# HRS DOCUMENTATION RECORD COVER SHEET

**Name of Site:** Highway 18 Ground Water
**EPA ID No.** TXN000606716

**Contact Persons**

| | | |
|---|---|---|
| Site Investigation: | Kandice Spera, TCEQ<br>Superfund Project Manager | 512/239-2263 |
| Documentation Record: | Brenda Cook, USEPA<br>Region 6 NPL Coordinator | 214/665-7436 |

Pathways, Components, or Threats Not Scored

### Surface Water Pathway

The Surface Water Pathway was not scored because the inclusion of this pathway would not significantly affect the site score. This pathway is not likely to be of concern in the future.

### Soil Exposure Pathway

The Soil Exposure Pathway was not scored because the inclusion of this pathway would not significantly affect the site score. A lack of certainty regarding source and contamination route leaves open the possibility that this pathway may contain contamination not discovered during the Site Inspection (SI) and Expanded Site Inspection (ESI) sampling events.

### Air Migration Pathway

The Air Migration Pathway was not scored because the inclusion of this pathway would not significantly affect the site score. This pathway is not likely to be of concern in the future.

# HRS DOCUMENTATION RECORD

Name of Site: Highway 18 Ground Water    Date Prepared: September 2016

EPA Region: 6

Street Address of Site*: Intersection of Highway 18 and Jeffee Drive

City, County, State, Zip Code: Kermit, Winkler County, Texas, 79745

General Location in the State: The Highway 18 Ground Water site is located (site center) at the intersection of S. Poplar Street/Highway 18 and Jeffee Drive in Winkler County, Texas, within the city limits of the City of Kermit (see Figure 1 for Regional Location Map).

Topographic Map: U.S. Geological Survey 7.5 Minute Topographic Map, Kermit Quadrangle. Map date 2016.

Latitude: 31° 51' 7.20" North

Longitude: -103° 5' 26.45" West

Ref: Coordinates are based on the center of the approximate plume as determined through previous sampling events (see Figure 2).

*The street address, coordinates, and contaminant locations presented in this HRS documentation record identify the general area the site is located. They represent one or more locations EPA considers to be part of the site based on the screening information EPA used to evaluate the site for NPL listing. EPA lists national priorities among the known "releases or threatened releases" of hazardous substances; thus, the focus is on the release, not precisely delineated boundaries. A site is defined as where a hazardous substance has been "deposited, stored, disposed, or placed, or has otherwise come to be located." Generally, HRS scoring and the subsequent listing of a release merely represent the initial determination that a certain area may need to be addressed under CERCLA. Accordingly, EPA contemplates that the preliminary description of facility boundaries at the time of scoring will be refined as more information is developed as to where the contamination has come to be located.

Scores

| | |
|---|---|
| Air Pathway | NS |
| Ground Water Pathway | 100.00 |
| Soil Exposure Pathway | NS |
| Surface Water Pathway | NS |
| **HRS SITE SCORE** | **50.00** |

## WORKSHEET FOR COMPUTING HRS SITE SCORE

| | | S | $S^2$ |
|---|---|---|---|
| 1. | Ground Water Migration Pathway Score ($S_{gw}$) | 100.00 | 10,000 |
| 2a. | Surface Water Overland/Flood Migration Component (from Table 4-1, line 30) | NS | NS |
| 2b. | Ground Water to Surface Water Migration Component (from Table 4-25, line 28) | NS | NS |
| 2c. | Surface Water Migration Pathway Score ($S_{sw}$) Enter the larger of lines 2a and 2b as the pathway score. | NS | NS |
| 3. | Soil Exposure Pathway Score ($S_s$) (from Table 5-1, line 22) | NS | NS |
| 4. | Air Migration Pathway Score ($S_a$) (from Table 6-1, line 12) | NS | NS |
| 5. | Total of $S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2$ | 100.00 | 10,000 |
| 6. | **HRS Site Score** Divide the value on line 5 by 4 and take the square root | | 50.00 |

**HRS Table 3-1 –Ground Water Migration Pathway Scoresheet**

| Factor Categories and Factors | Maximum Value | Value Assigned |
|---|---|---|
| **Likelihood of Release to an Aquifer:** | | |
| 1. Observed Release | 550 | 550 |
| 2. Potential to Release: | | |
| 2a. Containment | 10 | |
| 2b. Net Precipitation | 10 | |
| 2c. Depth to Aquifer | 5 | |
| 2d. Travel Time | 35 | |
| 2e. Potential to Release [lines 2a x (2b + 2c+ 2d)] | 500 | |
| 3. Likelihood of Release (higher of lines 1 and 2e) | 550 | 550 |
| **Waste Characteristics:** | | |
| 4. Toxicity/Mobility | (a) | 1000 |
| 5. Hazardous Waste Quantity | (a) | 100 |
| 6. Waste Characteristics | 100 | 18 |
| **Targets**: | | |
| 7. Nearest Well | 50 | 50 |
| 8. Population: | | |
| 8a. Level I Concentrations | (b) | 25,395.2 |
| 8b. Level II Concentrations | (b) | 1,907.64 |
| 8c. Potential Contamination | (b) | 75.5 |
| 8d. Population (lines 8a + 8b + 8c) | (b) | 27,378.34 |
| 9. Resources | 5 | 0 |
| 10. Wellhead Protection Area | 20 | 0 |
| 11. Targets (lines 7 + 8d + 9 + 10) | (b) | 27,428.34 |
| **Ground Water Migration Score For An Aquifer:** | | |
| 12. Aquifer Score [(lines 3 x 6 x 11)/82,500][c] | 100 | 100.00 |
| **Ground Water Migration Pathway Score:** | | |
| 13. Pathway Score ($S_{gw}$), (highest value from line 12 for all aquifers evaluated)[c] | 100 | 100.00 |

[a]Maximum value applies to waste characteristics category.
[b]Maximum value not applicable.
[c]Do not round to nearest integer.

# REFERENCES


Ref.
No. Description of the Reference

1. U.S. Environmental Protection Agency. Hazard Ranking System, 55 FR 51533, December 14, 1990. Excerpt. 1 page. A complete copy is available at http://semspub.epa.gov/src/document/HQ/174028.

2. U.S. Environmental Protection Agency. Superfund Chemical Data Matrix. Appendix A- Chemical Data, Factor Values and Benchmarks for Chemical Substances. Accessed on July 7, 2016 at: https://www.epa.gov/superfund/superfund-chemical-data-matrix-scdm. 3 excerpted pages.

3. Texas Commission on Environmental Quality. Ground Water Contamination Confirmed: City of Kermit – PWS ID# 2480001. November 6, 2002. 42 pages.

4. Texas Commission on Environmental Quality. DDW Water System Summary Sheet. Accessed on February 4, 2016 at: http://dww2.tceq.texas.gov/DWW/JSP/Violation.jsp?tinwsys_is_number=6510&tinwsys_st_code=TX&wsnumber=TX2480001&DWWState=TX&tmnviol_is_number=177431&tmnviol_st_code=TX. 12 pages.

5. City of Kermit. Water Well Schematics and Logs. February 10, 2014. 26 pages.

6. Kandice Spera. Texas Commission on Environmental Quality Project Manager. Telephone Memo to the File: Conversation with Sylvester Alarcon, Kermit PWS, regarding water distribution beyond city limits. April 22, 2015. 1 page.

7. EA Engineering, Science, and Technology, Inc. Field Summary Report for Public Water Supply and Private Water Well Sampling. August 2013. 199 pages.

8. U.S. Environmental Protection Agency. Final Analytical Report: City of Kermit PWS. September 5, 2014. 94 pages.

9. U.S. Environmental Protection Agency. Final Analytical Report: City of Kermit PWS. November 16, 2015. 96 pages.

10. Texas Water Development Board. Water Information Integration & Dissemination System, “Groundwater Database Results”. Available at: http://www2.twdb.texas.gov/apps/waterdatainteractive/groundwaterdataviewer. Accessed June 30, 2015, March 18, 2016, and April 4, 2016. 252 pages.

11. Kandice Spera. Texas Commission on Environmental Quality Project Manager. Field Notebook: Kermit PWS Site Inspection. July 28 - 30, 2014. 26 pages.

12. Matt Hubbard. Texas Commission on Environmental Quality Project Manager. Field Notebook: Kermit PWS Expanded Site Inspection; October 6-8, 2015. 24 pages.

13. Texas Commission on Environmental Quality. Field Notebook: Kermit PWS ID# 2480001. June 4-6, 2013. 19 pages.

14. Kandice Spera. Texas Commission on Environmental Quality Project Manager. Telephone Memo to the File: Conversation with John Shepard, City of Kermit Director of Public Works, regarding active wells. November 20, 2015. 1 page.

15. Stephen Ellis. Texas Commission on Environmental Quality Project Manager. Telephone Memo to the File: Conversation with Kermit PWS representative regarding well plugging details. July 14, 2016. 1 pages.

16. Texas Commission on Environmental Quality. Dry Cleaner Registration Forms. Accessed March 9, 2015. 43 pages.

17. Kandice Spera. Texas Commission on Environmental Quality Project Manager. Telephone Memo to the File: Conversation with owner regarding use of PCE at dry cleaning facility. May 16, 2014. 1 page.

18. Kandice Spera. Texas Commission on Environmental Quality Project Manager. Telephone Memo to the File: Conversation with owner regarding use of PCE at dry cleaning facility. September 24, 2013. 1 page.

19. Texas Commission on Environmental Quality. Field Notebook: Kermit PWS ESI Reconnaissance. July 22, 2015. 12 pages.

20. U.S. Department of Health & Human Services. Health & Safety Information on Household Products: Tetrachloroethylene. Accessed on January 8, 2016 at: http://hpd.nlm.nih.gov/cgi-bin/household/search?tbl=TblChemicals&queryx=127-18-4. 2 pages.

21. Texas Commission on Environmental Quality. Kermit PWS Site Inspection Work Plan. June 2014. 425 pages.

22. Texas Commission on Environmental Quality. Kermit PWS Expanded Site Inspection Work Plan. September 2015. 30 excerpted pages.

23. U.S. Environmental Protection Agency. Evaluating Ground Water Plumes Under the Hazard Ranking System, EPA 540-F-95-034, OSWER Publication 9320.8-01FS, September 1998. 5 pages.

24. Sergio Garza and John B. Wesselman. Geology and Ground-water Resources of Winkler County, Texas: Geological Survey Water-Supply Paper 1582. November 1959. 173 pages.

25. Peter G. George, Robert E. Mace, and Rima Petrossian. Aquifers of Texas. July 2011. 5 excerpted pages.

26. Robert G. Bradley and Sanjeev Kalaswad, PhD. "Chapter 12: The Dockum Aquifer in West Texas," in: Report 356 Aquifers of West Texas. Texas Water Development Board. December 2001. Accessed December 19, 2013 at: http://www.twdb.texas.gov/publications/reports/numbered_reports/doc/r356/chapter12_13.pdf. 8 pages.

27. Texas Water Development Board. 1976 Geologic Atlas of Texas: Pecos. Accessed June 22, 2016. https://www.twdb.texas.gov/groundwater/aquifer/GAT/pecos.htm. 4 pages.

28. Kandice Spera. Texas Commission on Environmental Quality Project Manager. Email Correspondence with John Shepard, City of Kermit Director of Public Works, regarding Kermit PWS details. August 6, 2013. 2 pages.

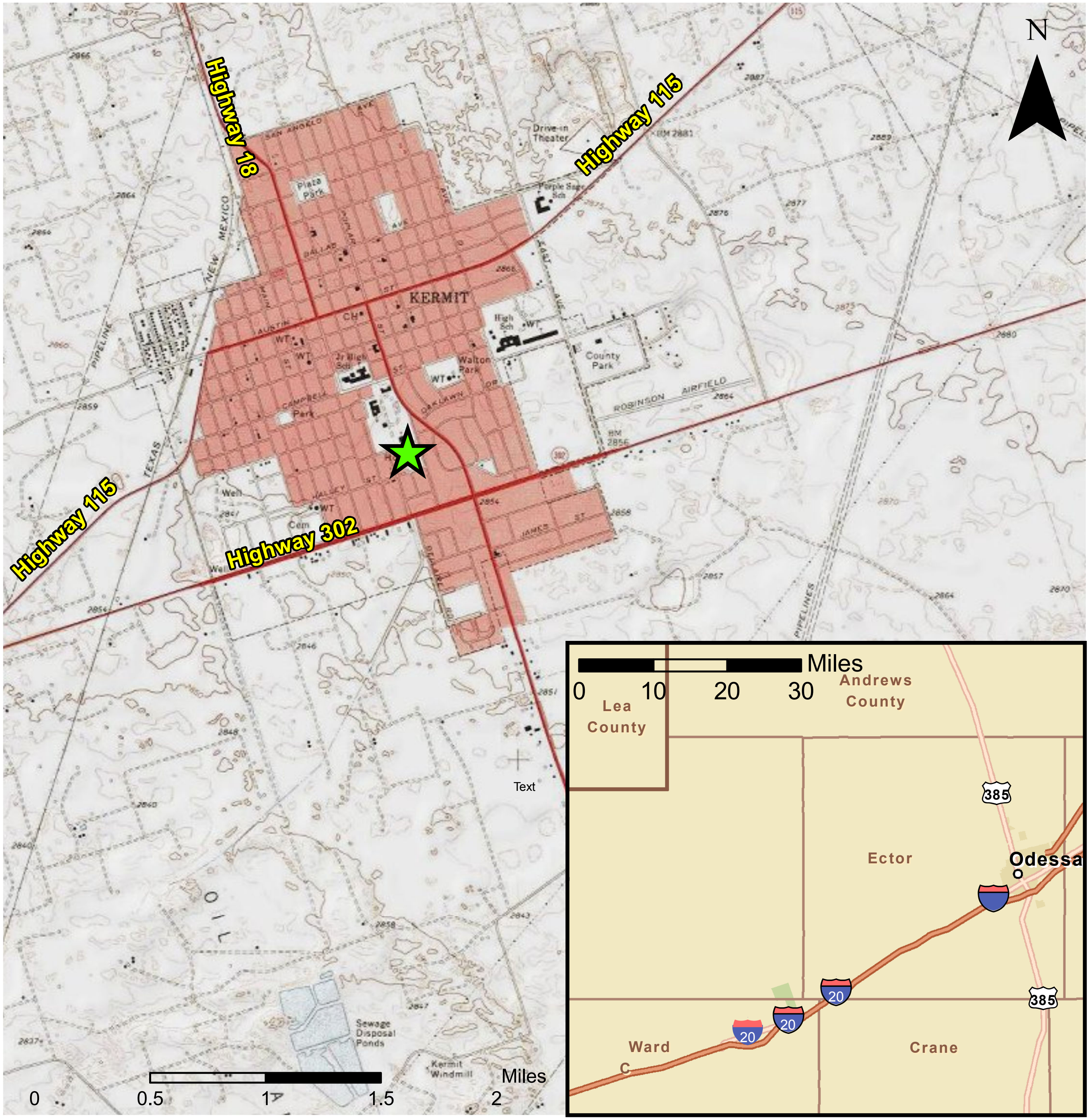
29. Kandice Spera. Texas Commission on Environmental Quality Project Manager. Email Correspondence with Midland County Fresh Water District representatives regarding well use details. July 1 and 2, 2015. 2 pages.

30. Texas Commission on Environmental Quality. Texas Drinking Water Watch- City of Midland Water Purification Plant. Accessed on April 5, 2016 at: http://dww2.tceq.texas.gov/DWW/JSP/Violation.jsp?tinwsys_is_number=6510&tinwsys_st_code=TX&wsnumber=TX2480001&DWWState=TX&tmnviol_is_number=177431&tmnviol_st_code=TX. 4 pages.

31. Stephen Ellis. Texas Commission on Environmental Quality Project Manager. Telephone Memo to the File: Conversation with Texas Moon employee regarding employee water well consumption. July 14, 2016. 1 pages.

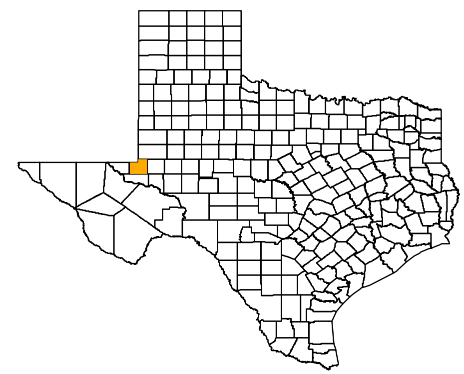
32. Texas Commission on Environmental Quality. Email Correspondence: Sean Ables to Kandice Spera. August 13, 2013. 1 page.

# Figure 1. Site Location Map



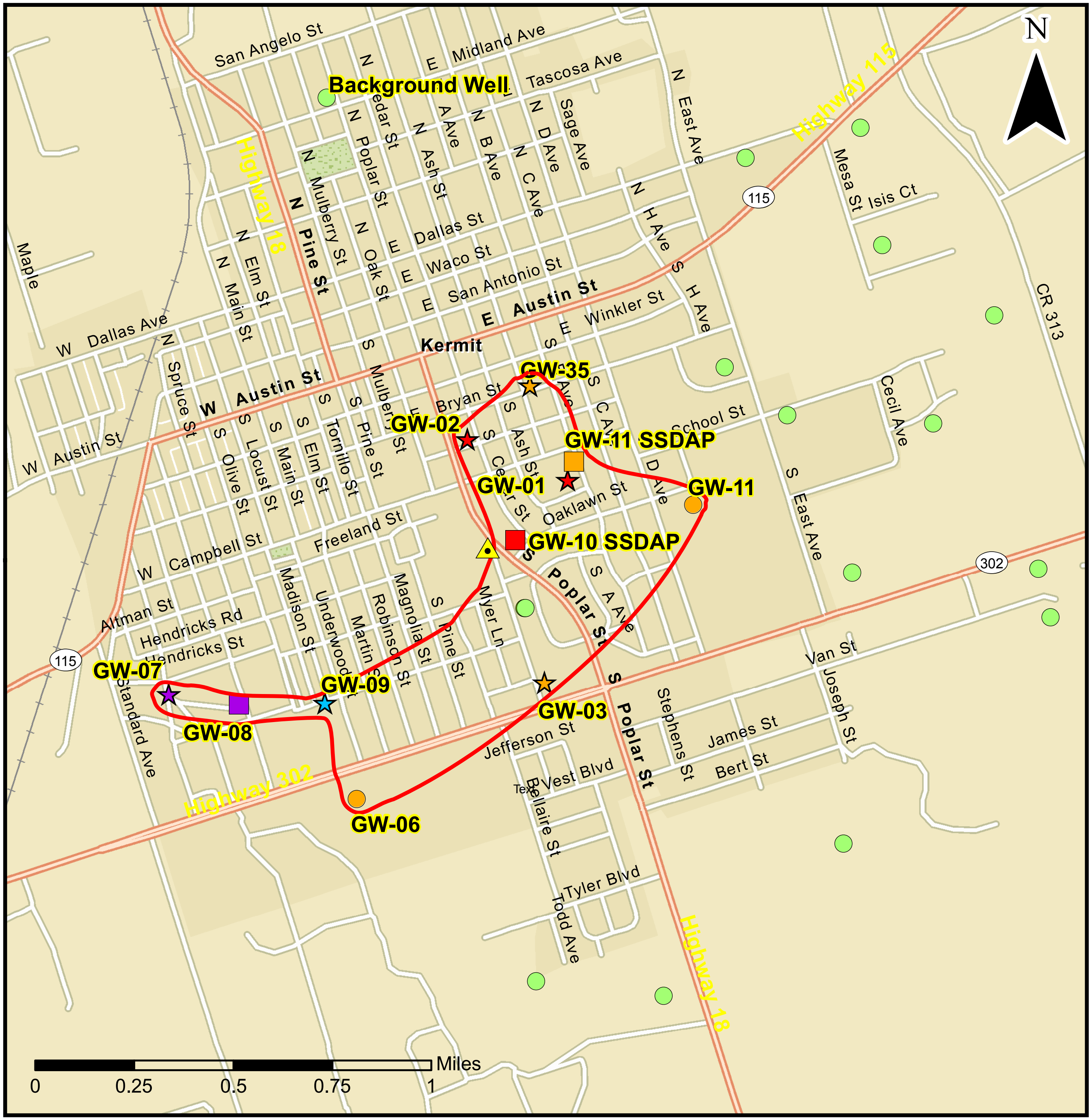

**High Plains Ground Water**
**TXN000606716**
**Kermit, Winkler County, Texas**

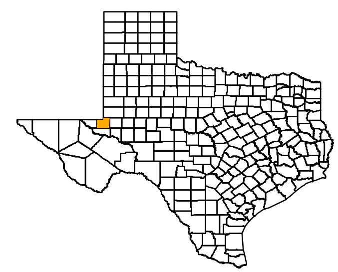
Site Center



The base map for the inset map is the Esri North America Street Map. The base map for the main map is the 2013 ESRI USA Topographic Map. The source of thess map images is Esri, used by the EPA with Esri's permission. For both maps: Map Projection: WGS 1984. Coordinate System: Web Mercator Auxiliary Sphere. This map was generated by the Remediation Division of the Texas Commission on Environmental Quality. It is intended for illustrative or informational purposes only, and is not suitable for legal, engineering, or survey purposes. This map does not represent an on-the-ground survey conducted by or under the supervision of a registered professional land surveyor. In cases where property boundaries are shown, it only represents their approximate relative locations. No claims are made to the accuracy or completeness of the data or to its suitability for a particular use. For more information concerning this map, contact the Remediation Division at 800-633-9363. Map created on March 18, 2016 by Kandice Spera.

# Figure 2. Ground Water Plume Map



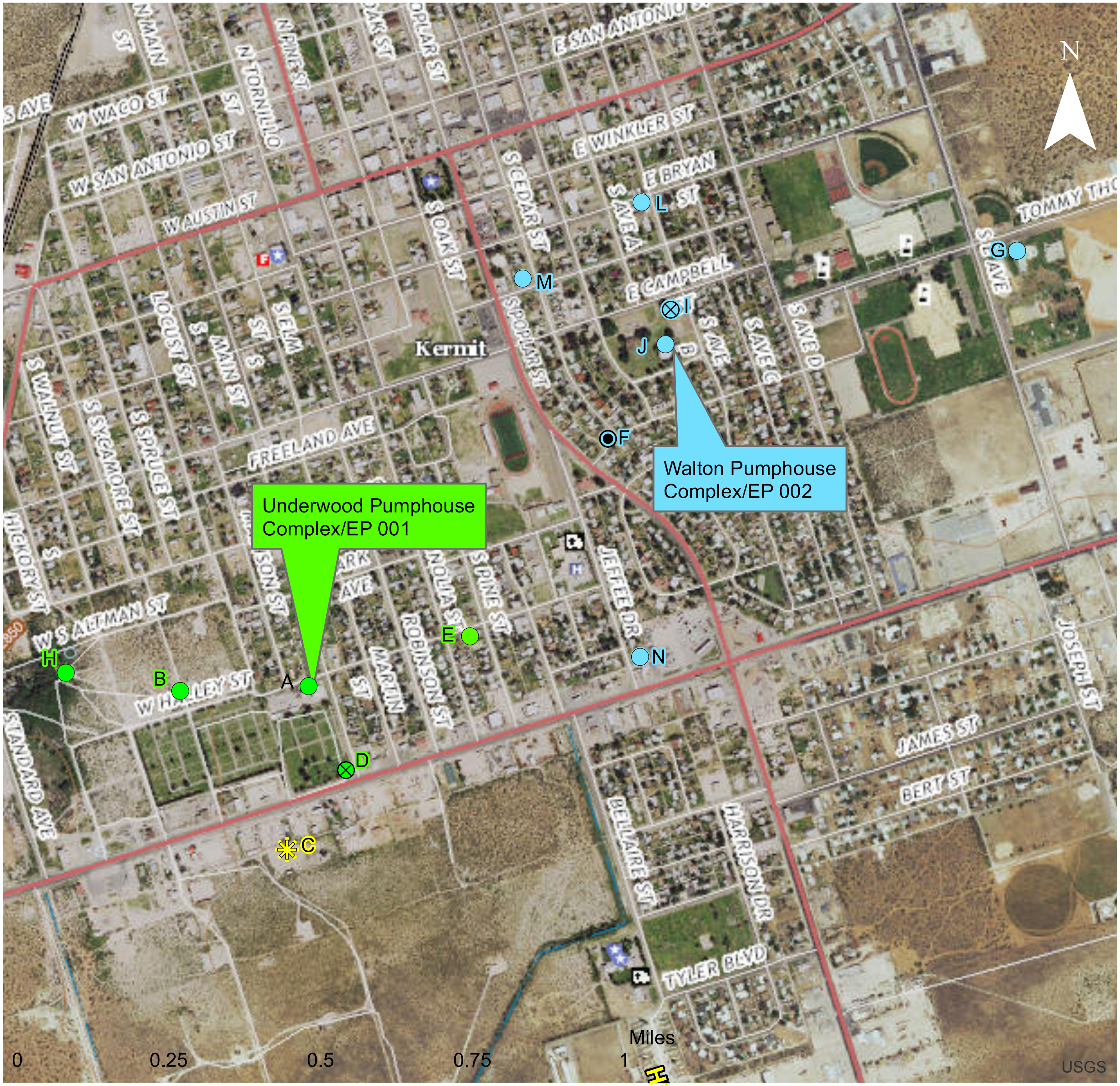



**Highway 18 Ground Water**
**TXN000606716**
**Kermit, Winkler County, Texas**

- Site Center: 31.849577 -103.090716
- Public Water Supply Well
- Approximate Plume Boundary
- Ground Water Sample- No Detection
- TCE detected < SCDM Benchmark
- TCE detected > SCDM Benchmark
- PCE detected < MCL
- PCE detected > MCL
- TCE detected > SCDM Benchmark (SSDAP PWS Sample)
- PCE detected < MCL (SSDAP PWS Sample)
- PCE detected > MCL (SSDAP PWS Sample)

The source of this map image is Esri used by the EPA with Esri's permission. Map Projection: WGS 1984. The base map is the Esri North America Street Map. This map was generated by the Remediation Division of the Texas Commission on Environmental Quality. It is intended for illustrative or informational purposes only, and is not suitable for legal, engineering, or survey purposes. This map does not represent an on-the-ground survey conducted by or under the supervision of a registered professional land surveyor. In cases where property boundaries are shown, it only represents their approximate relative locations. No claims are made to the accuracy or completeness of the data or to its suitability for a particular use. For more information concerning this map, contact the Remediation Division at 800-633-9363. Map created on March 18, 2016 by Stephen Ellis.

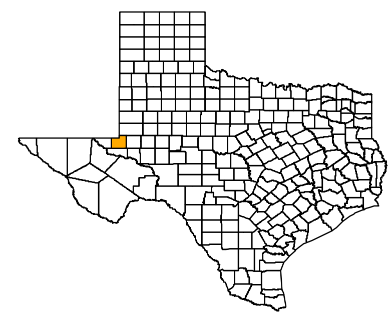
# Figure 3. Kermit Water Supply System Map




TCEQ

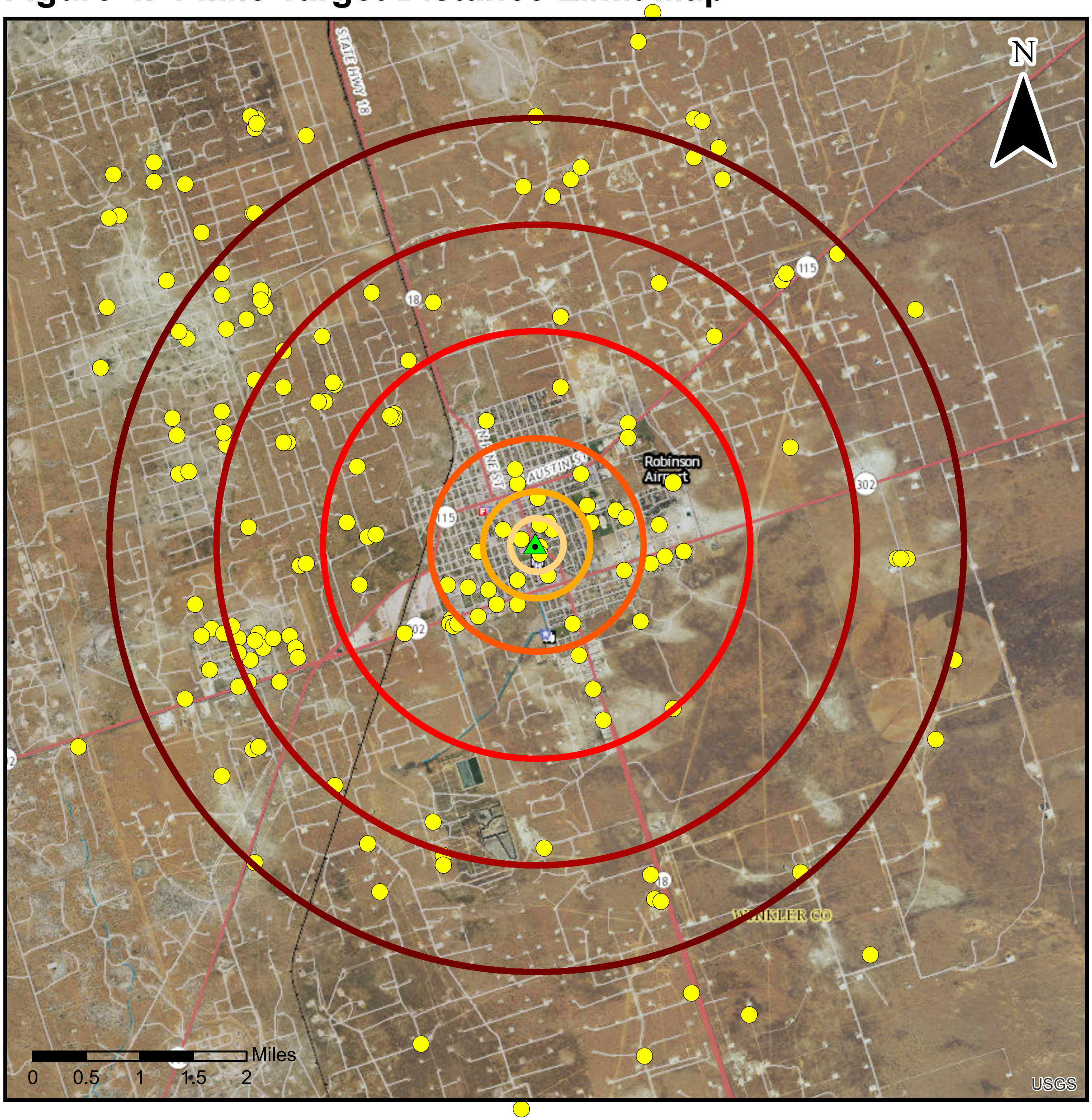
**High Plains Ground Water**
**TXN000606716**
**Kermit, Winkler County, Texas**

Active Well
Inactive Well
Monitor Well
Plugged Well
A Kermit PWS Well Designation



The base map is a USGS Imagery with Topo map published by the USGS, modified on 2/12/2015. Projection: Web Mercator Auxiliary Sphere. Coordinate System: WGS 1984. This map was generated by the Remediation Division of the Texas Commission on Environmental Quality. It is intended for illustrative or informational purposes only, and is not suitable for legal, engineering, or survey purposes. This map does not represent an on-the-ground survey conducted by or under the supervision of a registered professional land surveyor. In cases where property boundaries are shown, it only represents their approximate relative location. No claims are made to the accuracy or completeness of the data or to its suitability for a particular use. For more information concerning this map, contact the Remediation Division at 800-633-9363. Map created by Kandice Spera in March 2015.

# Figure 4. 4-Mile Target Distance Limit Map




TCEQ

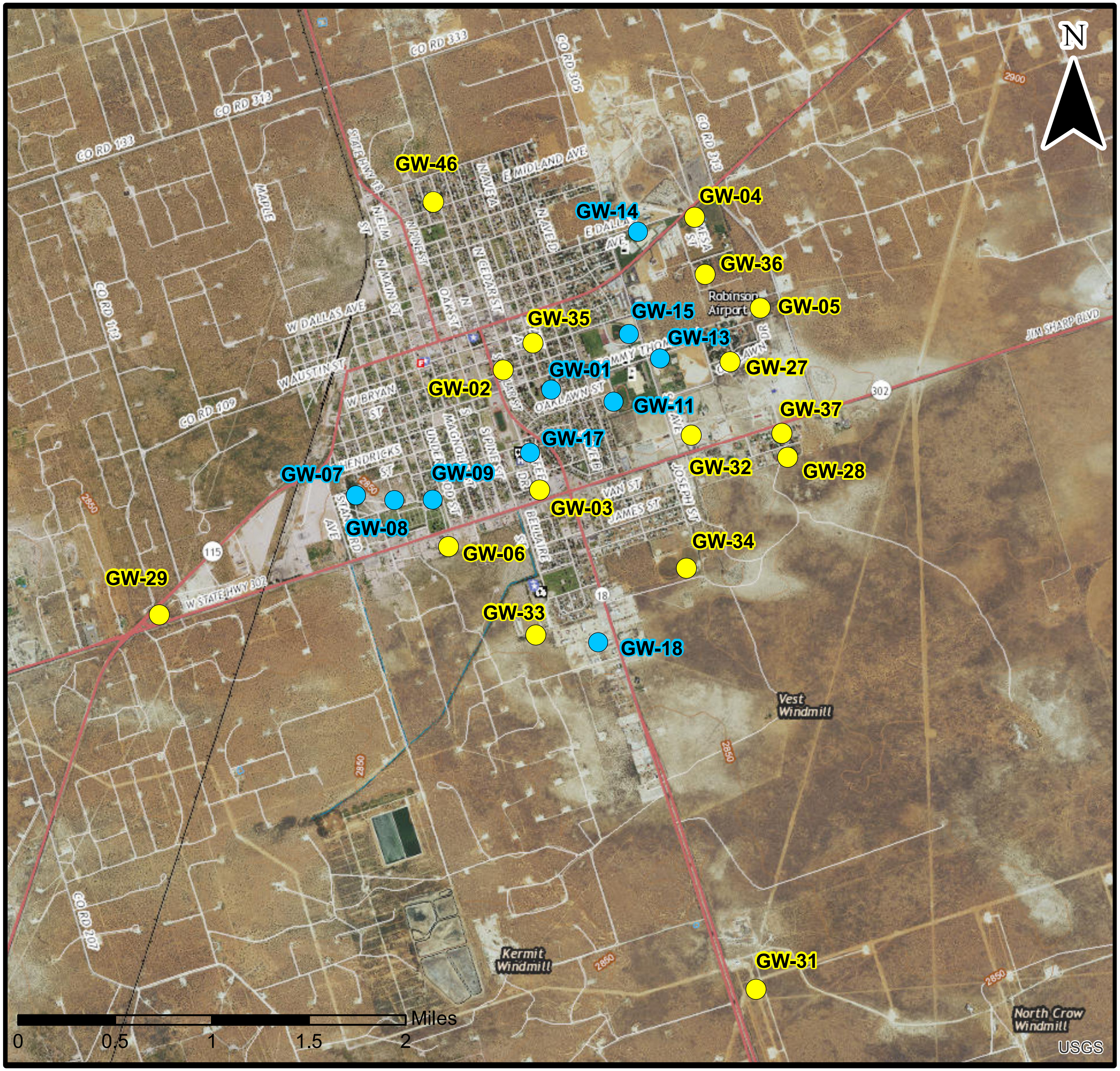
**High Plains Ground Water**
**TXN000606716**
**Kermit, Winkler County, Texas**

Site Center:
31.849577
-103.090716

Water Well
0.25 Mile
0.50 Mile
1.0 Mile
2.0 Miles
3.0 Miles
4.0 Miles

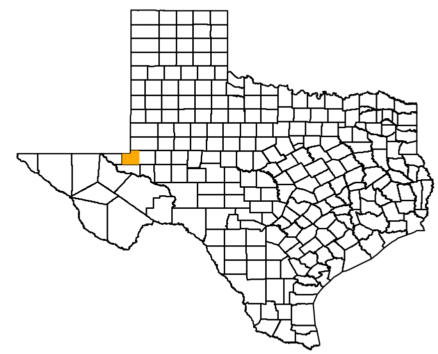
The base map is a USGS Imagery with Topo map published by the USGS, modified on 2/12/2015. Projection: Web Mercator Auxiliary Sphere. Coordinate System: WGS 1984. This map was generated by the Remediation Division of the Texas Commission on Environmental Quality. It is intended for illustrative or informational purposes only, and is not suitable for legal, engineering, or survey purposes. This map does not represent an on-the-ground survey conducted by or under the supervision of a registered professional land surveyor. In cases where property boundaries are shown, it only represents their approximate relative locations. No claims are made to the accuracy or completeness of the data or to its suitability for a particular use. For more information concerning this map, contact the Remediation Division at 800-633-9363. Map created on

# Figure 5. Ground Water Sample Location Map




**Highway 18 Ground Water**
**TXN000606716**
**Kermit, Winkler County, Texas**

SI Sample Location
ESI Sample Location



The base map is a USGS Imagery with Topo map published by the USGS, modified on 2/12/2015. Projection: Web Mercator Auxiliary Sphere. Coordinate System: WGS 1984. This map was generated by the Remediation Division of the Texas Commission on Environmental Quality. It is intended for illustrative or informational purposes only, and is not suitable for legal, engineering, or survey purposes. This map does not represent an on-the-ground survey conducted by or under the supervision of a registered professional land surveyor. In cases where property boundaries are shown, it only represents their approximate relative location. No claims are made to the accuracy or completeness of the data or to its suitability for a particular use. For more information concerning this map, contact the Remediation Division at 800-633-9363. Map created on October 27, 2015 by Kandice Spera.

# SITE SUMMARY

Site Description:

The Highway 18 Ground Water (formerly known as Kermit PWS) site is a tetrachloroethene (PCE) and trichloroethene (TCE) contaminated ground water plume originating from an unknown source located in Kermit, Texas, with the site center at the intersection of Highway 18 and Jeffee Drive (Figures 1 and 2). The Texas Commission on Environmental Quality (TCEQ) confirmed contamination through a Superfund Site Discovery and Assessment Program (SSDAP) sampling event in June 2013, a Site Inspection (SI) sampling event in July 2014, and an Expanded Site Inspection (ESI) sampling event in October 2015. Despite efforts to identity sources through soil sampling of dry cleaner and automotive repair facilities during the SI and ESI, contamination was determined to originate from an unknown source (or sources) that released into the Santa Rosa Aquifer.

The Kermit Public Water Supply (PWS) first detected TCE in its system in 1994; PCE was first detected in 2000 (Ref. 3, p. 20). The Kermit PWS owns 11 wells, all located within the Kermit city limits, which supply water to 5,714 individuals on 2,465 connections (Figure 3; Ref. 4, p. 2). Ground water is chlorinated before reaching two pump houses in the eastern and western half of the city, where it is then blended and distributed to the residents of Kermit (Ref. 5, p. 6). Each pump house supplies approximately half of the population of Kermit with water through a single blended system (Ref. 6, p. 1). (See Section 3.3, Targets, of this HRS documentation record for more detailed information). PCE was detected above the Maximum Contaminant Level (MCL) in three Kermit PWS wells, and at significant concentrations in three additional Kermit PWS wells during sampling between 2013 and 2015 (Ref. 2, p. 1; Ref. 7, p. 8; Ref. 8, pp. 32-33; Ref. 9, pp. 27, 61). Three separate Kermit PWS wells contained TCE during the same events; two sample results exceeded the Superfund Chemical Data Matrix (SCDM) benchmark for TCE (Ref. 2, p. 3; Ref. 7, p. 8; Ref. 8, pp. 33, 37; see also section 3.1.1, Observed Release, of this HRS documentation record). No Kermit PWS well recorded both TCE and PCE.

The City of Kermit is mixed residential and commercial, and the land directly surrounding the city in each direction is mainly industrial (oil fields) (Figure 3; Figure 5, p. 1). As a result of the heavy industrial use of land surrounding Kermit there are numerous wells within the 4-mile radius target distance limit (TDL) surrounding the site, yet very few are used for domestic drinking water (Ref. 10, pp. 1-12). Of the thirteen domestic wells sampled during the SI and the ESI, three are used for irrigation and recreation only, one is used commercially, and nine are used for drinking or as a sole source well (Ref. 13, pp. 7, 13; Ref. 11, pp. 10, 24; Ref. 12, pp. 8-24). PCE was detected above background in the sample obtained from one sole source well (GW-06) near the southern city limits during the ESI (Ref. 9, p. 33).

The Kermit Independent School District (ISD) owns three operational wells (GW-11, GW-14, and GW-15), all of which are used for irrigation; however, GW-11 and GW-15 are occasionally used for drinking purposes by students participating in extracurricular activities (Figure 5; Ref. 13, pp. 15, 17, 19; Ref. 10, pp. 2-4; Ref. 11, pp. 20-23). PCE was detected above background in the sample obtained from GW-11 during the SI (Ref. 8, p. 48).

## 2.2 SOURCE CHARACTERIZATION

### 2.2.1 SOURCE IDENTIFICATION

Name of source: Highway 18 Ground Water                                        Number of source: 1

Source Type: Other – Ground Water Plume with No Identified Source

Historically, PCE and TCE have been detected in the Kermit PWS during routine public drinking water monitoring conducted by the TCEQ and predecessor agencies (Ref. 3, 20-23; Ref. 4, pp. 9-12). Excepting a few direct well samples, testing was largely limited to blended entry point samples until 2013, after which time the lateral extent of the plume became evident. The plume was characterized using data collected during the SSDAP State Screening, July 2014 SI, and October 2015 ESI (Ref. 7, p. 8; Ref. 8, pp. 5-10, 31-62; Ref. 9, pp. 34-67; see Section 3.1.1 Observed Release for specific data). The data suggests the plume is located mainly in the center of Kermit, Texas, extending to the east just south of Kermit High School, to the south just south of Highway 302, and to the west as far as Standard Ave. (Figure 2).

Due to previous sampling events, all the wells within Kermit have multiple nomenclatures. Therefore, for consistency, the following table depicts the multiple names of each well; henceforth, all wells will be referred to by their SI/ESI name unless otherwise indicated.

| SI/ESI Name | SSDAP Name | Kermit PWS/ Other Name | Used for Scoring? | Pump House Station |
|---|---|---|---|---|
| GW-01 | GW-12 | G2480001J (Walton #1) | Yes (Level I) | Walton Pump House- EP002 |
| GW-02 | GW-09 | G2480001M (Santa Rosa #6) | Yes (Level I) | |
| GW-03 | GW-22 | G2480001N (Santa Rosa #7) | Yes (Level II) | |
| GW-35 | GW-01 | G2480001L (Santa Rosa #5) | Yes (Level II) | |
| GW-13 | GW-13 | G2480001G (Santa Rosa #2) | Yes (Potential) | |
| Not Applicable | GW-10 | G2480001F[1] (Santa Rosa #1) | No (plugged) | |
| GW-04 (not sampled) | GW-11 | G2480001I[2] (Santa Rosa #4) | No (not used) | |
| | | | | |
| GW-07 | GW-17 | G2480001H (Santa Rosa #3) | Yes (Level I) | Underwood Pump House- EP001 |
| Not Applicable | GW-20 | G2480001E (Underwood #5) | Yes (Potential) | |
| GW-08 | GW-18 | G2480001B (Underwood #2) | Yes (Level I) | |
| GW-09 | GW-19 | G2480001A (Underwood #1) | Yes (Level II) | |

| SI/ESI Name | SSDAP Name | Kermit PWS/ Other Name | Used for Scoring? | Pump House Station |
|---|---|---|---|---|
| GW-11 | GW-14 | Kermit ISD Well #1 | No (irrigation) | Not Applicable |
| GW-14 | GW-27 | Kermit ISD Well #2 | No (irrigation) | |
| GW-15 | GW-28 | Kermit ISD Well #3 | No (irrigation) | |
| GW-17 | GW-16 | Private Well | Yes (Potential) | |
| GW-18 | GW-25 | Private Well | No (industrial) | |
| GW-16/ GW-46 | GW-07 | Private Well (background) | No (irrigation) | |
| GW-06 | GW-26 | Private Well | Yes (Level II) | |

(Ref. 5, pp. 2, 4, 6; Ref. 7, p. 6; Ref. 11, pp. 10, 13-25; Ref. 12, pp. 8-24)

[1]Note: Well 'F' will be referred to as 'GW-10 (SSDAP),' as the well has been plugged and abandoned since the SSDAP sample event due to contamination from a nearby sewer line (Ref. 14, p. 1; Ref. 15, p. 1).

[2]Well 'I' will be referred to as 'GW-11 (SSDAP),' as the well was sampled only during the SSDAP sample event and has been inactive to the present (Ref. 14, p. 1).

Per Kermit PWS system officials, all water drawn from the PWS wells is diverted to two separate entry points (EP), EP001 and EP002 (Ref. 5, pp. 3, 7). At each EP, the water is combined, or blended, and stored in underground storage tanks (Ref. 5, p. 7). As depicted in the following table, PCE has been detected between 0.6 µg/L to 2.9 µg/L in blended samples from EP002 since 2000, and TCE has been detected between 0.5 µg/L to 1.4 µg/L in blended samples from EP001 since 1994 (Ref. 3, pp. 1, 4, 6, 10, 12, 20-22, 26-27, 33, 35, 38, 40; Ref. 4, pp. 3-5).

## Entry Point Sample Results

| Date | EP001 | | EP002 | | Reference |
|---|---|---|---|---|---|
| | PCE | TCE | PCE | TCE | |
| 6/24/1994 | U | U | U | U | Ref. 3, pp. 20-21 |
| 8/17/1994 | U | 1.4 | NS | NS | Ref. 3, p. 20 |
| 11/2/1994 | U | U | U | U | Ref. 3, pp. 20-21 |
| 8/9/1995 | U | 0.6 | U | U | Ref. 3, pp. 20-21 |
| 3/20/1996 | U | 0.7 | NS | NS | Ref. 3, p. 20 |
| 6/25/1996 | U | U | NS | NS | Ref. 3, p. 20 |
| 8/21/1996 | U | U | U | U | Ref. 3, pp. 20-21 |
| 7/22/1997 | U | 0.7 | U | U | Ref. 3, pp. 20-21 |
| 7/9/1998 | U | U | U | U | Ref. 3, pp. 20-21 |
| 7/6/1999 | U | 0.6 | U | U | Ref. 3, pp. 40, 42 |
| 8/23/1999 | U | 0.6 | NS | NS | Ref. 3, p. 35 |
| 5/2/2000 | U | 0.7 | 0.6 | U | Ref. 3, pp. 20-21 |
| 12/18/2000 | NS | NS | 1.3 | U | Ref. 3, p. 21 |

| Date | EP001 | | EP002 | | Reference |
|---|---|---|---|---|---|
| | PCE | TCE | PCE | TCE | |
| 3/8/2001 | U | 0.9 | 2.2 | U | Ref. 3, pp. 21-22 |
| 6/10/2002 | U | 0.7 | 0.7 | U | Ref. 3, pp. 22-23 |
| 10/15/2002 | NS | NS | 1.1 | U | Ref. 3, p. 1 |
| 8/12/2004 | U | 1.1 | U | U | Ref. 4, pp. 10, 12 |
| 7/11/2006 | U | 1.18 | 1.48 | U | Ref. 4, pp. 10, 12 |
| 5/1/2007 | U | 1.1 | 0.95 | U | Ref. 4, pp. 10, 12 |
| 6/24/2008 | U | 1.12 | 1.79 | U | Ref. 4, pp. 10, 12 |
| 9/21/2009 | U | 0.6 | 2.9 | U | Ref. 4, pp. 10, 12 |
| 9/27/2010 | U | 0.8 | 2.5 | U | Ref. 4, pp. 9-11 |
| 9/26/2011 | U | 0.5 | U | U | Ref. 4, pp. 9, 11 |
| 9/19/2012 | U | 1.2 | U | U | Ref. 4, pp. 9, 11 |
| 12/9/2013 | U | 0.81 | U | U | Ref. 4, pp. 9, 11 |
| 5/27/2014 | U | 0.95 | U | U | Ref. 4, pp. 9, 11 |
| 6/15/2015 | U | 0.92 | U | U | Ref. 4, pp. 9, 11 |

Values are µg/L
U= Not Detected
NS= Not Sampled

The TCEQ conducted a SSDAP State Screening in June 2013, during which sampling analyses detected PCE at significant concentrations in six wells sampled, and above the MCL in two wells (GW-02 and GW-10 SSDAP). TCE was detected in three additional wells (Ref. 7, pp. 6, 8). In July 2014 and October 2015, the TCEQ conducted a SI and an ESI, respectively, which confirmed the existence of a PCE plume in the vicinity of EP001 and a TCE plume in the vicinity of EP002 (Figure 2). Samples were collected in the course of the two events from twenty-six ground water wells within the 4-mile TDL, including nine PWS wells, thirteen private wells, three Kermit ISD wells, and one municipal water supply well. Significant concentrations of PCE and TCE were detected in analyses of ground water from the wells sampled during both mobilizations. Specifically, PCE was detected at significant concentrations (ranging from 0.6 µg/L to 43.5 µg/L) at sample locations GW-01, GW-02, GW-03, GW-06, GW-11, and GW-35 (Ref. 8, pp. 32, 48; Ref. 9, pp. 25, 27, 33, 61). TCE was detected at significant concentrations at sample locations GW-07 (1.46 µg/L) and GW-09 (0.7 µg/L) (Ref. 8, pp. 33, 37). Between the 2013 SSDAP State Screening and the 2015 ESI, concentrations of PCE or TCE have increased at resampled locations GW-01, GW-02, GW-03, GW-06, GW-07, and GW-11 (Ref. 7, p. 8; Ref. 8, pp. 32-33, 48; Ref. 9, pp. 25, 27, 33). PCE or TCE concentrations have decreased at resampled locations GW-08, GW-09, and GW-35 (Ref. 7, p. 8; Ref. 8, pp. 35-38; Ref. 9, p. 61).

The objective of the October 2015 ESI was to further delineate the ground water plume and to further attempt to determine a source of site contamination. Enhanced effort was applied to obtain additional ground water samples from 18 wells; of which, TCE was not detected in any of the wells sampled, but PCE was detected at concentrations significantly above background in four of the wells (Figure 2; Ref. 9, pp. 25, 27, 33, 61). Soil samples were also obtained from two possible sources, but PCE was not detected in any of the samples (Figure 5; Ref. 9, pp. 6-23). The following tables summarize the detections of PCE and TCE in ground water wells from the results of sampling analyses during the three investigations conducted by the TCEQ and from routine historical monitoring of wells that supply EP001 and EP002.

## PCE Sample Results in Wells

| Date | GW-01 (J) | GW-02 (M) | GW-03 (N) | GW-06 (private) | GW-11 (K ISD) | GW-35 (L) | GW-10 (F/SSDAP) | GW-11 (SSDAP) | GW-20 (E) |
|---|---|---|---|---|---|---|---|---|---|
| 5/2/2000 | NS | U | NS | NS | NS | NS | NS | NS | NS |
| 10/15/2002 | 3.5 | U | U | NS | NS | NS | 0.7 | 2.1 | NS |
| June 2013 (SSDAP) | 1.52 | **23.3** | 0.39J | 0.797 | 0.429J | 2.54 | **5.77** | 3.24 | U |
| July 2014 (SI) | **7.0** | NS | NS | NS | 1.5 | NS | NS | NS | NS |
| Oct 2015 (ESI) | NS | **43.5** | 0.6 | 1.0 | NS | 2.2 | NS | NS | NS |

(Ref. 3, pp. 1, 20-21; Ref. 7, p. 8; Ref. 8, pp. 32-33, 48; Ref. 9, pp. 25, 27, 33, 61)
Values are µg/L
U= Not Detected
NS= Not Sampled
J= Estimated Concentration
**Bold** values are greater than the MCL

## TCE Sample Results in Wells

| Date | GW-07 (H) | GW-08 (B) | GW-09 (A) |
|---|---|---|---|
| 8/23/1999 | 0.9 | U | U |
| June 2013 (SSDAP) | **1.39** | **1.46J** | 0.74 |
| July 2014 (SI) | **1.4** | U | 0.7 |

(Ref. 7, p. 8; Ref. 8, pp. 33, 37)
Values are µg/L
U= Not Detected
J= Estimated Concentration
**Bold** values are greater than the SCDM benchmark

The TCEQ researched possible sources in the vicinity of wells with detections of PCE in ground water with particular attention to industries that historically or characteristically use the hazardous substances of concern at the site. The TCEQ also conducted site reconnaissance, interviewed staff, and performed record searches to exclude possible sources of PCE near the site. No physical signs of a release of PCE or other hazardous substances were observed at any of the identified possible sources. For the July 2014 SI, the TCEQ identified two dry cleaners as possible sources; however, after review of the dry cleaning registration forms for both facilities, sample results showing no volatile organic compound (VOC) detections, and telephone conversations with the owners, TCEQ staff eliminated these two dry cleaners as possible sources of site contamination (Ref. 8, pp. 11-30; Ref. 16, pp. 1-44; Ref. 17, p. 1; Ref. 18, p. 1). Therefore, prior to the October 2015 ESI, the TCEQ conducted additional site reconnaissance and located two auto shops which were determined to be possible sources (Figures 2 and 5). Based on interviews conducted with staff at each location, neither establishment uses PCE- or TCE- based products; however, carburetor cleaners that may contain PCE are used in both facilities (Ref. 19, pp. 3, 5; Ref. 20, pp. 1-2). No physical signs of a release of hazardous substances were observed at either facility, and neither was confirmed to be a viable source by sampling and analyses of nearby ground water wells or soils in the immediate vicinity of the shops (Figure 5; Ref. 12, pp. 1-5; Ref. 9, pp. 6-23). Therefore, the ground water plume is considered the source, since no area where a hazardous substance has been deposited, stored, disposed, or placed could be confirmed through soil sampling or reconnaissance of nearby areas.

The lateral extent of the plume is delineated based on the detections of PCE and TCE during the SSDAP, SI, and ESI events which are listed in the Section 2.2.2, Hazardous Substances Associated with the Source, and depicted in Figure 2. The extent of the plume beyond approximately 0.25 mile northwest of the site center, and north of wells GW-07, GW-08, and GW-09 remains uncertain because of the lack of ground water wells in that area (Figure 2, Figure 5).

Despite the efforts of the SSDAP, SI, and ESI events, which included laboratory analysis of ground water from nearby properties and soil from the immediate vicinity of the identified possible sources nearest the highest detected contamination, the source of the contamination could not be confirmed. Subsequently, the site source was characterized as a ground water plume with no identified source, as described in Section 1.1 of the HRS.

### 2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

The ground water plume with no identified source, Source 1, contains measured levels of PCE and TCE significantly above background levels that were established within the Santa Rosa Aquifer (the aquifer being evaluated for the Ground Water Migration Pathway) as established in the analytical data tables provided below. PCE was detected above the background level in samples collected by the TCEQ for the U.S. EPA in 2014 and 2015, during both the SI and ESI, which are presented below. All field work was conducted as outlined in the SI and ESI work plans, including the SI Site Inspection Health and Safety Plan (HASP), and the TCEQ/EPA-approved Quality Assurance Project Plans (QAPPs) for the TCEQ Preliminary Assessment/Site Inspection Program: Federal Grant Identification Number V-96665501-0 (References 21 and 22). All deviations from the work plan and/or QAPP were noted in the field notebooks (Ref. 11, pp. 5, 12-13, 18, 21; Ref. 12, pp. 5-6, 12, 20). All ground water samples obtained during the SI and ESI event were analyzed by CLP OLM04.2 – GC/MS (Low Level) (Ref. 8, pp. 5-10, 31-62; Ref. 9, pp. 34-67).

## Background Concentrations

| Sample ID | Sample Type | Screen Interval/ Aquifer | Date | Hazardous Substance | Hazardous Substance Concentration | Reporting Limit[1] | Reference |
|---|---|---|---|---|---|---|---|
| GW 16/ GW-46 | GW-private | 255-273 ft.[2] bgs Santa Rosa | 07/28/14 & 10/07/15 | Trichloroethene (TCE) | U | 0.5 μg/L | Ref. 10, p. 226; Ref. 11, p. 10; Ref. 12, p. 9; Ref. 8, pp. 1, 5; Ref. 9, pp. 1, 50 |
| GW 16/ GW-46 | GW-private | 255-273 ft.[2] bgs Santa Rosa | 07/28/14 & 10/07/15 | Tetrachloroethene (PCE) | U | 0.5 μg/L | Ref. 10, p. 226; Ref. 11, p. 10; Ref. 12, p. 9; Ref. 8, pp. 1, 6; Ref. 9, pp. 1, 51 |

[1] The reporting limit (sometimes referred to as a quantitation limit) is defined as the lowest concentration at which an analyte can be reliably measured and reported without qualification. Reporting limits are adjusted for sample size, dilution, and matrix interference. Concentrations below the reporting limit are reported as non-detects (Ref. 8, p. 1; Ref. 9, p.1). The sample quantitation limit (SQL) is the quantity of a substance that can be reasonably quantified given the limits of detection for the methods of analysis and sample characteristics that may affect quantitation (Ref. 1, section 1.1).
[2]Stated interval is unscreened “open hole” construction.
U= Not Detected

## Source Samples

| Sample ID | Sample Type | Screen Interval/ Aquifer | Date | Hazardous Substance | Hazardous Substance Concentration | Reporting Limit[1] | Reference |
|---|---|---|---|---|---|---|---|
| GW-01 | GW- PWS | 245-516 ft. bgs Santa Rosa | 07/29/14 | Tetrachloroethene (PCE) | 7.0 µg/L | 0.5 µg/L | Ref. 11, p. 14; Ref. 5, p. 4; Ref. 8, pp. 1, 32, 86-92 |
| GW-02 | GW- PWS | 300-500 ft. bgs Santa Rosa | 10/07/15 | Tetrachloroethene (PCE) | 43.5 µg/L | 0.5 µg/L | Ref. 12, p. 10; Ref. 5, p. 4; Ref. 9, pp. 1, 25, 91-97 |
| GW-03 | GW-private | 277-517 ft. bgs Santa Rosa | 10/07/15 | Tetrachloroethene (PCE) | 0.6 µg/L | 0.5 µg/L | Ref. 12, p. 11; Ref. 5, p. 4; Ref. 9, pp. 1, 27, 91-97 |
| GW-06 | GW-private | Unknown[2] Santa Rosa | 10/07/15 | Tetrachloroethene (PCE) | 1.0 µg/L | 0.5 µg/L | Ref. 12, p. 16; Ref. 9, pp. 1, 33, 91-97 |
| GW-07 | GW-PWS | 230-405 ft. bgs Santa Rosa | 07/29/14 | Trichloroethene (TCE) | 1.4 µg/L | 0.5 µg/L | Ref. 5, p. 4; Ref. 11, p.15; Ref. 8, pp. 1, 33, 86-92 |
| GW-09 | GW-PWS | 220-530 ft. bgs Santa Rosa | 07/29/14 | Trichloroethene (TCE) | 0.7 µg/L | 0.5 µg/L | Ref. 5, p. 4; Ref. 11, p. 17; Ref. 8, pp. 1, 37, 86-92 |
| GW-11 | GW-ISD | Unknown[2] Santa Rosa | 07/30/14 | Tetrachloroethene (PCE) | 1.5 µg/L | 0.5 µg/L | Ref. 11, pp. 20-21; Ref. 8, pp. 1, 48, 86-92 |
| GW-21 | GW-Duplicate of GW-07 | 230-405 ft. bgs Santa Rosa | 07/29/14 | Trichloroethene (TCE) | 1.3 µg/L | 0.5 µg/L | Ref. 5, p. 4; Ref. 11, p. 15; Ref. 8, pp. 1, 41, 86-92 |

| Sample ID | Sample Type | Screen Interval/ Aquifer | Date | Hazardous Substance | Hazardous Substance Concentration | Reporting Limit | Reference |
|---|---|---|---|---|---|---|---|
| GW-24 | GW-Duplicate of GW-11 | Unknown[2] Santa Rosa | 07/30/14 | Tetrachloroethene (PCE) | 1.4 µg/L | 0.5 µg/L | Ref. 11, p. 21; Ref. 8, pp. 1, 56, 86-92 |
| GW-35 | GW-PWS | 320-500 ft. bgs Santa Rosa | 10/08/15 | Tetrachloroethene (PCE) | 2.2 µg/L | 0.5 µg/L | Ref. 12, p. 22; Ref. 5, p. 4; Ref. 9, pp. 1, 61, 91-97 |
| GW-38 | GW-Duplicate of GW-02 | 300-500 ft. bgs Santa Rosa | 10/07/15 | Tetrachloroethene (PCE) | 45.7 µg/L | 0.5 µg/L | Ref. 12, p. 10; Ref. 5, p. 4; Ref. 9, pp. 1,4, 45, 91-97 |

[1] The reporting limit (sometimes referred to as a quantitation limit) is defined as the lowest concentration at which an analyte can be reliably measured and reported without qualification. Reporting limits are adjusted for sample size, dilution, and matrix interference. Concentrations below the reporting limit are reported as non-detects (Ref. 8, p. 1; Ref. 9, p. 1). The sample quantitation limit (SQL) is the quantity of a substance that can be reasonably quantified given the limits of detection for the methods of analysis and sample characteristics that may affect quantitation (Ref. 1, section 1.1).

[2] Although depth and screened interval are not certain for all wells, the presence of PCE in all wells indicates a common connection to the Santa Rosa Aquifer.

**Location of the source with reference to a map:**
See Figure 2. Ground Water Plume Map

Source No: 1

**List of Hazardous Substances Associated with Source**

The following hazardous substances are associated with the source (see Section 3.1.1 of this HRS documentation record):

Tetrachloroethene (PCE) and Trichloroethene (TCE)

### 2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

| Containment Description | Containment Factor Value | References |
|---|---|---|
| Gas release to air: The air migration pathway was not evaluated; therefore, gas containment was not evaluated. | Not Scored | |
| Particulate release to air: The air migration pathway was not evaluated; therefore, particulate containment was not evaluated. | Not Scored | |
| Release to ground water: The Containment Factor Value for the ground water migration pathway was evaluated for "All Sources" for evidence of hazardous substance migration from source area (i.e., source area includes source and any associated containment structures). The applicable containment factor value was determined based on existing analytical evidence of hazardous substances in ground water samples from private and public wells (documented releases are listed and referenced in section 3.1 of this HRS documentation record). | 10 | Table 3-2 of the HRS (Ref.1, Section 3.1.2.1). |
| Release via overland migration and/or flood: The surface water pathway was not scored; therefore, surface water overland/flood migration component containment was not evaluated. | Not Scored | |

## 2.2.4 HAZARDOUS WASTE QUANTITY

### 2.4.2.1.1 Hazardous Constituent Quantity

The total Hazardous Constituent Quantity for Source No. 1 could not be adequately determined according to the HRS requirements; that is, the total mass of all CERCLA hazardous substances in the source and releases from the source is not known and cannot be estimated with reasonable confidence [1, pp. 51590-51591 (Section 2.4.2.1.1)]. Insufficient historical and current data [manifests, potentially responsible party (PRP) records, State records, permits, waste concentration data, etc.] are available to adequately calculate the total mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to calculate a total or partial Hazardous Constituent Quantity estimate for Source No. 1 with reasonable confidence. Scoring proceeds to the evaluation of Tier B, Hazardous wastestream quantity (Ref. 1, Section 2.4.2.1.1, p. 51591).

Hazardous Constituent Quantity Assigned Value: NS

### 2.4.2.1.2. Hazardous Wastestream Quantity

The total Hazardous Wastestream Quantity for Source No. 1 could not be adequately determined according to the HRS requirements; that is, the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and releases from the source is not known and cannot be estimated with reasonable confidence [1, p. 51591 (Section 2.4.2.1.2)]. Insufficient historical and current data (manifests, PRP records, State records, permits, waste concentration data, annual reports, etc.) are available to adequately calculate the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and the associated releases from the source. Therefore, there is insufficient information to adequately calculate the total or partial mass of the wastestream plus the mass of all CERCLA pollutants and contaminants in the source and the associated release from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous wastestream quantity for Source No. 1 with reasonable confidence. Scoring proceeds to the evaluation of Tier C, Volume (Ref. 1, Section 2.4.2.1.2, p. 51591).

Hazardous Wastestream Quantity Assigned Value: NS

Source No: 1

#### 2.4.2.1.3. Volume

For the migration pathways, the source is assigned a value for volume using the appropriate Tier C equation from HRS Table 2-5 (Ref. 1, Section 2.4.2.1.3). The hazardous waste quantity for a plume site with no identified source can be determined by measuring the area within all observed release samples combined with the vertical extent of contamination to arrive at an estimate of the plume volume (Ref. 1, section 2.4.2.1; Ref. 23, p. 4).

However, the lack of the vertical extent of contaminant delineation prohibits an exact volume concentration. The presence of contaminated ground water samples shows that the volume is greater than zero. Therefore, the volume of the ground water plume is assigned a volume hazardous waste quantity value greater than (>) 0. The value of > 0 reflects that the volume is known to be greater than 0, but the exact amount is unknown.

Volume Assigned Value: unknown, but > 0

#### 2.4.2.1.4 Area

Tier D area is not evaluated for source type “Other” (Ref. 1; Table 2-5).

Area Assigned Value: 0

#### 2.4.2.1.5 Source Hazardous Waste Quantity Value

As described in the HRS, the highest value assigned to a source from among the four tiers of hazardous constituent quantity (Tier A), hazardous waste stream quantity (Tier B), volume (Tier C) or area (Tier D) was selected as the source hazardous waste quantity value (Ref. 1, Section 2.4.2.1). Tier C was assigned the greatest value of unknown, but > 0.

Highest assigned value assigned from Ref. 1, Table 2-5: >0

## SUMMARY OF SOURCE DESCRIPTIONS

| Source No. | Source Haz. Waste Quantity Value | Source Hazardous Constituent Quantity Complete? (Y/N) | Containment Factor Value by Pathway | | | | |
|---|---|---|---|---|---|---|---|
| | | | Ground Water (GW) (Ref. 1, Table 3-2) | Surface Water (SW) | | Air | |
| | | | | Overland/flood (Ref. 1, Table 4-2) | GW to SW (Ref. 1, Table 3-2) | Gas (Ref. 1, Table 6-3) | Particulate (Ref. 1, Table 6-9) |
| 1 | >0 | N | 10 | NE | NE | NE | NE |

NE= Not Evaluated

# 3.0 GROUND WATER MIGRATION PATHWAY

## 3.0.1 GENERAL CONSIDERATIONS

## Ground Water Migration Pathway Description

**Regional Geology/Aquifer Description:**

The geologic setting of the site is within the Central Basin Platform, which divides the Permian Basin of West Texas into two sub-basins: the Delaware Basin on the west, and the Midland Basin on the east. The western quarter of Winkler County overlies the eastern rim of the Delaware Basin, and the rest of the county overlies the Central Basin Platform (Ref. 24, p. 19). The depositional history of Winkler County is characterized by restricted marine environments, resulting partially from the retreat of Permian Period seas from the continent and partially from the growth of reefs around the Delaware Basin. Reef accumulation in this region during the Guadalupian epoch of the Permian caused large lagoons to be isolated from the sea, which allowed for evaporation and increased salinity. Sediment deposition was concurrent in the lagoon area behind the reef barrier, on the reef itself, and on the sea floor (Ref. 24, p. 22).

Sedimentary rocks of Ordovician through Pennsylvanian age are found beneath the surface in Winkler County, but only rocks of Permian and younger formations are discussed, as they are the principal sources of ground water in the region (Ref. 24, p. 14). The Capitan Limestone was deposited as the reef of the Delaware Basin, and consists of limestone, dolomite, and talus characteristic of reefs, ranging in thickness from 1,500-2,000 feet, and sometimes greater in Winkler County (Ref. 24, p. 22). The Capitan interfingers with the Whitehorse Group to the east in the Central Basin Platform, which represents the back-reef complex, including the Grayburg, Queen, Seven Rivers, Yates, and Tansill Formations. The Grayburg Formation is approximately 300 feet thick in Winkler County, and consists of dolomite and sandy dolomite interbedded with red and gray sandstone and, locally, some anhydrite. The Queen Formation is 400 feet thick, consisting of red and gray sandstone interbedded with dolomite and some anhydrite and salt. The Seven Rivers Formation is approximately 550 feet thick, and consists of anhydrite, some red sandstone, shale, and dolomite. Toward the reef complex, the amount of dolomite increases while anhydrite decreases. The Yates Sandstone Formation is 300 feet thick in Winkler County, and consists of gray and red sandstone with large scattered frosted quartz, some thin beds of dolomite, and gray and red shale. The Tansill Formation is approximately 200 feet thick, and consists of dolomite nearer to the reef, grading to anhydrite, and anhydrite and salt away from the reef (Ref. 24, pp. 23-24).

Also of Permian age, the Ochoa Series overlies the Capitan Limestone, and includes, from oldest to youngest, the Castile Formation, the Salado Formation, the Rustler Formation, and the Dewey Lake Red Beds. The Castile Formation is comprised of a series of evaporites, calcareous anhydrite, and some salt deposited in front of the Capitan Reef. Thickness of the Castile ranges from 0-1,700 feet (Ref. 24, p. 18, 20). The Castile is not present in the Central Basin Platform (Ref. 24, p. 24). The Salado Formation sedimentary rocks were deposited in the Delaware Basin and across the Central Basin Platform, and consist mostly of halite with subordinate amounts of anhydrite, sylvite, and orange polyhalite. The Salado ranges in thickness from 400-2,000 feet (Ref. 24, pp. 18, 20). Where the Castile Formation is not present in the Central Basin Platform, the Salado overlies the Tansill Formation (Ref. 24, p. 24). A period of uplift and erosion occurred between the deposition of the Salado Formation and the following Rustler Formation (Ref. 24, p. 24). The Rustler Formation unconformably overlies the Salado and is comprised of dolomite, anhydrite, and limestone, with a basal zone of sand, conglomerate, and variegated shale. Thickness of the Rustler ranges from 300-500 feet in Winkler County (Ref. 24, p. 24). Evaporite deposition continued during the Salado and Rustler time periods with alternating intervals of limestone, dolomite, shale, and sand throughout the Delaware Basin and the shelf areas (Ref. 24, p. 20).The Dewey Lake Red Beds are the youngest of the Ochoa Series, and are comprised of thin-bedded siltstone cemented with gypsum and calcite, ranging in thickness from 230-580 feet (Ref. 24, p. 18).

The Dockum Aquifer is a minor aquifer found in the northwest part of Texas and is defined stratigraphically by the Dockum Group of the Triassic System that consist of alternating sandstones and shales (Ref. 25, p. 2; Ref. 24, p. 33; Ref. 26, p. 1). The Dockum Group is generally considered to have been deposited within a closed continental basin in fluvial, deltaic, and lacustrine environments (Ref. 26, p. 5). The beds are generally horizontal, and the top, relatively flat (Ref. 26, p. 4). The Dockum Group unconformably underlies the Trinity Group (Ref. 26, p. 5).

In the Winkler County region, the Dockum Group is comprised of the Tecovas Formation, the Santa Rosa Sandstone, and the Chinle Formation Equivalent. There are two other members of the Dockum group that are not present in the regional area: the Trujillo Sandstone and the Cooper Canyon, which disconformably overlie the Tecovas (Ref. 25, p. 2; Ref. 24, p. 172; Ref. 26, p. 4). Literature regarding the West Texas regional geology of the Dockum Group indicates that the Santa Rosa Formation is the basal unit of the Group; however, literature that describes the geologic and hydrogeologic units in the Winkler County region and the Kermit area put the Tecovas stratigraphically below the Santa Rosa Formation with depths ranging from 100-1,450 feet, and thickness ranging from 0 to 270 feet (Ref. 25, p. 2; Ref. 26, p. 4). The Tecovas is not known to yield water to wells in Winkler County (Ref. 24, p. 26; Ref. 24, p. 172). It consists of red shale, silt, and very fine grained sandstone that grades into the overlying Santa Rosa Sandstone (Ref. 24, p. 26). The Santa Rosa Sandstone ranges in thickness from 0 to 350 feet and consists of medium to coarse grained reddish-brown and gray subangular arkosic, micaceous, and conglomerate sandstone cemented with calcite and some silica (Ref. 24, pp. 26-27). It is the principal fresh-water aquifer in the county as well as the most extensive (Ref. 24, pp. 27, 29).

The Chinle Formation Equivalent is considered the geologic equivalent of the Chinle Formation in the Colorado Plateau region; however, locally, it makes up the top formation of the Dockum Group (Ref. 24, p. 26). For the remainder of the report, the Chinle Formation Equivalent will be referred to as “the Chinle.” The Chinle conformably underlies the Santa Rosa Formation where present; it is absent in parts of Winkler County and the West Texas Region (Ref. 24, p. 29; Ref. 24, p. 172). The Chinle ranges in thickness from 0 to 1,000 feet, and consists of brick-red to maroon and purple shale, and beds of fine red or gray sandstone and siltstone. The Chinle is not known to yield water to wells in Winkler County (Ref. 24, p. 27).

The Trinity Group unconformably overlies the Dockum Group, consisting of the Paluxy Sand, Glen Rose Limestone, and Twin Mountains Formations. This group has a maximum thickness of about 100 feet where it crops out in northeastern Winkler County (Ref. 24, p. 27). The Trinity consists of sandstone, siltstone, conglomerate, and gravel cemented with carbonate minerals (Ref. 24, p. 27). The Fredericksburg Group overlies the Trinity Group, and consists of the Kiamichi, Goodland Limestone, and Walnut Clay Formations. This group ranges in thickness of 0 to 50 feet, and consists of gray to cream and brown, hard to earthy fossiliferous and sandy marine limestone (Ref. 24, p. 28). The Fredericksburg Group and the Trinity Group are not present in the majority of the Winkler County regional area, having been removed by erosion (Ref. 24, p. 20).

The Cenozoic Pecos Alluvium Formation (Cenozoic Alluvium) regionally overlies the Fredericksburg Group, and consists of unconsolidated sand, silt, gravel, clay, and caliche, with an average thickness of about 100 feet, but can reach up to 1,050 feet where alluvium was deposited on an eroded “trough” of the underlying Triassic rocks. Throughout part of Winkler County, the Cenozoic Alluvium unconformably overlies the Santa Rosa Sandstone (Ref. 24, p. 28).

The youngest sedimentary unit in the regional area is the Quaternary System Sand Dunes (Figure 7; Ref. 24, p. 29). The Dune Sand ranges in thickness from 0-250 feet with thickness being the greatest in the areas of the high dunes, and is composed of windblown sand. It acts as an excellent recharge facility for the underlying aquifer formations and yields some water to pits and a few wells (Ref. 24, p. 17, 29). West of where the Sand Dunes occur is caliche-indurated sand and some silt and gravel (Ref. 24, p. 14).

**Site Geology/Aquifer Description:**

The site is located within the Central Basin Platform on the eastern edge of the Delaware Basin (Ref. 24, p. 25). Quaternary strata are exposed at the surface throughout the 4-mile TDL (Ref. 27, pp. 3-4). The approximated presence of the geologic formations and associated hydrologic units within Kermit, Winkler County, Texas are shown in Reference 27 and in the table at the end of this section.

In Winkler County, the Dockum Group is subdivided into, from top to bottom, the Chinle, the Santa Rosa Sandstone, and the Tecovas Formation (Ref. 24, pp. 26-27). The Santa Rosa Sandstone Formation is the most extensive aquifer in Winkler County with an approximate thickness of 300 feet; the depth from the ground surface to the top is approximately 200 feet (Ref. 13, p. 1; Ref. 24, pp. 29, 172-173). For the duration of the report, the name “Santa Rosa Aquifer” will be used to refer to the Dockum Aquifer. For HRS scoring, both the Cenozoic Pecos Alluvium Aquifer and the Santa Rosa Aquifer, also named the Dockum Aquifer, are being evaluated since they both underlie the site. A detailed justification for this follows.

In some parts of the West Texas region and in Winkler County, the Cenozoic Pecos Alluvium and the Santa Rosa Aquifers are hydraulically connected; however, the Chinle that overlies the Santa Rosa Sandstone throughout most of the City of Kermit acts as a confining unit between the two aquifers (Ref. 24, pp. 29, 172-173). The cross-section of the city and well logs from the City of Kermit PWS suggest that some of the city wells are drilled through the Cenozoic Pecos Alluvium, the Chinle, and the Santa Rosa Sandstone (Ref. 5, pp. 11, 13, 19, 21, 23, 25; Ref. 10, pp. 32, 73, 86, 101, 200-202; Ref. 24, pp. 26-27, 172). An aquifer test on City of Kermit wells in 1957 by the Texas Water Development Board indicated that the Santa Rosa (Dockum) Aquifer is partially confined, which further supports the existence of the Chinle confining layer in the area of the site (Ref. 24, pp. 44-47; Ref. 26, p. 5).

The City of Kermit began supplying water in 1941, originally with two wells that drew from the Cenozoic Pecos Alluvium Aquifer, and eventually incorporated or drilled new wells that used both the Cenozoic Pecos Alluvium and the Santa Rosa Sandstone, and some that used the Santa Rosa solely (Ref. 24, pp. 34-35). Wells that are examples of the expansion to the Santa Rosa are those with different drill dates, including GW-01 (Kermit PWS well J (the Walton #1 well)) that has an original drilling date of 1913, but a drill date of 1957 in the City’s drilling logs and the Texas Water Development Board’s records (Ref. 4, p. 3, Ref. 5, p. 13; Ref. 10, p. 204). Additionally, well GW-20 (SSDAP) (E (Underwood #5)), was originally drilled in 1946 to an original total depth of 501 feet below ground surface (bgs) (Ref. 5, p. 15; Ref. 10, p. 100). The well log indicates that the total depth of the well was expanded to 525 feet bgs in 1961, and the TWDB data indicates that it draws from the Santa Rosa (Dockum) (Ref. 5, p. 13; Ref. 10, p. 92, 100). The TCEQ Drinking Water Watch (DWW) indicates that the well draws from the Cenozoic Pecos Alluvium, and was drilled in 1969 (Ref. 4, p. 3). It is possible that the well draws from both aquifers given that the well is an open hole from 236 feet bgs to the total depth of 525 feet bgs. There is a discrepancy regarding the depth, where the TWDB log indicates the original total depth was 501 feet, but the drillers’ log in the same reference indicates that the total depth of the well in 1961 was 341 feet bgs (Ref. 10, pp. 99, 100, 102). Well D (Underwood #4) was also deepened in 1961 (Ref. 10, pp. 83-84).

There are some discrepancies with other wells in the city’s well logs, including question marks on the drillers’ logs indicating uncertainty of the aquifer from which wells draw, and stated uncertainties about the aquifer (Ref. 10, pp. 128, 210, 226). Only one well with an uncertainty is used for scoring the site, GW-01 (City well J (Walton #1)) (Ref. 10, p. 210).

Wells GW-01 and GW-11 (SSDAP) (Wells J and I) are approximately 300 feet apart, are indicated to be drilled into one or both aquifers, have open hole intervals at similar depths, and similar total depths (Figure 3; Ref. 5, p. 3; Ref. 10, pp. 197-221). GW-01 (Well J (the Walton #1 well)) is open hole at 245-516 feet (Ref. 5, p. 4), and the TWDB well data indicates that it draws from the Santa Rosa (Dockum) and the Cenozoic Pecos Alluvium; however, the TCEQ DWW indicates that the well draws only from the Santa Rosa (Dockum) (Ref. 4, p. 3; Ref. 10, p. 204). GW-11 (SSDAP) (Well I (Santa Rosa #4)) is open hole at 260-497 feet, and logs indicate that it draws from the Santa Rosa (Dockum), and notes the bottom of the Cenozoic Pecos Alluvium at 228 feet bgs (Ref. 10, pp. 197, 200). Given that the base of the Cenozoic Pecos Alluvium through the cross section of Kermit is indicated at 2700 feet in elevation (150-200 feet depth), it is not likely that the city wells are currently drawing from this aquifer since they are screened or are open hole at depths greater than 200 feet (Ref. 5, p. 3; Ref. 24, p. 172). Additionally, literature describes an erosional trough on the Triassic surface, where the Cenozoic Alluvium would have had much thicker deposits at greater depths (Ref. 24, p. 22).

The geology in the vicinity of the site is primarily based on the City of Kermit vicinity cross-sections with literature and well logs to support (Ref. 10, pp. 14-252; Ref. 24, pp. 8-31, 170-173). The City of Kermit vicinity cross-sections includes two wells drilled into the plume: Well D-277 or GW-07 (Well H (Santa Rosa #3)), and D-291 or GW-10 (SSDAP ) (Well F (Santa Rosa #1)) (Figure 2; Ref. 24, pp. 172-173; Ref. 10, p. 157, 244; Ref. 5, p. 5). Other wells with available driller's logs showing lithology that are used for scoring the site are GW-11 (SSDAP ) (Well I (Santa Rosa #4), GW-35 (Well L (Santa Rosa #5/GW-35)), GW-02, (Well M (Santa Rosa #6), GW-03 (Well N (Santa Rosa #7/GW-3)), and GW-08 (Well B (Underwood #2)) (Ref. 5, pp. 20, 22, 24, 26; Ref. 10, p. 32).

- **Aquifer/Stratum 1: Cenozoic Pecos Alluvium/Cenozoic Pecos Alluvium**

The apparent thickness of the Cenozoic Pecos Alluvium ranges from about 100 feet to 170 feet throughout Kermit, Texas, and the depth to the top of the formation just underlies the ground surface (Ref. 24, pp. 172-173). Well logs indicate that the top of the Cenozoic Pecos Alluvium strata varies from 2 feet bgs to 6 feet bgs with a top caliche or sand layer. Well logs indicate that it is composed of caliche, white, tan, brown, and red sand, sandy clay, sandy clay with caliche streaks, sandy clay with gravel, and gravel (Ref. 5, pp. 20, 22, 24, 26).

Water in the Cenozoic Pecos Alluvium is unconfined and occurs under water-table conditions (Ref. 24, p. 29). The City of Kermit has historically tapped into this aquifer for public supply (Ref. 24, p. 34). Currently, the TCEQ DWW indicates that only one well uses the Cenozoic Pecos Alluvium as its water source (Ref. 4, p. 4). However, city logs indicate that well GW-35 (Well L (Santa Rosa #5)) is slotted between 320 feet bgs to 500 feet bgs, which is deeper than the Cenozoic Pecos Alluvium is known to exist. Based on the known lithology of the stratum, in well GW-35 (Well L (Santa Rosa #5)) the bottom of the Cenozoic Pecos Alluvium is approximately 270 feet bgs (Ref. 5, pp. 4, 22).

The hydraulic conductivity is estimated at $10^{-4}$ or $10^{-6}$ cm/sec, based on its varied lithology (Ref. 1, Table 3-6).

- **Aquifer/Stratum 2: Dockum/Chinle Formation Equivalent**

The Chinle Formation Equivalent (Chinle) occurs throughout the City of Kermit, but pinches out near the southwest corner of the City (Ref. 24, pp. 172-173). The Chinle consists of brick-red to maroon and purple shale and thin beds of fine red or gray sandstone and siltstone (finer than the underlying Santa Rosa), with locally occurring limestone beds several feet thick. Green and gray mottling and yellow streaks are also common (Ref. 24, p. 27). In the City of Kermit, the Chinle ranges in thickness from 0 to approximately 50 feet (Ref. 24, pp. 172-173).

In the plume itself, the cross section of the City of Kermit illustrates that well GW-07 (Kermit Well H (Santa Rosa #3/D-277)) was drilled through the Chinle (Figure 2; Ref. 24, pp. 172-173; Ref. 10, p. 167). Well logs indicate that the Chinle exists between the Cenozoic Pecos Alluvium and the Santa Rosa Sandstone from 228-288 feet bgs in well GW-11 (SSDAP) Kermit Well I (Santa Rosa #4) (Ref. 10, p. 200). Additionally, it can be inferred that the Chinle exists from 215-230 feet bgs in GW-08 (Well B (Underwood #2)) by the strata "red bed shales" (Ref. 10, p. 32).

The Chinle is also identified from 240 feet bgs to 270 feet bgs in city well D (Underwood #4), which was not sampled but is near the plume boundary (Figures 2 and 3; Ref. 10, pp. 85).

Based on the lithology of the Chinle, the estimated hydraulic conductivity is $10^{-6}$ cm/sec (Ref. 1, Table 3-6).

- **Aquifer/Stratum 3: Dockum/Santa Rosa Formation**

The Santa Rosa Sandstone conformably underlies the Chinle and consists of medium-to-coarse-grained reddish-brown and gray subangular arkosic, micaceous, and conglomerate sandstone cemented with calcite and some silica (Ref. 24, pp. 26-27). In the City of Kermit, the Santa Rosa is approximately 250-300 feet thick (Ref. 24, pp. 172-173).

The Santa Rosa Formation is recharged via the flow through the Cenozoic Alluvium, which decreases north-northeast of Kermit where part of the water flows down into the Santa Rosa Formation (Ref. 24, p. 30). The water in the Santa Rosa Formation moves in all directions away from the point at which it meets the Cenozoic Pecos Alluvium (Ref. 24, p. 31). However, the general ground water flow in the Santa Rosa (Dockum) Aquifer in West Texas is to the southeast; yet, the ground water gradient of the Santa Rosa throughout the site is from the northeast to the southwest (Ref. 13, p. 1; Ref. 26, pp. 4-5). Where present, the Chinle acts as a confining layer in the vicinity of the site between the Cenozoic Pecos Alluvium and the Santa Rosa Sandstone which, as a result, creates artesian pressure (Ref. 24, p. 29).

The hydraulic conductivity (K) for the Santa Rosa is estimated at $10^{-4}$ cm/sec (Ref. 1, Table 3-6).

- **Aquifer/Stratum 4: Dockum/Tecovas Formation**

In the vicinity of the City of Kermit, the Tecovas Formation underlies the Santa Rosa Formation, and is the bottom formation of the Dockum Group in the site area (Ref. 24, p. 26). It consists of red shale, silt, and very fine grained sandstone that grades into the overlying Santa Rosa Sandstone (Ref. 24, p. 26). In Kermit, it ranges in thickness from approximately 100-150 feet, although in many parts represented in the cross section, the boundaries are inferred (Ref. 24, pp. 172-173). The Tecovas Formation is not known to yield water to wells in Winkler County (Ref. 24, p. 26).

- **Aquifer Interconnections/Distance from Source**

A review of the literature, well logs, and stratigraphic cross-sections of the City of Kermit revealed evidence of interconnection of the Santa Rosa Sandstone and the Cenozoic Pecos Alluvium hydrologic units within a two-mile radius of the source where the Chinle confining layer is absent (Figure 2; Ref. 5, pp. 3, 5, 12, 14, 20, 22, 24, 26; Ref. 10, pp. 73, 101, 201; Ref. 24, p. 27, 172-173). As evident in cross-section D-D', the Chinle pinches out in the southwest corner of the City of Kermit. For scale, the City of Kermit itself is approximately two miles east-west. In the city cross sections, D-277 is GW-07 (Kermit PWS well 'H'), which is the western-most boundary of the known plume (Figure 2; Ref. 24, p. 172; Ref. 10, p. 167). In another cross-section (C-C') that partially transects east of Kermit and goes through the southern quadrant of the city, the Chinle has been inferred in wells D-287 and D-300, but has pinched out in the two wells on either side (D-210 and G-12) (Ref. 24, p. 171). Wells D-210 and G-12 are within two miles of wells inside the plume, D-277 (GW-07 or Kermit PWS well ‘H’), D-279 (GW-09 or Kermit PWS well A), and D-293 (GW-01 or Kermit PWS well J) (Figure 2; Ref. 10, pp. 16, 167, 210; Ref 27, pp. 170-171).

The Chinle was not specifically identified in well GW-20 (SSDAP) (Kermit PWS well E (Underwood #5) and Kermit well C (Underwood #3), both of which are within two miles of the plume boundary (Figures 2 and 3; Ref 13, pp. 73, 101). Although it was not specifically identified, it can be interpreted to be continuous between those two wells, based on the well logs, locations of the wells, and the City of Kermit cross sections.

Therefore, the Chinle is continuous throughout the City of Kermit, but pinches out within two miles of the plume, indicating that there is possible interconnection between the Cenozoic Pecos Alluvium and the Santa Rosa Aquifers. Additionally, the Santa Rosa Formation is recharged through the Cenozoic Alluvium (Ref. 24, p. 30). The water in the Santa Rosa Formation moves in all directions away from the point at which it meets the Cenozoic Pecos Alluvium (Ref. 24, p. 31).

No other interconnections exist within a two-mile radius of the source.

- **Aquifer Discontinuities within Target Distance Limit**

No vertical or horizontal discontinuities are known to exist within the Santa Rosa Aquifer or the Cenozoic Pecos Alluvium that transect any part of the entire 4-mile TDL (Ref. 10, pp. 14-226; Ref. 24, p. 27, 172-173).

| System | Group | Formation | Function | County Thickness | Site-Specific Thickness |
|---|---|---|---|---|---|
| Quaternary | | Dune Sand | Recharge Facility | 0-250 ft. | 0-10 ft. |
| | | Cenozoic Pecos Alluvium | Aquifer | 0-1,050 ft. | 200-250 ft. |
| Triassic | Dockum Group | Chinle Formation Equivalent | Non-yielding | 0-1000 ft. | 0-60 ft. |
| | | Santa Rosa Sandstone | Primary Aquifer | 0-350 ft. | 230-501 ft. |
| | | Tecovas Formation | Non-yielding | 0-270 ft. | No information |
| Ref. 10, pp. 32, 85, 101, 244; Ref. 24, pp. 26-29, 172-173 | | | | | |

## SUMMARY OF AQUIFER(S) BEING EVALUATED

| Aquifer No. | Aquifer Name | Is Aquifer Interconnected with Upper Aquifer within 2 miles? (Y/N/NA) | Is Aquifer Continuous within 4-mile TDL? (Y/N) | Is Aquifer Karst? (Y/N) |
|---|---|---|---|---|
| 1 | Cenozoic Pecos Alluvium | NA | Y | N |
| 2 | Santa Rosa | Y | Y | N |

## 3.1 LIKELIHOOD OF RELEASE

### 3.1.1 OBSERVED RELEASE

Aquifer Being Evaluated: Santa Rosa Aquifer

Chemical Analysis

- Background Concentrations:

One background sample, GW-46 (collected as GW-16 in the SI), a private water supply well located approximately 1.0 mile north-northwest of the site center, was collected approximately 0.7 mile outside of the plume area (Figure 2; Ref. 12, p. 9; Ref. 8, p. 6). The specific and regional ground water gradient in the area of the plume is from the northeast to the southwest (see Section 3.0.1). Well GW-46 was chosen as a background sample location for the ESI because its depth (273 feet bgs) is similar to the drinking water wells at the site, including GW-02 (the well with the highest PCE detection), and its location up-gradient of the site is completed in the Santa Rosa Aquifer (Figures 2 and 6; Ref. 10, p. 226; Ref. 12, p. 9). Additionally, all samples collected from GW-46 (GW-16 in SI sample results) during the SI and ESI sampling events recorded no detection of PCE or TCE (Ref. 8, pp. 5-6; Ref. 9; pp. 50-51). All ground water samples obtained during the SI and ESI events were analyzed by method CLP OLM04.2 (Ref. 8, pp. 5-10, 31-62; Ref. 9, pp. 24-67).

| Sample ID | Screened Interval (feet bgs) | Date | References |
|---|---|---|---|
| GW-16 (SI background sample) | 255-273 feet bgs | 07/28/14 | Ref. 10, p. 226 |
| GW-46 (ESI background sample) | 255-273 feet bgs | 10/07/15 | Ref. 10, p. 226 |

| Sample ID | Hazardous Substance | Concentration (units) | Reporting Limit[1] | References |
|---|---|---|---|---|
| GW-16 | Tetrachloroethene (PCE) | U | 0.5 µg/L | Ref. 11, p. 10; Ref. 8, pp. 1, 6 |
| GW-16 | Trichloroethene (TCE) | U | 0.5 µg/L | Ref. 11, p. 10; Ref. 8, pp. 1, 5 |
| GW-46 | Tetrachloroethene (PCE) | U | 0.5 µg/L | Ref. 12, p. 9; Ref. 9, pp. 1,51 |
| GW-46 | Trichloroethene (TCE) | U | 0.5 µg/L | Ref. 12, p. 9; Ref. 9, pp. 1, 50 |

[1] The reporting limit (sometimes referred to as a quantitation limit) is defined as the lowest concentration at which an analyte can be reliably measured and reported without qualification. Reporting limits are adjusted for sample size, dilution, and matrix interference. Concentrations below the reporting limit are reported as non-detects. (Ref 8. p. 1; Ref. 9, p.1). The sample quantitation limit (SQL) is the quantity of a substance that can be reasonably quantified given the limits of detection for the methods of analysis and sample characteristics that may affect quantitation (Ref. 1, section 1.1).
U = Not Detected

- Contaminated Samples:

Please refer to Figure 2 and Figure 5 for sample locations.

| Sample ID | Screened Interval (feet bgs) | Date | References |
|---|---|---|---|
| GW-01 | 245-516 | 07/29/14 | Ref. 5, p. 4; Ref. 11, p. 14 |
| GW-02 | 300-500 | 10/07/15 | Ref. 5, p. 4; Ref. 12, p. 10 |
| GW-03 | 277-517 | 10/07/15 | Ref. 5, p. 4; Ref. 12, p. 11 |
| GW-06 | unknown* | 10/07/15 | Ref. 12, p. 16 |
| GW-07 | 230-405 | 07/29/14 | Ref. 5, p. 4; Ref. 11, p. 15 |
| GW-08 | 220-300 | 06/04/13 | Ref. 5, p 4; Ref. 11, p. 16 |
| GW-09 | 220-530 | 07/29/14 | Ref. 5, p. 4; Ref. 11, p. 17 |
| GW-11 | unknown* | 07/30/14 | Ref. 11, p. 20 |

| | | | |
|---|---|---|---|
| GW-35 | 320-500 | 10/08/15 | Ref. 5, p. 4; Ref. 12, p. 22 |
| GW-10<br>(SSDAP Location) | 264-561 | 06/04/13 | Ref. 5, p. 4; Ref. 1<br>3, p. 5 |
| GW-11<br>(SSDAP Location) | 260-497 | 06/05/13 | Ref. 5, p. 4; Ref. 13, p. 11 |

*Although depth and screened interval are not certain for all wells, the presence of PCE in all wells indicates a common connection to the Santa Rosa Aquifer.

| Sample ID | Hazardous Substance | Concentration (µg/L) | Reporting Limit[1] | References |
|---|---|---|---|---|
| GW-01 | Tetrachloroethene (PCE) | 7.0 | 0.5 | Ref. 11, p. 14; Ref. 8, pp. 1,32, 86-92 |
| GW-02 | Tetrachloroethene (PCE) | 43.5 | 0.5 | Ref. 12, p. 10; Ref. 9, pp. 1, 25, 91-97 |
| GW-03 | Tetrachloroethene (PCE) | 0.6 | 0.5 | Ref. 12, p. 11; Ref. 9, pp. 1, 27, 91-97 |
| GW-06 | Tetrachloroethene (PCE) | 1.0 | 0.5 | Ref. 12, p. 16; Ref. 9, pp. 1, 33, 91-97 |
| GW-07 | Trichloroethene (TCE) | 1.4 | 0.5 | Ref. 11, p. 15; Ref. 8, pp. 1, 33, 86-92 |
| GW-08* (SSDAP Location) | Trichloroethene (TCE) | 1.46 | 0.5 | Ref. 11, p. 16; Ref. 13, p. 2; Ref. 7, pp. 8, 46, 154 |
| GW-09 | Trichloroethene (TCE) | 0.7 | 0.5 | Ref. 11, p. 17; Ref. 8, pp. 1, 37, 86-92 |
| GW-11 | Tetrachloroethene (PCE) | 1.5 | 0.5 | Ref. 11, p. 20; Ref. 8, pp. 1, 48, 86-92 |
| GW-35 | Tetrachloroethene (PCE) | 2.2 | 0.5 | Ref. 12, p. 22; Ref. 9, pp.1, 61, 91-97 |
| GW-10* (SSDAP Location) | Tetrachloroethene (PCE) | 5.77 | 0.5 | Ref. 13, p. 5; Ref. 7, pp. 8, 52, 160 |
| GW-11* (SSDAP Location) | Tetrachloroethene (PCE) | 3.24 | 0.5 | Ref. 13, p. 11; Ref. 7, pp. 8, 91, 178 |

[1] The reporting limit (sometimes referred to as a quantitation limit) is defined as the lowest concentration at which an analyte can be reliably measured and reported without qualification. Reporting limits are adjusted for sample size, dilution, and matrix interference. Concentrations below the reporting limit are reported as non-detects. ( Ref. 8, p. 1; Ref. 9, p.1). The sample quantitation limit (SQL) is the quantity of a substance that can be reasonably quantified given the limits of detection for the methods of analysis and sample characteristics that may affect quantitation (Ref. 1, section 1.1).

* Collected during SSDAP state screening.

Attribution:

The Highway 18 Ground Water site is a contaminated ground water plume originating from an unknown source (or sources) where hazardous substances may have been released and seeped through the ground to the aquifer. When the source itself consists of a ground water plume with no identified source, no separate attribution is required (Ref. 1, Sec. 3.1.1).

The TCEQ conducted a Pre-CERCLIS Screening, PA, SI, and ESI to identify possible sources of the contamination at the Highway 18 Ground Water site. The TCEQ identified two dry cleaning facilities and two automotive repair facilities as possible sources of chlorinated solvents in the area of the plume (Figure 5; Ref. 11, pp. 2-8; Ref. 12, pp. 1-6).

No physical signs of a release of hazardous substances were observed at any of these facilities during TCEQ site visits in June 2014, July 2015, and October 2015 (Ref. 11, pp. 1-8; Ref. 12, pp. 1-5; Ref. 19, pp. 3, 5). The SI and ESI events attempted to identify a contamination source by sampling ground water wells and soil in the vicinity of possible sources (Ref. 8, pp. 4, 11-30; Ref. 9, pp. 4, 6-23). All existing wells currently used for drinking water lie to the north, northeast, east, southeast, south, and southwest of these possible sources (Figure 2). The highest concentrations of PCE were found in wells (GW-01 and GW-02) south and southeast of the possible source area along Highway 18 (Figure 2; Ref. 8, p. 32; Ref. 9, p. 25).

At the time of the 2014 SI, the two dry cleaning facilities were deemed to be possible sources due to uncertainty regarding PCE use; however, after review of the dry cleaning registration forms for both facilities, telephone conversations with the owners, and sample results showing no VOC detections, TCEQ staff eliminated one of the facilities as a possible source for this site (Ref. 8, pp. 11-30; Ref. 16, pp. 3-4, 27-49; Ref. 18, p. 1). There is no TCEQ documentation of PCE use at the other facility; however, the facility owner recalled using PCE prior to registration with the TCEQ in 2009 (Ref. 16, pp. 2-3, 5-26; Ref. 17, p. 1). VOCs were not detected in any SI soil samples (Ref. 8, pp. 11-30). This facility, located 0.40 mile north of GW-01 and 0.39 mile northeast of GW-02, is the only dry cleaner facility in the City of Kermit which may have used PCE (Figure 5).

During the 2015 ESI reconnaissance visit, both auto shop owners told TCEQ staff that their respective facilities do not knowingly use PCE-based products (Ref. 19, pp. 3, 5). However, brake and carburetor cleaners are used at one facility, while just carburetor cleaner is used at the other facility (Ref. 19, pp. 3, 5). Some brake and carburetor cleaners use PCE as part of their formulation, thus both auto shops were investigated (Ref. 20, pp. 1-2). Soil samples were collected from both facilities during the 2015 ESI and analyzed using CLP OLM04.2, but there were no VOC detections (Ref. 9, pp. 6-23).

Despite an extensive search, the ground water plume could not be definitively attributed to any identified source.

Hazardous Substances Released

Tetrachloroethene (PCE) and Trichloroethene (TCE)

Ground Water Observed Release Factor Value: 550

### 3.1.2 POTENTIAL TO RELEASE

As specified in the HRS, since an observed release was established to the Santa Rosa Aquifer, the potential to release was not evaluated (Ref. 1, Section 3.1.1).

### 3.2 WASTE CHARACTERISTICS

#### 3.2.1 TOXICITY/MOBILITY

| Hazardous Substance | Source No. (and /or Observed Release) | Toxicity Factor Value | Mobility Factor Value | Does Hazardous Substance Meet Observed Release by chemical analysis? (Y/N) | Toxicity/ Mobility (Ref. 1, Table 3-9) | References |
|---|---|---|---|---|---|---|
| Tetrachloroethene (PCE) | Observed Release | 100 | 1 | Y | 100 | Ref. 1, Sections 2.4.1.1, 3.2.1.2; Ref. 2, pp. 1-2 |
| Trichloroethene | Observed Release | 1000 | 1 | Y | 1000 | Ref. 1, Sections 2.4.1.1, 3.2.1.2; Ref. 2, p. 3 |

Toxicity/Mobility Factor Value: 1000
(Ref. 1, Table 3-9)

#### 3.2.2 HAZARDOUS WASTE QUANTITY

| Source No. | Source Type | Source Hazardous Waste Quantity | Source Hazardous Constituent Quantity Complete? |
|---|---|---|---|
| 1 | Other - GW plume | >0 | No |

Sum of Values:

Hazardous Waste Quantity Factor Value: 100

The hazardous constituent quantity data are not adequately determined for one or more sources for the site. Targets for the Ground Water Migration Pathway are subject to Level I and Level II concentrations, as well as potential contamination. According to Section 2.4.2.2 of the HRS, a pathway hazardous waste quantity factor value of 100 is assigned because the hazardous constituent quantity data is not adequately determined for one or more sources, and targets for the Ground Water Migration Pathway are subject to actual contamination (Ref. 1, Section 2.4.2.2, Table 2-6).

### 3.2.3 WASTE CHARACTERISTICS FACTOR CATEGORY VALUE

Toxicity/Mobility Factor Value: 1000
Hazardous Waste Quantity Factor Value: 100

Toxicity/Mobility Factor Value X
Hazardous Waste Quantity Factor Value: 100,000 or 1 X $10^5$(subject to a maximum product of 1 x $10^8$)
(Ref. 1, Section 2.4.3.1)

Waste Characteristics Factor Category Value: 18
(Ref. 1, Section 2.4.3.1, Table 2-7)

## 3.3 TARGETS

The City of Kermit PWS owns 11 wells, all located within the Kermit city limits, which supply water to 5,714 individuals on 2,465 connections (Figure 3; Ref. 4, p. 2). Five of the wells (GW-09 or A, GW-08 or B, D, GW-20 (SSDAP) or E, and GW-07 or H) feed into the Underwood Pump House (henceforth known as EP001), and six of the wells (GW-13 or G, GW-11 (SSDAP or I, GW-01 or J, GW-35 or L, GW-02 or M, and GW-03 or N) feed into the Walton Pump House (henceforth known as EP002) (Figure 3; Ref. 5, p. 6). Well GW-10 (SSDAP) or F was previously sampled and contained PCE; however it was plugged in 2015 because of its proximity to a leaking sewer line (Ref. 15, p. 1). Wells D and GW-11 (SSDAP) or I are currently inactive, thus nine Kermit PWS wells are currently used in production (Ref. 14, p. 1). Ground water is chlorinated before reaching the pump houses, where it is then blended and distributed to the residents of Kermit (Ref. 5, p. 6). Therefore, EP001 and EP002 are post-chlorination and post-blending sample points. Each pump house supplies approximately half of the population of Kermit with water through a single blended system (Ref. 6, p. 1).

Level I Concentrations

Level I concentrations are those concentrations detected in ground water which exceed the SCDM benchmark for a given contaminant.

The City of Kermit wells GW-01, GW-02, GW-07, and GW-08 are subject to Level I contamination.

| Sample ID | Hazardous Substance | Concentration (µg/L) | Reporting Limit[1] | SCDM benchmark (µg/L)[2] | References |
|---|---|---|---|---|---|
| GW-01 | Tetrachloroethene (PCE) | 7.0 | 0.5 | 5 | Ref. 2, pp. 1-3; Ref. 11, p. 14; Ref. 8, p. 32 |
| GW-02 | Tetrachloroethene (PCE) | 43.5 | 0.5 | 5 | Ref. 2, pp. 1-3; Ref. 12, p. 10; Ref. 9, p. 25 |
| GW-07 | Trichloroethene (TCE) | 1.4 | 0.5 | 1.1 | Ref. 2, pp. 1-3; Ref. 11, p. 15; Ref. 8, p. 33 |
| GW-08 | Trichloroethene (TCE) | 1.46 | 0.5 | 1.1 | Ref. 2, pp. 1-3; Ref. 11, p. 16; Ref. 13, p. 2; Ref. 7, pp. 8, 46, 154 |

[1] The reporting limit (sometimes referred to as a quantitation limit) is defined as the lowest concentration at which an analyte can be reliably measured and reported without qualification. Reporting limits are adjusted for sample size, dilution, and matrix interference. Concentrations below the reporting limit are reported as non-detects (Ref. 8, p. 1; Ref. 9, p.1). The sample quantitation limit (SQL) is the quantity of a substance that can be reasonably quantified given the limits of detection for the methods of analysis and sample characteristics that may affect quantitation (Ref. 1, section 1.1).
[2]The MCL was used for PCE; Cancer Risk was used for TCE.

### 3.3.1 NEAREST WELL

The City of Kermit wells GW-01, GW-02, GW-08, and GW-07 are subject to Level I contamination (see Section 3.1.1), thus a value of 50 is assigned.

Nearest Well Factor Value: 50
(Ref. 1, Table 3-11)

### 3.3.2 POPULATION

**3.3.1.1 Level of Contamination**

**3.3.1.2 Level I Concentrations**

Level I Population Targets

The City of Kermit wells GW-01, GW-07, GW-08, and GW-02 are subject to Level I contamination. Nine active wells are used equally to supply 5714 residents, thus 5714/9= 634.88 individuals per well (Ref. 4, p. 2; Ref. 28, p. 1). 634.88 x 4 (wells affected by level I contamination) = 2,539.52 individuals

2,539.52 individuals X 10 =25,395.2 target points are assigned (Ref 1. Section 3.3.2.2).

Level I Concentrations Factor Value: 25,395.2

#### 3.3.2.3 Level II Concentrations

Level II concentrations are those concentrations detected in ground water between the reporting limit and the SCDM benchmark for a given contaminant.

Level II Population Targets

| Level II Well | Aquifer No. | Population | References |
|---|---|---|---|
| GW-03 | 1 | 634.88 | Ref. 4, p. 2; Ref. 28, p. 1; Ref. 9, p. 27 |
| GW-06 | 1 | 3 | Ref. 4, p. 2; Ref. 12, p. 16; Ref. 9, p. 33 |
| GW-09 | 1 | 634.88 | Ref. 4, p. 2; Ref. 28, p. 1; Ref. 8, p. 37 |
| GW-11 | 1 | 0[1] | Ref. 11, p. 20; Ref. 8, p. 48 |
| GW-35 | 1 | 634.88 | Ref. 4, p. 2; Ref. 28, p. 1; Ref. 9, p. 61 |

[1] Kermit ISD well GW-11 is used only occasionally by athletes (transient use); therefore, a population was not assigned.

Utilizing the Kermit PWS well distribution formula discussed in the Level I Concentrations section, 634.88 x 3 (wells affected by level II contamination) =1,904.64 individuals (Kermit PWS) + 3 individuals (private well GW-06) = 1,907.64 individuals (Ref. 4, p. 2; Ref. 28, p. 1; Ref. 12, p. 16).

Sum of Population Served by Level II Wells: 1,907.64 (Ref. 1, Section 3.3.2.3)

Level II Concentrations Factor Value: 1,907.64

#### 3.3.2.4 Potential Contamination

Potential Population Targets

The potential contamination factor was evaluated and scored. The wells were researched within radii of 0 to 0.25, 0.25 to 0.5, 0.5 to 1, 1 to 2, 2 to 3, and 3 to 4-miles of the site (Figure 4). Texas State well identification numbers, well depths, and distances from the site were obtained from the Texas Water Development Board's Water Information Integration and Dissemination Groundwater Database interactive viewer. Information for the public water system wells were verified through contact with the respective water system representatives (Ref. 4, p. 2; Ref. 5, pp. 3, 7-26; Ref. 28, p. 1).

| Distance Category | Population | References (Ref. 1, Table 3-12) | Distance-Weighted Population Value (Ref. 1, Table 3-12) |
|---|---|---|---|
| 0 to 1/4 mile | 643 | Ref. 28, p. 1; Ref. 11, p. 25 | 522 |
| >1/4 to 1/2 mile | 0 | Ref. 28, p. 1; Ref. 11, p. 20 | 0 |
| >1/2 to 1 mile | 635 | Ref. 28, p. 1; Ref. 12, p. 25; Ref. 11, p. 23 | 167 |
| >1 to 2 miles | 19 | Ref. 12, pp. 8-9, 12-15, 23 | 3 |
| >2 to 3 miles | 289 | Ref. 10, 229; Ref. 29, p. 2; Ref. 30, p. 3; Ref. 31, p. 1 | 21 |
| >3 to 4 miles | 859 | Ref. 10, 229; Ref. 29, pp. 1-2; Ref. 30, p. 3 | 42 |
| | | | 755 |

Calculations:

**0-0.25 mile**
GW-01 has been counted under the Level I contamination category. Kermit well 'E' (designated as GW-20 in the SSDAP sampling event) is the only other PWS well in this distance category, supplying 634.88 individuals within this distance category (Figure 3; Ref. 4, p. 2; Ref. 28, p. 1). Private well GW-17 supplies water to 8 individuals (Ref. 11, p. 25). Hence, a population of 643 is estimated for the 0-0.25 mile category.

Distance-Weighted Population Value: 522 (based on 643 total residents) (Ref. 1, Table 3-12)

**0.25-.05 mile**
GW-02 has been counted under the Level I contamination category. GW-03 and GW-35 have been counted under the Level II contamination category. Kermit well 'I,' the only other PWS well in this distance category, draws from the same portion of the aquifer as GW-01 (counted under the Level I category), consequently, the Kermit PWS utilizes only GW-01 on a regular basis due to the risk of overdrawing the aquifer (Ref. 28, p. 1). Kermit ISD well GW-11 is located in this distance category; although the well is mainly used for irrigation, students occasionally drink from it during extracurricular activities, thus the well falls in the category of transient use (Ref. 11, p. 20).

Distance-Weighted Population Value: 0 (based on 0 total residents) (Ref. 1, Table 3-12)

**0.5-1 mile**

GW-07 and GW-08 have been counted under the Level I contamination category, and GW-06 and GW-09 have been counted under the Level II contamination category. Kermit 'G' (GW-13) is the only other PWS well in this distance category, supplying 634.88 individuals within this distance category (Ref. 4, p. 2; Ref. 28, p. 1). Private well GW-32 supplies a liquor store with water which they treat through reverse osmosis and sell to an unknown number of users (Ref. 12, p. 24). Kermit ISD well GW-15 is located in the category; although the well is mainly used for irrigation, students occasionally drink from it during extracurricular activities, thus the well falls in the category of transient use (Ref. 11, p. 23). Hence, a population of 635 is estimated for the 0.5-1 mile distance category.

Distance-Weighted Population Value: 167 (based on 635 total residents) (Ref. 1, Table 3-12)

**1 mile-2 miles**

There are ten private drinking water wells in this distance category, and no PWS wells. Based on in-person interviews, the total combined number of users for these private water wells is 19 individuals (Ref. 12, pp. 8-9, 12-15, 23).

Distance-Weighted Population Value: 3 (based on 19 total residents) (Ref. 1, Table 3-12)

**2-3 miles**

The Midland County Fresh Water District (FWD) owns 25 wells southeast of Kermit (known as the Clearwater Ranch Project) which serve as a supplemental water supply to the City of Midland (Ref. 29, p. 1). They provide 4% to 5% of 25% of the city supply, thus: 119,385 (Midland water customers) x 0.25 = 29,846.25 x 0.04 = 1,193.85 (individuals supplied by the Midland County FWD well field) /25 wells = 47.754 individuals per well (Ref. 29, p. 2; Ref. 30, p. 1-3). Six of those wells lie within this distance category, thus 286.524 (47.754 x 6) individuals obtain water from wells in this distance category (Ref. 10, p. 229). Private well GW-29 supplies a bar with a transient population and three full time employees (Ref. 12, p. 21; Ref. 31, p. 1). Hence, a population of 289 is calculated for the 2-3 mile distance category.

Distance-Weighted Population Value: 21 (based on 289 total residents) (Ref. 1, Table 3-12)

**3-4 miles**

The Midland County Fresh Water District (FWD) owns 18 wells within this category. Utilizing the formula from the previous distance category, 859.572 (47.754 x 18) individuals obtain water from wells in this distance category (Ref. 10, p. 229; Ref. 29, pp. 1-2; Ref. 30, p. 3). Hence, a population of 859 is estimated for the 3-4 mile distance category.

Distance-Weighted Population Value: 42 (based on 859 total residents) (Ref. 1, Table 3-12)

Sum of Distance-Weighted Population Values: 755
Sum of Distance-Weighted Population Values/10: 75.5

Potential Contamination Factor Value: 75.5 (Ref. 1, Table 3-12)

### 3.3.3 RESOURCES

Water drawn from the aquifer being evaluated is used for one or more of the following resource purposes (irrigation) listed in the HRS (Ref.1, Section 3.3.3).

- Irrigation (5-acre minimum) of commercial food crops or commercial forage crops,
- Watering of commercial livestock,
- Ingredient in commercial food preparation,
- Supply for commercial aquaculture, or
- Supply for a major or designated water recreation area, excluding drinking water use.

Wells are used for irrigation in the area but it is uncertain if they meet the requirements to qualify as a resource (Ref.1, Section .3.3.3; Ref. 11, pp. 20-21; Ref. 8, pp. 2, 48, 86-92)

Resources Factor Value: 0

### 3.3.4 WELLHEAD PROTECTION AREA

The City of Kermit is not located within a wellhead protection area (Ref.1, Section 3.3.4; Ref. 32, p. 1).

Wellhead Protection Area Factor Value: 0