4.1.2**. **Table 5-2** provides the estimated construction cost for each WWTP construction phase in 2017 dollars. Cost calculations are provided in **Appendix B**.

Table 5-2: Blanco Basin WWTP Treatment Project Costs

Component	Construction Phase	Capacity Avg Flow (MGD)	Complete Construction (Year)	Total Project Cost (2017 $)
WWTP (Initial)	1	6	2021	44,373,000
WWTP (Exp 1)	2	12	2027	67,730,000
WWTP (Exp 2)	3	6	2035	33,865,000
WWTP (Exp 3)	4	6	2041	33,865,000

5.2.3 Pumping, Conveyance, and Treatment at San Marcos WWTP Costs

As discussed in **Section 5.1.3**, a lift station could be built at the proposed Blanco Basin WWTP site to pump wastewater to the existing San Marcos WWTP temporarily or permanently for treatment. **Table 5-3** provides the estimated construction cost for each construction phase in 2017 dollars. Cost calculations are provided in **Appendix B**.

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Table 5-3: Pumping, Conveyance, and Treatment at San Marcos WWTP Project Costs

Component	Construction Phase	Capacity Avg Flow (MGD)	Complete Construction (Year)	Total Project Cost (2017 $)
Lift Station	1	6	2021	11,667,000
Forcemain	1	6	2021	16,464,000
SM WWTP (Exp)	1	6	2021	42,000,000
			TOTAL	**70,131,000**
Lift Station	2	12	2027	17,500,000
Forcemain	2	12	2027	18,816,000
SM WWTP (Exp)	2	12	2027	84,000,000
			TOTAL	**120,316,000**
Lift Station	3	6	2035	8,750,000
Forcemain	3	6	2035	14,112,000
SM WWTP (Exp)	3	6	2035	42,000,000
			TOTAL	**64,862,000**
Lift Station	4	6	2041	8,750,000
Forcemain	4	6	2041	14,112,000
SM WWTP (Exp)	4	6	2041	42,000,000
			TOTAL	**64,862,000**

Energy costs for pumping to the San Marcos WWTP are approximately $475,000/year, $740,000/year, $390,000/year, and $390,000/year for each construction phase respectively.

5.2.4 Interim Wastewater Facilities Costs

As discussed in **Section 5.1.4**, a lift station will need to be built to accommodate wastewater flows by developments currently underway to pump wastewater to the existing San Marcos WWTP for treatment. **Table 5-4** provides the estimated construction cost for each construction phase in 2017 dollars. Cost calculations are provided in **Appendix B**.

Table 5-4: Interim Wastewater Facilities Project Costs

Component	Construction Phase	Capacity Avg Flow (MGD)	Complete Construction (Year)	Total Project Cost (2017 $)
Lift Station	1	1	2018	1,944,444
Forcemain	1	1	2018	6,272,000
SM WWTP (Exp)	1	1	2018	7,000,000
			TOTAL	**15,216,444**

Energy costs for pumping to the San Marcos WWTP are approximately $160,000/year.

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5.2.5 Summary of Component Costs

As shown in the previous Interceptor cost estimate section, the cost difference between the two (2) phased construction options is initially $4.8M cheaper for Alternative 2 and overall $1M cheaper for Alternative 2 for both construction phases.

In comparison to the ultimate build-out, a phased approach to construction allows for an initial project savings of $10M - $15M. However, the phased construction increases overall cost by $14M to $16M.

For treatment, the benefits and resultant costs for the proposed Blanco Basin WWTP are more beneficial than expansion of the existing WWTPs for the cities of Kyle and San Marcos. The initial construction phase cost to pump flows to an existing WWTP is approximately $28M more than building the initial phase of the Blanco Basin WWTP. Although a higher cost of treatment was used for wastewater treatment plant expansion versus new treatment plant construction, the added cost required for a lift station and forcemain is more than a third of the overall cost. This cost difference only increases as the additional phases of construction are incorporated to a total project cost difference of $110M more for pumping to existing WWTPs. A summary of this comparison is provided in **Table 5-5**.

Table 5-5: Comparison of Blanco Basin WWTP to Expansion of Existing San Marcos WWTP

Complete Construction (Year)	Component	Capacity Avg Flow (MGD)	Blanco Basin WWTP Cost (2017 $)	San Marcos WWTP Expansion Cost (2017 $)
2021	Interceptor (Alt 1)	24.7	$35.7M	$35.7M
	Treatment	6	$44.4M	$42.0M
	Lift Station	6	--	$11.7M
	Forcemain	6	--	$16.5M
2027	Treatment	12	$67.7M	$84.0M
	Lift Station	12	--	$17.5M
	Forcemain	12	--	$18.8M
2035	Treatment	6	$33.9M	$42.0M
	Lift Station	6	--	$8.8M
	Forcemain	6	--	$14.1M
2041	Treatment	6	$33.9M	$42.0M
	Lift Station	6	--	$8.8M
	Forcemain	6	--	$14.1M
		TOTAL	**$215.6M**	**$356.0M**

In addition to the capital cost difference, another considerable difference is the energy costs required. For Phase 1 of construction (6 MGD) of a lift station to convey wastewater to the San Marcos WWTP versus an on-site lift station to convey flow to the Blanco Basin WWTP, the difference in energy costs per year is approximately $350,000. At ultimate build-out, this energy difference increase to almost $2M per year.

As stated previously, the biggest benefit for the location of the Blanco Basin WWTP is that a large unserved area can be served by gravity with a large collection interceptor. This saves considerable operations and maintenance costs for large lift stations throughout the system. Based on the rate of proposed development, interim lift stations may be required throughout the planning period to capture flows from disperse developments until sufficient density is achieved.

The estimated costs in this section provide a basis for Alliance Water to evaluate how much risk is acceptable to build an initial phase of the wastewater facility system dependent on future development projections to either reduce upfront costs and increase future costs or have higher upfront costs and lower future costs.

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6 Recommendations

The projected population and resulting wastewater flows included in this Feasibility Study represent an aggressive growth rate for the planning period. Recent history has supported the aggressive growth rate but only time will define future requirements.

The evaluation in this Feasibility Study Report determined that it is feasible and cost-effective to construct a WWTP for the proposed service area to be collected by a gravity wastewater interceptor. This feasibility review also determined through coordination with TCEQ that suitable locations for discharge exist at the downslope end of the proposed Blanco Basin WWTP service area. Additionally, a review of siting considerations determined that suitable locations for siting the proposed WWTP exist near these potential discharge locations. Thus, the primary feasibility consideration is cost-effectiveness versus expansion of the existing San Marcos and Kyle WWTP. The cost evaluation indicates it is more economical to treat the wastewater flow at the proposed Blanco Basin WWTP than it is to pump the flow to existing WWTPs and expand those treatment plants.

Based on this evaluation, it is recommended that Alliance Water proceed on the following basis:

- Install a wastewater interceptor to serve the Feasibility Study Area. Interceptor (initial phase) to be generally along the route defined in this Feasibility Study and sized for 6 MGD (24 MGD peak) flow. Interceptor to be installed in a 30-foot wide permanent easement to facilitate future installation of a second interceptor.
- Permit and construct a 6 MGD (initial phase) wastewater treatment plant on Parcel 3 to serve the Feasibility Study Area.
- Construction of the interceptor and WWTP to be complete by January 2021.
- Monitor growth rate within the Feasibility Study Area to determine when additional capacity is required and use the “flow trigger” defined in this Feasibility Study to initiate that capacity increase.
- Between now and January 2021, coordinate with developers to convey their wastewater flows to an existing WWTP or to a central point and provide pumping/conveyance to a selected existing WWTP.

In order to implement this recommendation, this following action is recommended:

- Acquire Parcel 3 for Blanco Basin WWTP site.
- Initiate preliminary engineering of interceptor to finalize route and allow easement acquisition to proceed.
- Initiate preliminary engineering of the Blanco Basin WWTP to finalize area requirements and outfall location.
- Initiate application to TCEQ for a TPDES permit for the Blanco Basin WWTP.

Appendix A

Interceptor Sizing Alternatives

(Ultimate, Phased, Equally Phased)

Alliance Water Blanco River Basin WWTP Feasibility Study
Interceptor Sizing Conceptual Evaluation
Date: 7/7/2017
Originated by: M. Rumbaugh
Checked by: X. He, C. Wauters, R. Li

Population

Area	2020	2030	2050	Notes
Base	16,143	72,435	143,215	
A	-	-	-	Not Conveyed by Interceptor
B	-	-	-	Not Conveyed by Interceptor
C	-	-	-	Not Conveyed by Interceptor
D	907	9,456	16,478	
E	1,934	10,696	15,069	
F	4,578	25,500	64,500	
G	1,141	6,186	7,734	
TOTAL	**24,703**	**124,273**	**246,996**	

Flows

Population Flow Factor (gpcd)	100
2020 Peak Factor	4
2030 Peak Factor	3.5
2050 Peak Factor	3

		Average Flow in MGD			Average Flow in CFS			Peak Flow in MGD			Peak Flow in CFS		
Segment	**Area Served**	**2020**	**2030**	**2050**	**2020**	**2030**	**2050**	**2020**	**2030**	**2050**	**2020**	**2030**	**2050**
3	1/3 Base +F	1.00	4.96	11.22	1.54	7.68	17.37	3.98	17.38	33.67	6.16	26.89	52.10
2	2/3 Base +E+F+G	1.84	9.07	18.28	2.85	14.03	28.28	7.37	31.74	54.83	11.40	49.11	84.85
1	Base D+E+F+G	2.47	12.43	24.70	3.82	19.23	38.22	9.88	43.50	74.10	15.29	67.30	114.66

Ground Slope Constraints

Segment	L (ft)	$NG_{(up)}$ (ft MSL)	$NG_{(dn)}$ (ft MSL)	$S_{(NG)}$ ft/ft
3	21,827	640	610	0.0014
2	15,048	610	560	0.0033
1	8,976	560	543	0.0019
Sum	**45,851**			

Notes:
1) Lengths manually scaled from draft figure 4
2) Segment 3 ends at Alt F boundary
3) Elevations visually estimated from USGS maps (Martindale and San Marcos North quadrangles)

Assumed Depth Constraints

Minimum Depth (ft)	8	(upstream end of Segment 3)
Maximum Depth (ft)	20	(downstream end of Segment 1)

Capacity/Diameter/Slope Criteria

1) Convey 2050 peak flow at ≤ full pipe depth with flow velocity ≥ 2 ft/s and ≤ 10 ft/s
2) Confirm full pipe flow capacity ≥ 2050 peak flow
3) Convey 2020 average flow with flow velocity ≥ 2 ft/s
4) Slope not less than natural ground slope in any segment
5) Maximum depth not exceeded at segment boundaries or end points

Conceptual Level Diameter, Slope and Depth

Segment 3	Upstream		Downstrm			2050						2020					
Dia (in)	FL (ft MSL)	Depth (ft)	FL (ft MSL)	Depth (ft)	Slope (ft/ft)	Q_{peak} (MGD)	V_{peak} (ft/s)	% $Depth_{peak}$ (%)	Q_{avg} (MGD)	V_{avg} (ft/s)	% $Depth_{avg}$ (%)	Q_{peak} (MGD)	V_{peak} (ft/s)	% $Depth_{peak}$ (%)	Q_{avg} (MGD)	V_{avg} (ft/s)	% $Depth_{avg}$ (%)
54	632.00	8.00	594.89	15.11	0.0017	33.67	5.3	55%	11.22	4.0	30%	3.98	2.6	15%	1.00	1.3	5%

Segment 2	Upstream		Downstrm			2050						2020					
Dia (in)	FL (ft MSL)	Depth (ft)	FL (ft MSL)	Depth (ft)	Slope (ft/ft)	Q_{peak} (MGD)	V_{peak} (ft/s)	% $Depth_{peak}$ (%)	Q_{avg} (MGD)	V_{avg} (ft/s)	% $Depth_{avg}$ (%)	Q_{peak} (MGD)	V_{peak} (ft/s)	% $Depth_{peak}$ (%)	Q_{avg} (MGD)	V_{avg} (ft/s)	% $Depth_{avg}$ (%)
54	594.89	15.11	551.25	8.75	0.0029	54.83	7.3	65%	18.28	5.6	35%	7.37	4.1	20%	1.84	2.7	10%

Segment 1	Upstream		Downstrm			2050						2020					
Dia (in)	FL (ft MSL)	Depth (ft)	FL (ft MSL)	Depth (ft)	Slope (ft/ft)	Q_{peak} (MGD)	V_{peak} (ft/s)	% $Depth_{peak}$ (%)	Q_{avg} (MGD)	V_{avg} (ft/s)	% $Depth_{avg}$ (%)	Q_{peak} (MGD)	V_{peak} (ft/s)	% $Depth_{peak}$ (%)	Q_{avg} (MGD)	V_{avg} (ft/s)	% $Depth_{avg}$ (%)
60	551.25	8.75	533.30	9.70	0.0020	74.10	6.8	80%	24.70	5.0	35%	9.88	3.7	20%	2.47	2.4	10%

Notes
1) "% Depth" indicates % depth of flow vs. diameter
2) Calculation is based on Manning's equation with n=0.013, using equations and lookup table "Results" in "Calculator" worksheet

Conclusion:
1) Feasible to construct interceptor in a single phase while meeting 2020 and 2050 velocity criteria.
2) Doing so may result in an interceptor downstream segment that is oversized vs. capacity required and deeper than phased construction.

Alliance Water Blanco River Basin WWTP Feasibility Study
Interceptor Sizing Conceptual Evaluation
Date: 6/29/2017
Originated by: M. Rumbaugh
Checked by: X. He, C. Wauters, R. Li

Population

Area	2020	Phase I	2030	2050	Notes
Base	16,143	29,726	72,435	143,215	
A	1,210	7,599	27,689	58,752	Not Conveyed by Interceptor
B	200	1,419	5,253	10,505	Not Conveyed by Interceptor
C	152	2,253	8,859	20,704	Not Conveyed by Interceptor
D	907	2,970	9,456	16,478	
E	1,934	4,048	10,696	15,069	
F	4,578	9,626	25,500	64,500	
G	1,141	2,358	6,186	7,734	
Interceptor	**24,703**	**48,729**	**124,273**	**246,996**	
WWTP	**26,265**	**60,000**	**166,074**	**336,957**	

Flows

Population Flow Factor (gpcd)	100
2020/Phase I Peak Factor	4
2030 Peak Factor	3.5
2050 Peak Factor	3

		Average Flow in MGD				Average Flow in CFS				Peak Flow in MGD				Peak Flow	
Segment	**Area Served**	**2020**	**Phase I**	**2030**	**2050**	**2020**	**Phase I**	**2030**	**2050**	**2020**	**Phase I**	**2030**	**2050**	**2020**	**Phase I**
3	1/3 Base +F	1.00	1.95	4.96	11.22	1.54	3.02	7.68	17.37	3.98	7.81	17.38	33.67	6.16	12.09
2	2/3 Base +E+F+G	1.84	3.59	9.07	18.28	2.85	5.55	14.03	28.28	7.37	14.34	31.74	54.83	11.40	22.19
1	Base D+E+F+G	2.47	4.87	12.43	24.70	3.82	7.54	19.23	38.22	9.88	19.49	43.50	74.10	15.29	30.16

Ground Slope Constraints

Segment	Length (ft)	$NG_{(up)}$ (ft MSL)	$NG_{(dn)}$ (ft MSL)	$S_{(NG)}$ ft/ft
3	21,827	640	610	0.0014
2	15,048	610	560	0.0033
1	8,976	560	543	0.0019
Sum	**45,851**			

Notes:
1) Lengths manually scaled from draft figure 4
2) Segment 3 ends at Alt F boundary
3) Elevations visually estimated from USGS maps (Martindale and San Marcos North quadrangles)

Assumed Depth Constraints

Minimum Depth (ft)	8	(upstream end of Segment 3)
Maximum Depth (ft)	20	(downstream end of Segment 1)

Capacity/Diameter/Slope Criteria

Minimize Phase I Diameter while meeting the following:
1) Convey 2050 peak flow at ≤ full pipe depth with flow velocity ≥ 2 ft/s and ≤ 10 ft/s
2) Confirm full pipe flow capacity ≥ 2050 peak flow
3) Convey 2020 average flow with flow velocity ≥ 2 ft/s
4) Slope not less than natural ground slope in any segment
5) Maximum depth not exceeded at segment boundaries or end points

Conceptual Level Diameter, Slope and Depth - Phase I Interceptor

Segment 3	Upstream		Downstrm			2050 (Full Capacity)			Phase I					
Dia (in)	FL (ft MSL)	Depth (ft)	FL (ft MSL)	Depth (ft)	Slope (ft/ft)	Q_{peak} (MGD)	V_{peak} (ft/s)	% $Depth_{peak}$ (%)	Q_{peak} (MGD)	V_{peak} (ft/s)	% $Depth_{peak}$ (%)	Q_{avg} (MGD)	V_{avg} (ft/s)	% $Depth_{avg}$ (%)
30	632.00	8.00	602.00	8.00	0.0014	9.95	3.1	100%	7.81	3.4	65%	1.95	2.4	30%

Segment 2	Upstream		Downstrm			2050 (Full Capacity)			Phase I					
Dia (in)	FL (ft MSL)	Depth (ft)	FL (ft MSL)	Depth (ft)	Slope (ft/ft)	Q_{peak} (MGD)	V_{peak} (ft/s)	% $Depth_{peak}$ (%)	Q_{peak} (MGD)	V_{peak} (ft/s)	% $Depth_{peak}$ (%)	Q_{avg} (MGD)	V_{avg} (ft/s)	% $Depth_{peak}$ (%)
30	602.00	8.00	552.00	8.00	0.0033	15.25	4.8	100%	14.34	5.5	75%	3.59	3.7	30%

Segment 1	Upstream		Downstrm			2050 (Full Capacity)			Phase I					
Dia (in)	FL (ft MSL)	Depth (ft)	FL (ft MSL)	Depth (ft)	Slope (ft/ft)	Q_{peak} (MGD)	V_{peak} (ft/s)	% $Depth_{peak}$ (%)	Q_{peak} (MGD)	V_{peak} (ft/s)	% $Depth_{peak}$ (%)	Q_{avg} (MGD)	V_{avg} (ft/s)	% $Depth_{peak}$ (%)
39	552.00	8.00	535.00	8.00	0.0019	23.33	4.4	100%	19.49	4.8	65%	4.87	3.4	30%

Conceptual Level Diameter, Slope and Depth - Phase II Interceptor

Segment 3	Upstream		Downstrm			Phase II (2050)					
Dia (in)	FL (ft MSL)	Depth (ft)	FL (ft MSL)	Depth (ft)	Slope (ft/ft)	Q_{peak} (MGD)	V_{peak} (ft/s)	% $Depth_{peak}$ (%)	Q_{avg} (MGD)	V_{avg} (ft/s)	% $Depth_{peak}$ (%)
42	632.00	8.00	602.00	8.00	0.0014	23.72	4.4	75%	9.27	3.5	40%

Segment 2	Upstream		Downstrm			Phase II (2050)					
Dia (in)	FL (ft MSL)	Depth (ft)	FL (ft MSL)	Depth (ft)	Slope (ft/ft)	Q_{peak} (MGD)	V_{peak} (ft/s)	% $Depth_{peak}$ (%)	Q_{avg} (MGD)	V_{avg} (ft/s)	% $Depth_{peak}$ (%)
45	602.00	8.00	552.00	8.00	0.0033	39.58	7.1	70%	14.69	5.3	35%

Segment 1	Upstream		Downstrm			Phase II (2050)					
Dia (in)	FL (ft MSL)	Depth (ft)	FL (ft MSL)	Depth (ft)	Slope (ft/ft)	Q_{peak} (MGD)	V_{peak} (ft/s)	% $Depth_{peak}$ (%)	Q_{avg} (MGD)	V_{avg} (ft/s)	% $Depth_{peak}$ (%)
54	552.00	8.00	535.00	8.00	0.0019	50.77	6.1	75%	19.8	4.9	40%

Notes
1) "% Depth" indicates % depth of flow vs. diameter
2) Calculation is based on Manning's equation with n=0.013, using equations and lookup table "Results" in "Calculator" worksheet

Alliance Water Blanco River Basin WWTP Feasibility Study
Interceptor Sizing Conceptual Evaluation
Date: 6/29/2017
Originated by: M. Rumbaugh
Checked by: X. He, C. Wauters, R. Li

Population

Area	2020	Phase I	2030	2050	Notes
Base	16,143	29,726	72,435	143,215	
A	1,210	7,599	27,689	58,752	Not Conveyed by Interceptor
B	200	1,419	5,253	10,505	Not Conveyed by Interceptor
C	152	2,253	8,859	20,704	Not Conveyed by Interceptor
D	907	2,970	9,456	16,478	
E	1,934	4,048	10,696	15,069	
F	4,578	9,626	25,500	64,500	
G	1,141	2,358	6,186	7,734	
Interceptor	**24,703**	**48,729**	**124,273**	**246,996**	
WWTP	**26,265**	**60,000**	**166,074**	**336,957**	

Flows

Population Flow Factor (gpcd) 100
2020/Phase I Peak Factor 4
2030 Peak Factor 3.5
2050 Peak Factor 3

		Average Flow in MGD				Average Flow in CFS				Peak Flow in MGD				Peak Flow in CFS			
Segment	**Area Served**	**2020**	**2030**	**2050**	**1/2 2050**	**2020**	**2030**	**2050**	**1/2 2050**	**2020**	**2030**	**2050**	**1/2 2050**	**2020**	**2030**	**2050**	**1/2 2050**
3	1/3 Base +F	1.00	4.96	11.22	5.61	1.54	7.68	17.37	8.68	3.98	17.38	33.67	16.84	6.16	26.89	52.10	26.05
2	2/3 Base +E+F+G	1.84	9.07	18.28	9.14	2.85	14.03	28.28	14.14	7.37	31.74	54.83	27.42	11.40	49.11	84.85	42.42
1	Base D+E+F+G	2.47	12.43	24.70	12.35	3.82	19.23	38.22	19.11	9.88	43.50	74.10	37.05	15.29	67.30	114.66	57.33

Ground Slope Constraints

Segment	L (ft)	$NG_{(up)}$ (ft MSL)	$NG_{(dn)}$ (ft MSL)	$S_{(NG)}$ ft/ft
3	21,827	640	610	0.0014
2	15,048	610	560	0.0033
1	8,976	560	543	0.0019
Sum	**45,851**			

Notes:
1) Lengths manually scaled from draft figure 4
2) Segment 3 ends at Alt F boundary
3) Elevations visually estimated from USGS maps (Martindale and San Marcos North quadrangles)

Assumed Depth Constraints

Minimum Depth (ft) 8 (upstream end of Segment 3)
Maximum Depth (ft) 20 (downstream end of Segment 1)

Capacity/Diameter/Slope Criteria

Minimize Phase I Diameter while meeting the following:
1) Convey 2050 peak flow at ≤ full pipe depth with flow velocity ≥ 2 ft/s and ≤ 10 ft/s
2) Confirm full pipe flow capacity ≥ 2050 peak flow
3) Convey 2020 average flow with flow velocity ≥ 2 ft/s
4) Slope not less than natural ground slope in any segment
5) Maximum depth not exceeded at segment boundaries or end points

Conceptual Level Diameter, Slope and Depth - Phase I Interceptor and Phase II Interceptor, at Equal Sizes (Each convey 1/2 of 2050 flow)

Segment 3	Upstream		Downstrm			Phase II (2050)						Phase I (2020)					
Dia (in)	**FL (ft MSL)**	**Depth (ft)**	**FL (ft MSL)**	**Depth (ft)**	**Slope (ft/ft)**	Q_{peak} (MGD)	V_{peak} (ft/s)	% $Depth_{peak}$ (%)	Q_{avg} (MGD)	V_{avg} (ft/s)	% $Depth_{avg}$ (%)	Q_{peak} (MGD)	V_{peak} (ft/s)	% $Depth_{peak}$ (%)	Q_{avg} (MGD)	V_{avg} (ft/s)	% $Depth_{avg}$ (%)
36	632.00	8.00	597.08	12.92	0.0016	16.84	4.3	75%	5.61	3.2	35%	3.98	2.9	30%	1.00	2.0	15%

Segment 2	Upstream		Downstrm			Phase II (2050)						Phase I (2020)					
Dia (in)	**FL (ft MSL)**	**Depth (ft)**	**FL (ft MSL)**	**Depth (ft)**	**Slope (ft/ft)**	Q_{peak} (MGD)	V_{peak} (ft/s)	% $Depth_{peak}$ (%)	Q_{avg} (MGD)	V_{avg} (ft/s)	% $Depth_{avg}$ (%)	Q_{peak} (MGD)	V_{peak} (ft/s)	% $Depth_{peak}$ (%)	Q_{avg} (MGD)	V_{avg} (ft/s)	% $Depth_{avg}$ (%)
39	597.08	12.92	547.42	12.58	0.0033	27.42	6.4	70%	9.14	4.8	35%	7.37	4.4	30%	1.84	3.0	15%

Segment 1	Upstream		Downstrm			Phase II (2050)						Phase I (2020)					
Dia (in)	**FL (ft MSL)**	**Depth (ft)**	**FL (ft MSL)**	**Depth (ft)**	**Slope (ft/ft)**	Q_{peak} (MGD)	V_{peak} (ft/s)	% $Depth_{peak}$ (%)	Q_{avg} (MGD)	V_{avg} (ft/s)	% $Depth_{avg}$ (%)	Q_{peak} (MGD)	V_{peak} (ft/s)	% $Depth_{peak}$ (%)	Q_{avg} (MGD)	V_{avg} (ft/s)	% $Depth_{avg}$ (%)
48	547.42	12.58	530.42	12.58	0.0019	37.05	5.7	75%	12.35	4.2	35%	9.88	3.9	30%	2.47	2.6	15%

Notes
1) "% Depth" indicates % depth of flow vs. diameter
2) Calculation is based on Manning's equation with n=0.013, using equations and lookup table "Results" in "Calculator" worksheet

Appendix B

Component Cost Estimates

Alliance Water WWTP Feasibility Study
Cost Estimate for Infrastructure Components

Interceptor Costs

Assumptions:

1. Interceptor Pipe 10 ($/lf/in-dia)
2. Manhole Spacing 800 ft (per TCEQ Ch 217.55 Table C.3 for diameters 18-30 inch)
   1,000 ft (per TCEQ Ch 217.55 Table C.3 for diameters 36-48 inch)
   2,000 ft (per TCEQ Ch 217.55 Table C.3 for diameters 54 inch or larger)
3. Manhole 5,000 ($/each)
4. Contingency 40%
5. No cost is included for property acquisition, ROW/easement acquisition, legal, or engineering cost.

Alternative 1 (Full Build-out)

One construction phase to accommodate ultimate flows.
Capacity 24.7 MGD with construction complete in 2021.

Segment	Description	Length (lf)	Length (mi)	Diameter (in)	Manholes Required (ea)	Pipe Construction Cost ($)	Manhole Construction Cost ($)	Total Construction Cost ($)	Contingency ($)	Total Project Cost ($)
3	Alt F to Harris Hill Rd (FM 160)	22,000	4.2	54	11	11,880,000	55,000	11,935,000	4,774,000	16,709,000
2	Harris Hill Rd to Railroad	15,000	2.8	54	8	8,100,000	40,000	8,140,000	3,256,000	11,396,000
1	Railroad to WWTP	9,000	1.7	60	5	5,400,000	25,000	5,425,000	2,170,000	7,595,000
	Total	46,000	8.7		24		TOTAL	25,500,000	10,200,000	35,700,000

Alternative 2 (Phased Construction)

Two construction phases to accommodate ultimate flows.
First Phase Capacity 6 MGD with construction complete in 2021. Second Phase Capacity 18.7 MGD with construction complete in 2027.

Phase 1

Segment	Description	Length (lf)	Length (mi)	Diameter (in)	Manholes Required (ea)	Pipe Construction Cost ($)	Manhole Construction Cost ($)	Total Construction Cost ($)	Contingency ($)	Total Project Cost ($)
3	Alt F to Harris Hill Rd (FM 160)	22,000	4.2	30	28	6,600,000	140,000	6,740,000	2,696,000	9,436,000
2	Harris Hill Rd to Railroad	15,000	2.8	30	19	4,500,000	95,000	4,595,000	1,838,000	6,433,000
1	Railroad to WWTP	9,000	1.7	39	9	3,510,000	45,000	3,555,000	1,422,000	4,977,000
	Total	46,000	8.7		56		TOTAL	14,890,000	5,956,000	20,846,000

Phase 2

Segment	Description	Length (lf)	Length (mi)	Diameter (in)	Manholes Required (ea)	Pipe Construction Cost ($)	Manhole Construction Cost ($)	Total Construction Cost ($)	Contingency ($)	Total Project Cost ($)
3	Alt F to Harris Hill Rd (FM 160)	22,000	4.2	42	22	9,240,000	110,000	9,350,000	3,740,000	13,090,000
2	Harris Hill Rd to Railroad	15,000	2.8	45	15	6,750,000	75,000	6,825,000	2,730,000	9,555,000
1	Railroad to WWTP	9,000	1.7	54	5	4,860,000	25,000	4,885,000	1,954,000	6,839,000
	Total	46,000	8.7		42		TOTAL	21,060,000	8,424,000	29,484,000
		92,000	17.4		98		GRAND TOTAL	35,950,000	14,380,000	50,330,000

Alternative 3 (Equal Phased Construction)

Two equal construction phases to accommodate ultimate flows.
First Phase Capacity 12.35 MGD with construction complete in 2021. Second Phase Capacity 12.35 MGD with construction complete in 2027.

Phase 1

Segment	Description	Length (lf)	Length (mi)	Diameter (in)	Manholes Required (ea)	Pipe Construction Cost ($)	Manhole Construction Cost ($)	Total Construction Cost ($)	Contingency ($)	Total Project Cost ($)
3	Alt F to Harris Hill Rd (FM 160)	22,000	4.2	36	22	7,920,000	110,000	8,030,000	3,212,000	11,242,000
2	Harris Hill Rd to Railroad	15,000	2.8	39	15	5,850,000	75,000	5,925,000	2,370,000	8,295,000
1	Railroad to WWTP	9,000	1.7	48	9	4,320,000	45,000	4,365,000	1,746,000	6,111,000
	Total	46,000	8.7		46		TOTAL	18,320,000	7,328,000	25,648,000

Phase 2

Segment	Description	Length (lf)	Length (mi)	Diameter (in)	Manholes Required (ea)	Pipe Construction Cost ($)	Manhole Construction Cost ($)	Total Construction Cost ($)	Contingency ($)	Total Project Cost ($)
3	Alt F to Harris Hill Rd (FM 160)	22,000	4.2	36	22	7,920,000	110,000	8,030,000	3,212,000	11,242,000
2	Harris Hill Rd to Railroad	15,000	2.8	39	15	5,850,000	75,000	5,925,000	2,370,000	8,295,000
1	Railroad to WWTP	9,000	1.7	48	9	4,320,000	45,000	4,365,000	1,746,000	6,111,000
	Total	46,000	8.7		46		TOTAL	18,320,000	7,328,000	25,648,000
		92,000	17.4		92		GRAND TOTAL	36,640,000	14,656,000	51,296,000

Alliance Water WWTP Feasibility Study
Cost Estimate for Infrastructure Components

Blanco Basin WWTP Treatment Costs

Assumptions:

1. Treatment (Initial) 4 ($/gpd)
   Treatment (Expansion) 3 ($/gpd)
2. Peak Factor (Lift Station) 4 Initial (Avg Flow to Peak Flow)
   Peak Factor (Lift Station) 3 Expansion (Avg Flow to Peak Flow)
3. Lift Station 500 ($/gpm) (Peak)
4. Solids Handling 300,000 ($/MGD) (Avg)
5. Contingency 30%
6. No cost is included for property acquisition, ROW/easement acquisition, legal, or engineering cost.

Phase	Description	Treatment Capacity (MGD)	WWTP Lift Station Avg Flow (MGD)	WWTP Lift Station Peak Flow (MGD)	Solids Handling ($)	Treatment Construction Cost ($)	WWTP Lift Station Construction Cost ($)	Solids Handling Construction Cost ($)	Total Construction Cost ($)	Contingency ($)	Total Project Cost ($)
1	Initial	6	6	24	1,800,000	24,000,000	8,333,333	1,800,000	34,133,333	10,240,000	44,373,333
2	Expansion 1	12	12	36	3,600,000	36,000,000	12,500,000	3,600,000	52,100,000	15,630,000	67,730,000
3	Expansion 2	6	6	18	1,800,000	18,000,000	6,250,000	1,800,000	26,050,000	7,815,000	33,865,000
4	Expansion 3	6	6	18	1,800,000	18,000,000	6,250,000	1,800,000	26,050,000	7,815,000	33,865,000
		30						TOTAL	138,333,333	41,500,000	179,833,333

Alliance Water WWTP Feasibility Study
Cost Estimate for Infrastructure Components

Pumping, Conveyance, and Treatment at San Marcos WWTP

Assumptions:
1. Peak Factor (Lift Station) 4 Initial (Avg Flow to Peak Flow)
Peak Factor (Lift Station) 3 Expansion (Avg Flow to Peak Flow)
2. Lift Station 500 ($/gpm) (Peak)
3. Forcemain Pipe 10 ($/lf/in-dia)
4. Treatment (Expansion) 5 ($/gpd)
5. Contingency 40%
6. No cost is included for property acquisition, ROW/easement acquisition, legal, or engineering cost.

Phase 1

Phase	Description	Treatment Capacity (MGD)	Lift Station Peak Flow (MGD)	Lift Station Construction Cost ($)	Total Construction Cost ($)	Contingency ($)	Total Project Cost ($)
1	Lift Station	6.0	24	8,333,333	8,333,333	3,333,333	11,666,667

Phase	Description	Length (lf)	Length (mi)	Diameter (in)	Total Construction Cost ($)	Contingency ($)	Total Project Cost ($)
1	Forcemain (LS at WWTP to SM WWTP)	28,000	5.3	42	11,760,000	4,704,000	16,464,000

Phase	Description	Treatment Capacity (MGD)	Treatment Construction Cost ($)	Total Construction Cost ($)	Contingency ($)	Total Project Cost ($)
1	SM WWTP Expansion	6	30,000,000	30,000,000	12,000,000	42,000,000
			GRAND TOTAL	50,093,333	20,037,333	70,130,667

Phase 2

Phase	Description	Treatment Capacity (MGD)	Lift Station Peak Flow (MGD)	Lift Station Construction Cost ($)	Total Construction Cost ($)	Contingency ($)	Total Project Cost ($)
2	Lift Station	12.0	36	12,500,000	12,500,000	5,000,000	17,500,000

Phase	Description	Length (lf)	Length (mi)	Diameter (in)	Total Construction Cost ($)	Contingency ($)	Total Project Cost ($)
2	Forcemain (LS at WWTP to SM WWTP)	28,000	5.3	48	13,440,000	5,376,000	18,816,000

Phase	Description	Treatment Capacity (MGD)	Treatment Construction Cost ($)	Total Construction Cost ($)	Contingency ($)	Total Project Cost ($)
2	SM WWTP Expansion	12	60,000,000	60,000,000	24,000,000	84,000,000
			GRAND TOTAL	85,940,000	34,376,000	120,316,000

Phase 3

Phase	Description	Treatment Capacity (MGD)	Lift Station Peak Flow (MGD)	Lift Station Construction Cost ($)	Total Construction Cost ($)	Contingency ($)	Total Project Cost ($)
3	Lift Station	6.0	18	6,250,000	6,250,000	2,500,000	8,750,000

Phase	Description	Length (lf)	Length (mi)	Diameter (in)	Total Construction Cost ($)	Contingency ($)	Total Project Cost ($)
3	Forcemain (LS at WWTP to SM WWTP)	28,000	5.3	36	10,080,000	4,032,000	14,112,000

Phase	Description	Treatment Capacity (MGD)	Treatment Construction Cost ($)	Total Construction Cost ($)	Contingency ($)	Total Project Cost ($)
3	SM WWTP Expansion	6	30,000,000	30,000,000	12,000,000	42,000,000
			GRAND TOTAL	46,330,000	18,532,000	64,862,000

Phase 4

Phase	Description	Treatment Capacity (MGD)	Lift Station Peak Flow (MGD)	Lift Station Construction Cost ($)	Total Construction Cost ($)	Contingency ($)	Total Project Cost ($)
4	Lift Station	6.0	18	6,250,000	6,250,000	2,500,000	8,750,000

Phase	Description	Length (lf)	Length (mi)	Diameter (in)	Total Construction Cost ($)	Contingency ($)	Total Project Cost ($)
4	Forcemain (LS at WWTP to SM WWTP)	28,000	5.3	36	10,080,000	4,032,000	14,112,000

Phase	Description	Treatment Capacity (MGD)	Treatment Construction Cost ($)	Total Construction Cost ($)	Contingency ($)	Total Project Cost ($)
4	SM WWTP Expansion	6	30,000,000	30,000,000	12,000,000	42,000,000
			GRAND TOTAL	46,330,000	18,532,000	64,862,000

Alliance Water WWTP Feasibility Study
Cost Estimate for Infrastructure Components

Interim Wastewater Facilities

Assumptions:

1. Peak Factor (Lift Station) 4 Initial (Avg Flow to Peak Flow)
2. Lift Station 500 ($/gpm) (Peak)
3. Forcemain Pipe 10 ($/lf/in-dia)
4. Treatment (Expansion) 5 ($/gpd)
5. Contingency 40%
6. No cost is included for property acquisition, ROW/easement acquisition, legal, or engineering cost.

Phase 1

Phase	Description	Treatment Capacity (MGD)	Lift Station Peak Flow (MGD)	Lift Station Construction Cost ($)	Total Construction Cost ($)	Contingency ($)	Total Project Cost ($)
1	Lift Station	1.0	4	1,388,889	1,388,889	555,556	1,944,444

Phase	Description	Length (lf)	Length (mi)	Diameter (in)	Total Construction Cost ($)	Contingency ($)	Total Project Cost ($)
1	Forcemain (LS at WWTP to SM WWTP)	28,000	5.3	16	4,480,000	1,792,000	6,272,000

Phase	Description	Treatment Capacity (MGD)	Treatment Construction Cost ($)	Total Construction Cost ($)	Contingency ($)	Total Project Cost ($)
1	SM WWTP Expansion	1	5,000,000	5,000,000	2,000,000	7,000,000

GRAND TOTAL	10,868,889	4,347,556	15,216,444

Alliance Water WWTP Feasibility Study
Cost Estimate for Infrastructure Components

Energy Costs for Pumping

Assumptions:

Lift Station from Blanco Basin WWTP to San Marcos WWTP

Flow	24	MGD
	37.14	cfs
	16,666	gpm
Pipe Diameter Size	42	inch
Velocity	3.86	ft/s
Total Length	28,000	ft
C	100	
Start Elev	530	ft
High Point	593	ft
Bottom of LS	510	ft
Static loss	83	ft
Local losses	N/A	ft
Friction losses	47.68	ft
Total losses	130.68	ft

Lift Station on-site at Blanco Basin WWTP to Treatment

Flow	24	MGD
	37.14	cfs
	16,666	gpm
Pipe Diameter Size	42	inch
Velocity	3.86	ft/s
Total Length	200	ft
C	100	
Start Elev	530	ft
High Point	545	ft
Bottom of LS	510	ft
Static loss	35	ft
Local losses	N/A	ft
Friction losses	0.34	ft
Total losses	35.34	ft

Cost of Pumping Water:

Lift Station from Blanco Basin WWTP to San Marcos WWTP:

$C = 0.746 * Q * h * c / (3960 * u_p * u_m)$

Q = volume flow	16,666	gpm
h = head	130.68	ft
c = cost rate per kWh	0.09	$/kWh
u_p = pump efficiency	0.8	
u_m = motor efficiency	0.85	
C = cost per hour ($)	54	($/hr)
	475,693	($/yr)

Lift Station on-site at Blanco Basin WWTP to Treatment:

$C = 0.746 * Q * h * c / (3960 * u_p * u_m)$

Q = volume flow	16,666	gpm
h = head	35.34	ft
c = cost rate per kWh	0.09	$/kWh
u_p = pump efficiency	0.8	
u_m = motor efficiency	0.85	
C = cost per hour ($)	15	($/hr)
	128,645	($/yr)

Difference in Energy Costs
347,048 ($/yr)

Alliance Water WWTP Feasibility Study
Cost Estimate for Infrastructure Components

Energy Costs for Pumping

Assumptions:

Interim Lift Station within Blanco Basin to San Marcos WWTP

Flow	4	MGD
	6.19	cfs
	2,778	gpm
Pipe Diameter Size	16	inch
Velocity	4.43	ft/s
Total Length	28,000	ft
C	100	
Start Elev	560	ft
High Point	610	ft
Bottom of LS	540	ft
Static loss	70	ft
Local losses	N/A	ft
Friction losses	189.68	ft
Total losses	259.68	ft

Cost of Pumping Water:

$C = 0.746 * Q * h * c / (3960 * u_p * u_m)$

Q = volume flow	2,778	gpm
h = head	259.68	ft
c = cost rate per kWh	0.09	$/kWh
u_p = pump efficiency	0.8	
u_m = motor efficiency	0.85	
C = cost per hour ($)	18	($/hr)
	157,546	($/yr)