Skyway Gardens

FEASIBILITY REPORT

Prepared By:
TRE & Associates, LLC.
110 Mesa Park Drive, Suite 200
El Paso, Texas 79912
TBPE Firm # 13987

Prepared For:
Investment Builders, Inc.
7400 Viscount Blvd.
El Paso, Texas 79925

February 28, 2018
Table of Contents

Executive Summary ................................................................................................................. 1
Introduction ................................................................................................................................. 3
Site ............................................................................................................................................... 3
    Location ................................................................................................................................. 3
    Millage Rates for Taxing Jurisdiction .................................................................................. 4
    Platting Determination, Physical Boundary and Property ID .............................................. 5
    Zoning and Proposed Uses ................................................................................................. 6
Existing Conditions .................................................................................................................... 7
    Environmental assessment .................................................................................................... 7
    Soil Report ............................................................................................................................ 7
    Survey/Topography ................................................................................................................ 7
    Utilities .................................................................................................................................... 8
    Flood Zone ............................................................................................................................ 8
Subdivision Requirements ......................................................................................................... 8
    Local Requirements ............................................................................................................ 8
    Required Approvals, Permits and Fees ............................................................................... 9
    Timeline ............................................................................................................................... 9
    Ingress and Egress ............................................................................................................... 10
    Onsite Requirements .......................................................................................................... 10
    Offsite Requirements ........................................................................................................... 10
    Set-back Requirements ....................................................................................................... 10
    Fire Protection Requirements ............................................................................................. 10
    Drainage Requirements ...................................................................................................... 11
Conclusion .................................................................................................................................. 12
References .................................................................................................................................. 13

Figures

Figure 1: Vicinity Map ............................................................................................................. 1
Figure 2: Location Map .......................................................................................................... 3
Figure 3: Skyway Gardens Parcel Boundary ........................................................................... 5
Figure 4: Site Layout .............................................................................................................. 6
Figure 5: Overall Drainage Areas ............................................................................................ 11

Tables

Table 1: 2017 Millage Rates ................................................................................................... 4
Table 2: List of Required Approvals, Permits and Fees .......................................................... 9
Table 3: Activities and Timeline ............................................................................................. 9

Appendices

Appendix A-Utility Commitment Letters
Appendix B-U.S.G.S. Topo Map and West Texas Survey’s Boundary Survey
Appendix C-United States Department of Agriculture Soil’s Report
EXECUTIVE SUMMARY

TRE & Associates LLC (TRE), completed a Feasibility Report for the Skyway Gardens Development located in City of Alpine’s Extraterritorial Jurisdiction (ETJ). The intention of this study is to assist Investment Builders Inc. in meeting the 2018 Housing Tax Credit (HTC) requirements for an engineering analysis of the proposed development. It is the intent of Investment Builders Inc. to annex into the corporate limits of the City of Alpine. TRE performed due diligence by coordinating with City of Alpine, Brewster County, American Electric Power, Big Bend Telephone and AT&T when conducting this report. The site was analyzed for development within the year of 2018.

Skyway Gardens is a multi-family development that will be located on Lechuguilla Road near S Walker Street. It is proposed to be a new tax credit development which will consist of 49 units and recreational areas. Each of proposed buildings will contain units that range from 670 square feet to 1,060 square feet in size. The club house is proposed to be 2,065 square feet and will contain fitness center, community room, as well as other amenities. The site is abutted by a single roadway with 2 proposed driveways for adequate access. There are no adverse soil or environmental conditions and the site is nearby existing electric, gas, water and wastewater utilities. Skyway Gardens Project is in close proximity to schools and commercial services as seen in Figure 1 below, which illustrates the site as well as places of interest nearby.

Figure 1: Vicinity Map
All aspects of the site development are anticipated to be in compliance with the applicable guidelines, ordinances and codes of City of Alpine. The platting and subdivision improvement plans will need to be presented to City of Alpine Planning and Zoning Commission and City Council, in order to obtain approval. The report identifies the permits and fees that are required in order to develop the complex. After careful review and study of the proposed development, it was determined that there are no apparent concerns. Therefore, this report was written in support of the multi-family development.
INTRODUCTION

Investment Builders Inc. is preparing an application for 2018 HTC. Skyway Gardens is a proposed apartment development which will consist of 238,491 square feet (5.475 acres). The proposed development will include 49 units of 1, 2 and 3 bedrooms as well as a club house. The Site is located in Alpine, Texas. Ordinances, guidelines and codes from the City of Alpine were utilized in preparation of this report. The site, existing conditions and subdivision requirements were the areas of focus for the study.

SITE

LOCATION

The site is located in Alpine, Texas which is illustrated in Figure 2 below. The site is located south of Lechuguilla Street and east of S. Walker Street. The site is bound by commercial development to the north and west, vacant land to the south and Moss Creek to the east.
**MILLAGE RATES FOR TAXING JURISDICTION**

Table 1 below lists the 2017 millage rate per $100 and the entities associated with each rate.

<table>
<thead>
<tr>
<th>Entity</th>
<th>Millage Rate per $100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brewster County</td>
<td>0.386</td>
</tr>
<tr>
<td>Big Bend Regional Hospital District</td>
<td>0.121</td>
</tr>
<tr>
<td>City of Alpine</td>
<td>0.535</td>
</tr>
<tr>
<td>Alpine I.S.D.</td>
<td>1.233</td>
</tr>
<tr>
<td><strong>Total Tax Rate</strong></td>
<td><strong>2.275</strong></td>
</tr>
</tbody>
</table>
The site consists of approximately 5.475 acres, which is currently being platted as a parcel shown in Figure 3, below. The current legal description of the 5.475-acre property is as follows: “A 5.475 acre tract of land out of Section 102 in Block 9, G.H.&S.A. RY CO Survey being out of a 10.16 acre tract of land described in Book 210 at Page 472 and being all of a 1.0 acre tract of land described in Book 324 at Page 164 both recorded among the Official Public Records of Brewster County, Texas.” The property identification number from the Brewster County Central Appraisal District for Skyway Gardens is 32385.

Figure 3: Skyway Gardens Parcel Boundary
**ZONING AND PROPOSED USES**

According to Appendix C Zoning, Schedule of Districts Section IV, R-3 (Apartment District) zoning allows for high-density living including apartment houses, multiple family dwellings and town houses. However, the site lies within the City of Alpine ETJ with no zoning designations. Annexation petition has been submitted to City of Alpine with a request of R-3 zoning. The site will be used to develop an apartment complex. **Figure 4** below illustrates the proposed site plan. The site plan below is anticipated to adhere to all applicable site development and building code ordinances set by the City of Alpine.

![Site Layout Diagram]

**Figure 4: Site Layout**
EXISTING CONDITIONS

ENVIRONMENTAL ASSESSMENT

Construction & Environmental Consultants, Inc. (CECI) conducted the Phase I environmental site assessment dated February 26, 2018 which can be referenced in the application for the Texas Department of Housing Authority submittal. The study was performed in accordance with all ASTM site assessment standards, which included the site as well as surrounding areas. The intent of the assessment was to identify potential environmental concerns. CECI accounted for historical, regulatory, on-site recognized as well as off-site recognized environmental concerns while preparing their assessment. The historical review indicated that there was no evidence revealing prior industrial use for the proposed site. Federal and State environmental regulatory lists were utilized to determine that there are no regulatory environmental concerns. Further assessments as well as site reconnaissance aided in determining that there is no concern for off-site or on-site environmental conditions. Overall, the findings indicated that no environmental conditions exist for the site at this time.

SOIL REPORT

A soils report for the area of interest was obtained from the United States Department of Agriculture and can be referenced in Appendix C. The soil for the area of study is composed of 100% Musquiz clay loam and similar soils. The soil is classified as Group C from the AASHTO classification system. This type of soil consists of fine loamy, clay with a depth of approximately 80 inches below the surface. According to the report, the soil is well drained and there is no frequency of flooding or ponding associated with the soils. The report also indicates that there are no soil limitations that would affect the site.

SURVEY/TOPOGRAPHY

A survey of the site was obtained from West Texas Surveys and U.S. Geological Survey Topo Map which can be referenced in Appendix B. The survey from West Texas Surveys includes boundary information while USGS Topo map includes topographic information. Topography of the development area shows contours that are gently sloping down in a south-easterly direction.
**Utilities**

American Electric Power currently supplies overhead electric service near the site. The existing overhead electric distribution system is fully capable of supporting the new development. City of Alpine is able to provide natural gas service through extension of existing gas main from E. Avenue K. AT&T and Big Bend Telephone Company also has facilities in the vicinity which will provide service to the new development. City of Alpine also provides water and wastewater service to the area. There are existing 6” water and 6” wastewater lines along Lechuguilla Road with confirmed capacity that the site will be able to tie into. Utility availability confirmations can be referenced in Appendix A.

**Flood Zone**

The site currently lies in Flood Zone C. Flood Zone C is defined as an area of minimal flooding as per FIRM No. 4800840200C dated April 2, 1991.

**Subdivision Requirements**

**Local Requirements**

It will be necessary that the site be in compliance with all codes, ordinances, regulations and standards set by the City of Alpine. A URL link has been provided in the reference section of this report which contains the City’s development codes. City of Alpine Utility Department rules and regulations must be followed for water and wastewater. In addition, all building plans must conform to the 2012 International Building Code as adopted by the City of Alpine.
**Required Approvals, Permits and Fees**

Table 2 below lists the required reviews, approvals, permits and fees for the development of Skyway Gardens.

**Table 2: List of Required Approvals, Permits and Fees.**

<table>
<thead>
<tr>
<th>Review</th>
<th>Approval</th>
<th>Permit</th>
<th>Fees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building</td>
<td>City of Alpine Building Official</td>
<td>City of Alpine</td>
<td>$6484 ($25+$0.15 per sf)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Building Official</td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td>City of Alpine Building Official</td>
<td>City of Alpine</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Building Official</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Platting</td>
<td>City of Alpine</td>
<td>P&amp;Z Council</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$250</td>
</tr>
<tr>
<td>Re-zoning</td>
<td>City of Alpine</td>
<td>P&amp;Z Council</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$250</td>
</tr>
<tr>
<td>Subdivision Improvement Plans</td>
<td>City of Alpine Building Official</td>
<td>City of Alpine</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Building Official</td>
<td>Streets Dept</td>
</tr>
<tr>
<td>Water and Wastewater</td>
<td>City of Alpine Building Official</td>
<td>City of Alpine</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Building Official</td>
<td>Utility Dept</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Wastewater: $2025 Water: $2625</td>
</tr>
</tbody>
</table>

**Timeline**

Table 3 below lists the activities required to complete the development of the site along with the anticipated beginning and ending dates.

**Table 3: Activities and Timeline**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Begin Date</th>
<th>End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annexation</td>
<td>February 2018</td>
<td>July 2018</td>
</tr>
<tr>
<td>Platting</td>
<td>July 2018</td>
<td>August 2018</td>
</tr>
<tr>
<td>Subdivision Plan Approval</td>
<td>July 2018</td>
<td>August 2018</td>
</tr>
<tr>
<td>Recording of Plat</td>
<td>September 2018</td>
<td>September 2018</td>
</tr>
<tr>
<td>Building Plan Approval</td>
<td>August 2018</td>
<td>September 2018</td>
</tr>
<tr>
<td>Building Plan Permits</td>
<td>October 2018</td>
<td>October 2018</td>
</tr>
<tr>
<td>Construction</td>
<td>October 2018</td>
<td>November 2018</td>
</tr>
</tbody>
</table>
**INGRESS AND EGRESS**

A driveway access point to the site will be provided from Lechuguilla Road. There are no written ingress and egress requirements for this development.

**ONSITE REQUIREMENTS**

Section 98 of City of Alpine Code of Ordinances requires that the site be provided with water and sanitary sewer facilities. A comprehensive description of proposed drainage improvements can be found in the subsection entitled Drainage Requirements of this report. Also, no less than one parking space per unit shall be provided. The current site plan has incorporated 100 spaces, satisfying the local ordinance requirements.

**OFFSITE REQUIREMENTS**

No offsite developments or improvements are required for this development.

**SET-BACK REQUIREMENTS**

Section IV. Yard Standards  
(Minimum in feet)

<table>
<thead>
<tr>
<th></th>
<th>Front Yard</th>
<th>Side Yard</th>
<th>Side Yard Abutting a Side Street</th>
<th>Rear Yard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apartments</td>
<td>25</td>
<td>5</td>
<td>12.5</td>
<td>20</td>
</tr>
</tbody>
</table>

**FIRE PROTECTION REQUIREMENTS**

Alpine Fire Department requires that the 2012 International Fire Code be met.
**DRAINAGE REQUIREMENTS**

Per Section 86-4 of Alpine City Ordinance, ponding upon streets, sidewalks or other public property is prohibited. City of Alpine allows discharge of drainage runoff into Moss Creek. Drainage improvements are proposed as shown below in order to comply with the Alpine City Ordinance. Storm water in Skyway Gardens will be conveyed through swale along inverted crown roadway into the proposed retention pond. Storm water from the upstream property will be directed south of the site to be conveyed to Moss Creek as shown on Figure 5.

**Figure 5: Overall Drainage Areas**
CONCLUSION

Skyway Gardens tax credit development will provide 49 units to the City of Alpine. The property will have two access points providing adequate access through Lechuguilla Road. The surrounding development supports the multi-family development with nearby schools and commercial services in close proximity. There are no adverse soil or environmental conditions and the site has nearby existing electric, gas, water and wastewater utilities. The site will also provide for adequate drainage to retain all of its onsite runoff and direct upstream runoff in a southeasterly direction towards the nearby Moss Creek. On the basis of review of the information obtained during our assessment, it is our professional opinion that the development for the proposed site is feasible.
REFERENCES

- City Development Codes
  - http://cityofalpine.com/city-ordinances/
- United States Department of Agriculture
- Brewster County Central Appraisal District
  - http://www.brewstercotad.org/
- FEMA Flood Map Service Center
  - https://msc.fema.gov/portal
- USGS National Map Viewer
  - https://viewer.nationalmap.govviewer/
Appendix A

Utility Commitment Letters
Changho Yi

From: Eddie Pallarez <efpallarez@aep.com>
Sent: Friday, February 09, 2018 3:37 PM
To: Changho Yi
Cc: Linda Troncoso
Subject: RE: Service Availability Request

Follow Up Flag: Follow up
Flag Status: Flagged

Changho,

AEP does have primary service within the perimeter of this property and is eager to serve the proposed apartment complex. Please contact me for more information or call AEP Call Center 877-373-4858 to request new service.

From: Changho Yi [mailto:cyi@tr-eng.com]
Sent: Friday, February 09, 2018 11:19 AM
To: Eddie Pallarez
Cc: Linda Troncoso
Subject: [EXTERNAL] FW: Service Availability Request

This is an EXTERNAL email. STOP. THINK before you CLICK links or OPEN attachments. If suspicious please forward to incidents@aep.com for review.

Good morning Mr. Pallarez,

As per our conversation, please see the attached location map and preliminary site plan for an apartment complex project within the City of Alpine ETJ. This apartment complex project will consist of approximately 49 units. At this time, I respectfully request a confirmation of service availability for this property.

Also, at the bottom of this email chain, you can see Mr. Billy Melton’s response to another project he was helping me with.

If you have any questions, please let me know.
Thank you in advance for all your help,

Changho Yi, EIT
TRE & ASSOCIATES, LLC
110 Mesa Park Drive, Suite 200
El Paso, Texas 79912
P: (915)852-9093
F: (915)629-8506
C: (915)352-6558
cyi@tr-eng.com
Changho Yi

From: ARMSTRONG, LARRY <la4193@att.com>
Sent: Tuesday, February 06, 2018 3:02 PM
To: Changho Yi
Cc: ARMSTRONG, LARRY
Subject: RE: Service Availability for Alpine Property

Changho,

Yes, AT&T Texas Inc is the Local Exchange Carrier for Alpine, TX.

While there are no facilities in the area of your proposed apartment complex, we will build facilities to meet this new complex.

I will need a “911” address for the apartment complex to build to your location.

Thanks,

Larry Armstrong
Mgr Eng Design
432-684-1776

From: Changho Yi [mailto:cyi@tr-eng.com]
Sent: Tuesday, February 06, 2018 12:04 PM
To: ARMSTRONG, LARRY <la4193@att.com>
Cc: Linda Troncoso <ltroncoso@tr-eng.com>
Subject: Service Availability for Alpine Property

Good morning Larry,

I am working on a project in Alpine that consists of approximately 6-acres for a future apartment complex development of approximately 49 units (see attached).
At this time, I respectfully request your confirmation on utility availability for this property location.
If there isn’t an existing service line nearby, I would greatly appreciate it if you could still confirm provision of future service to the area.

Please let me know if you have any questions.
Thank you,

Changho Yi, EIT
TRE & ASSOCIATES, LLC
110 Mesa Park Drive, Suite 200
El Paso, Texas 79912
Good afternoon Mr. Yi. After speaking with our Engineering department there is only one type of active service available at this location. It is all dependent upon line-of-sight. Fiber could be made available to the location but it would require a small build out. In the event you wish to know what the exact dollar amount would be for that build out an engineering fee of $325 would need to be paid and not only would we provide an exact dollar amount but also any construction information that may lower the build out cost as well. Please let me know how you would like to proceed. Thank You for your time and hope you have a great evening.

-Rob

Changho Yi
TRE & ASSOCIATES, LLC
110 Mesa Park Drive, Suite 200
El Paso, Texas 79912
P: (915)852-9093

From: Changho Yi <cyi@tr-eng.com>
Sent: Monday, February 12, 2018 9:09 AM
To: Robert Rodriguez
Cc: Linda Troncoso
Subject: RE: Service for Alpine Property Project

Good morning Mr. Rodriguez,

I’m following up on the request for confirmation of service availability. Please let me know if you have any questions.

Thank you,

Changho Yi, EIT
TRE & ASSOCIATES, LLC
110 Mesa Park Drive, Suite 200
El Paso, Texas 79912
P: (915)852-9093
Good morning Changho Yi,

A natural gas main is located on E. Ave K that is estimated around 1300 to 1500 feet away from your location. The gas department currently charges $5.00 dollars per foot and a $500.00 dollar tap fee per location of a riser.

Hope this works for you.

Thanks,

Randy Guzman
Gas Utility Director
City of Alpine Gas Department
432-837-3437

Good morning Randy,

Please see below for the gas service availability request.

Thank you,

Changho Yi, EIT
TRE & ASSOCIATES, LLC
110 Mesa Park Drive, Suite 200
El Paso, Texas 79912
P: (915)852-9093
F: (915)629-8506
C: (915)352-6558
cyi@tr-eng.com
Changho Yi,

There is a 6" Water and a 6" sewer line that runs on the North Side of the property until it reaches Harrison after that the Water is a private line that runs to the end of Lechuguilla. The sewer ends at the manhole and turns into the RV park as a private sewer line. Please let me know if I can help in any other way.

J. Horry
Assistant City Manager
City Of Alpine
309 W. Sul Ross
Alpine, TX  79830
O. 432.837.3281 X 130
F.  432.837.1710

On Tue, Feb 6, 2018 at 12:39 PM, Changho Yi <cyi@tr-eng.com> wrote:

Good morning Mr. Horry,

I'm just following up on the water and wastewater service availability for the 6-acre property along Lechuguilla Road.

I would greatly appreciate it if you could confirm whether the existing sewer line along Lechuguilla extends adjacent to the property.
Appendix B

U.S.G.S. Topo Map and West Texas Survey’s Boundary Survey
METES AND BOUNDS DESCRIPTION of a 5.475 acre tract of land out of Section 102 in Block 9, G.H.&S.A. Ry Co Survey being out of a 10.16 acre tract of land described in Book 210 at Page 472 and being all of a 1.0 acre tract of land described in Book 324 at Page 164 both recorded among the Official Public Records of Brewster County, Texas and being more particularly described as follows:

BEGINNING at a point in the center of Lechuguilla Lane, a 60 foot road easement recorded in Book 171 at Page 435 of the Official Public Records said point being the northwest corner of this described tract, a 1/2" iron rod with cap marked "West Texas Surveys" set and being a point in the south line of a tract of land conveyed to John and Lorraine Tout by general warranty deed recorded in Book 171 at Page 435 among the Official Public Records of Brewster County and from which a 1/2" iron rod found to mark the southwest corner of Sanders Addition recorded at Plat Envelope 203 among the Map Records of Brewster County bears South 69 deg. 53 min. 55 sec. West a distance of 309.50 feet and a 1" pipe found to mark the southeast corner of Sanders Addition bears North 58 deg. 19 min. 23 sec. East a distance of 281.67 feet; Thence

North 64 deg. 26 min. 39 sec. East passing at 208.71 feet the northeast corner of the aforesaid 1.0 acre tract and continuing in all a distance of 653.0 feet to the northeast corner of this described tract, a 1/2" iron rod with cap marked "West Texas Surveys" set in the center of the aforesaid Lechuguilla Lane 60 foot road easement and from which the northeast corner of the aforesaid 10.16 acre tract bears North 64 deg. 26 min. 39 sec. East 144.10 feet; Thence

South 25 deg. 33 min. 21 sec. East a distance of 438.71 feet to a point for the southeast corner of this described tract, a 1/2" iron rod with cap marked "West Texas Surveys" set and from which a 1/2" iron rod with cap marked "Walker 4425" found to mark the southeast corner of the aforesaid 10.16 acre tract bears South 48 deg. 20 min. 57 sec. East 371.96 feet; Thence

South 64 deg. 26 min. 39 sec. West a distance of 444.29 feet to a point in the west line of the aforesaid 10.16 acre tract a 1/2" iron rod with cap marked "West Texas Surveys" set and from which a 1/2" iron rod with cap marked "Walker 4425" found for the southwest corner of the aforesaid 10.16 acre bears South 25 deg. 33 min. 21 see East 343.46 feet; Thence

North 25 deg. 33 min. 21 sec. West a distance of 230.0 feet to a point for an interior corner of the described tract and being the southeast corner of the aforesaid 1.0 acre tract, a 1/2" iron rod with cap marked "Walker 4425" found; Thence

South 64 deg. 26 min. 39 sec. West a distance of 208.71 feet to a point for corner being the southwest corner of the aforesaid 1.0 acre tract, a 1/2" iron rod with cap marked "Walker 4425" found; Thence

North 25 deg. 33 min. 21 sec. West passing at 178.71 feet a 1/2" iron rod with cap marked "Walker 4425" found to mark the south line of the 60 foot road easement and continuing in all a distance of 208.71 feet to the POINT OF BEGINNING and containing 5.475 acres of land.

This survey was prepared without the benefit of a title report and may not reflect easements, rights of ways, or other restrictions of record. A Plat Of Survey accompanies this description. Bearings are based upon deed bearings shown on previous survey of this property by Steve Walker RPLS #4425.

According to the information depicted on the FIRM MAP Community Panel No. 480084 0002 C dated April 2, 1991 part of this property is in ZONE A 2, an area determined to be within the established 100 year floodplain of Moss Creek. See note on Plat Of Survey in reference to flood limits.

I hereby certify that the information and description shown hereon was based upon an actual field survey made on the ground by me and that the information shown hereon is true and correct to the best of my knowledge and belief.

Signed Ken West Date Feb 27, 2006

Ken West Registered Professional Land Surveyor #5927
Appendix C

United States Department of Agriculture Soil’s Report
Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require
alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA’s TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.
# Contents

Preface ........................................................................................................................................... 2  
How Soil Surveys Are Made ........................................................................................................ 5  
Soil Map ....................................................................................................................................... 8  
  Soil Map .................................................................................................................................. 9  
Legend ........................................................................................................................................ 10  
Map Unit Legend .......................................................................................................................... 11  
Map Unit Descriptions .................................................................................................................. 11  
  Brewster County, Texas (Main Part) ......................................................................................... 13  
    MZA—Musquiz clay loam, 0 to 3 percent slopes ............................................................... 13  
References ..................................................................................................................................... 15
How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil
scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and
identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.
Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.
The soil surveys that comprise your AOI were mapped at 1:31,700.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: 
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Brewster County, Texas (Main Part)
Survey Area Data: Version 25, Nov 7, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 3, 2014—Mar 16, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.
Map Unit Legend

<table>
<thead>
<tr>
<th>Map Unit Symbol</th>
<th>Map Unit Name</th>
<th>Acres in AOI</th>
<th>Percent of AOI</th>
</tr>
</thead>
<tbody>
<tr>
<td>MZA</td>
<td>Musquiz clay loam, 0 to 3 percent slopes</td>
<td>5.8</td>
<td>100.0%</td>
</tr>
<tr>
<td>Totals for Area of Interest</td>
<td></td>
<td>5.8</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.
An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a soil series. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into soil phases. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A complex consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An association is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An undifferentiated group is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include miscellaneous areas. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.
Brewster County, Texas (Main Part)

MZA—Musquiz clay loam, 0 to 3 percent slopes

Map Unit Setting
- National map unit symbol: 2q8cd
- Elevation: 4,500 to 6,700 feet
- Mean annual precipitation: 14 to 20 inches
- Mean annual air temperature: 59 to 61 degrees F
- Frost-free period: 180 to 220 days
- Farmland classification: Prime farmland if irrigated

Map Unit Composition
- Musquiz and similar soils: 80 percent
- Minor components: 20 percent
- Estimates are based on observations, descriptions, and transects of the map unit.

Description of Musquiz

Setting
- Landform: Fan remnants
- Down-slope shape: Linear
- Across-slope shape: Linear
- Parent material: Loamy alluvium derived from igneous rock

Typical profile
- A - 0 to 7 inches: clay loam
- Bt - 7 to 35 inches: clay
- Btk - 35 to 79 inches: clay

Properties and qualities
- Slope: 0 to 3 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Well drained
- Runoff class: Medium
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 25 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: High (about 9.1 inches)

Interpretive groups
- Land capability classification (irrigated): None specified
- Land capability classification (nonirrigated): 6c
- Hydrologic Soil Group: C
- Ecological site: Clay Loam, Mixed Prairie (R042XE758TX)
- Hydric soil rating: No

Minor Components

Berrend
- Percent of map unit: 10 percent
Landform: Fan remnants
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: Loamy Slope, Mixed Prairie (R042XE694TX)
Hydric soil rating: No

Phantom
Percent of map unit: 5 percent
Landform: Fan skirts
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clay Flat, Mixed Prairie (R042XE272TX)
Hydric soil rating: No

Murray
Percent of map unit: 5 percent
Landform: Fan remnants
Landform position (three-dimensional): Riser
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Loamy Slope, Mixed Prairie (R042XE694TX)
Hydric soil rating: No
References


