130 ENVIRONMENTAL PARK

APPENDIX IID
WETLANDS DOCUMENTATION

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APPENDIX IID.1

WATERS OF THE UNITED STATES DELINEATION REPORT
AND
WETLAND DETERMINATION AND IDENTIFICATION

WATERS OF THE UNITED STATES DELINEATION REPORT AND WETLAND DETERMINATION AND IDENTIFICATION

For:

130 Environmental Park

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1.0 PURPOSE

Halff Associates (Halff) has been retained to provide to 130 Environmental Park, LLC the environmental services necessary to perform a Section 404 jurisdictional delineation and a wetlands determination and identification for the proposed 130 Environmental Park in Caldwell County, Texas. The study area consists of approximately 1,200 acres and is located on the east side of State Highway (SH) 130/US 183 north of the City of Lockhart, Texas, extending from the intersection of US 183 and FM 1185 east to Homannville Trail. **Figure 1** shows the general project location with respect to larger metropolitan areas. **Figure 2** shows the location within Caldwell County and in relation to the City of Lockhart.

130 Environmental Park, LLC intends to permit and operate a new municipal solid waste facility in northern Caldwell County. The 130 Environmental Park will include a Type I municipal solid waste disposal facility and a Type V municipal solid waste transfer station. This document has been prepared to meet wetland delineation guidelines published by the U.S. Army Corps of Engineers (USACE), to serve as supporting documentation for a jurisdictional determination under Section 404 of the Clean Water Act, and to provide information for a wetlands determination and identification pursuant to Texas Commission on Environmental Quality rules at 30 TAC 330.61(m)(2) and (3).

2.0 METHODS

Supporting information including aerial photographs, United States Geological Survey (USGS) quadrangle maps, soil survey maps, and floodplain maps were reviewed prior to conducting site investigations. In June and July 2013, site investigations were conducted to determine the present day extent of wetlands and waters of the United States. Limits of wetlands and waters of the United States were identified in the field by Halff personnel with training and experience in the identification and mapping of such waters and wetlands. Water feature limits were based on the presence of the ordinary high water mark (OHWM) of the surface tributary system, or the presence of wetland indicators where applicable. Limits of wetlands and waters of the United States were measured in the field in June and July 2013 by two different techniques. The majority of the survey data, specifically the wetlands and stream locations that were within and in the vicinity of the proposed project area, were collected using a Spectra Precision Epoch 50 Global Positioning System (GPS) receiver and conventional methods utilizing survey control points within the project. Other features which were measured with Global Positioning System

(GPS) receivers, either with a Spectra Precision Epoch 50 or Trimble GeoXT GPS receiver. Survey data were then converted and analyzed using ArcView Geographic Information System (GIS) software. All coordinates are State Plane South-Central Texas Zone 4204 (NAD 1983) coordinates.

Prior to conducting the field study, Halff utilized background information to establish a series of transects to provide adequate coverage of the study area. Transects were established perpendicular to the hydrological gradient of three distinct stream systems identified on USGS quadrangle maps in order to intersect areas suspected to contain wetlands or other aquatic features (e.g., reservoir on USGS map, apparent inundation on aerial photography, and riparian woodlands). Twenty-one east-west and 6 north-south transects were established, with multiple wetland determination data points recorded, documenting vegetation, hydrology, and soil characteristics along each transect. Given that a substantial portion of the study area consisted of dense mesquite uplands and post oak woodlands, Halff determined that the approximate 500-foot spacing between transects was necessary to provide representative coverage of the study area. Halff also investigated areas between these transects, especially areas known or suspected to contain aquatic features. The collection of information for wetland data points was consistent with the USACE guidelines for wetland delineations per the "1987 Corps of Engineers Wetlands Delineation Manual," in addition to the "Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region (Version 2.0)." **Figure B-1** (**Appendix B**) shows the location of transects with respect to aquatic features identified in the field. **Figure 3.1** through **Figure 3.6** shows all mapped aquatic features on an aerial photograph.

3.0 RESULTS

Supporting information for this report includes current and historical aerial photographs, a USGS topographic map, and a soil survey map which are in **Appendix A**. A discussion of these maps is provided in **Section 3.1**. Results of the site investigation are provided in **Section 3.2**.

3.1 Supporting Information

3.1.1 Topographic Map Information

The USGS Quadrangle Map for "Lockhart North, Texas" (**Appendix A, Figure A-1**) shows the study area with topography peaking in the northern portion of the study area and generally sloping south and east towards Dry Creek. The Dry Creek tributary system enters the study area from the east and flows south to a large on-channel impoundment near the southern study area boundary. Contours suggest the presence of a potential drainage network that would flow north to south toward Dry Creek, representing a secondary tributary system to Dry Creek. Much of the area surrounding Dry Creek and its on-channel impoundment is depicted within the mapped limits of the maximum pool elevation, as determined by the emergency spillway elevation. Another tributary enters the study area from the north and flows south until it outfalls into the on-channel impoundment of Dry Creek. Several headwater tributaries are mapped as flowing west to east into this tributary, one of which includes an on-channel open water pond along its stream course. Another tributary enters the study area from the north in the southwestern portion of the study area. This tributary flows north to south and exits the study area under FM 1185. Contours suggest the presence of other drainages that would flow west to east toward this receiving tributary, one of which includes an on-channel open water pond along its course. Several apparent off channel open water ponds are shown in the central portion of the study area.

3.1.2 Soil Survey Information

Soils data for the study area was obtained from the Natural Resource Conservation Service (NRCS) Soil Data Mart, which is derived from the U.S. Department of Agriculture (USDA) soil survey for Caldwell County (1978). The soil units mapped from USDA GIS data are shown atop a 2012 aerial photograph of the study area in **Appendix A, Figure A-2**. **Table 1** provides key characteristics for these soil types.

Table 1 - Soil Types within the Study Area

Soil Id	Soil Series	Topography	Available Water Capacity	Drainage Class	Flooded	Ponded
BuB	Burleson Clay	1-3% slopes	Moderate	Moderately Well Drained	No	No
CfB	Crocket fine sandy loam	1-3% slopes	Moderate	Moderately Well Drained	No	No
CrC2	Crockett soils	2-5% slopes, eroded	Moderate	Moderately Well Drained	No	No
CrD3	Crockett soils	3-8% slopes, eroded	Moderate	Moderately Well Drained	No	No
DAM	Dams	---	---	---	---	---
FeE	Fett gravelly soils	1-12% slopes	Low	Somewhat Poorly Drained	No	No
HeC2	Heiden clay	3-5% slopes, eroded	Moderate	Well Drained	No	No
HmB	Heiden-Wilson complex	1-3% slopes	Moderate	Well Drained 55% / Moderately Well Drained 30%	No	No
HoC2	Houston Black clay	3-5% slopes, eroded	Moderate	Moderately Well Drained	No	No
MaA	Mabank loam	0-1% slopes	Moderate	Moderately Well Drained	No	Yes
MaB	Mabank loam	1-3% slopes	Moderate	Moderately Well Drained	No	No
Ts	Tinn soils, frequently flooded	0-1 % slopes	High	Moderately Well Drained	No	No
W	Water	---	---	---	---	---
WgC	Wilson gravelly loam	1-5% slopes	Moderate	Moderately Well Drained	No	No

The majority of the study area is mapped as Fett gravelly soils and Wilson gravelly loam (soil map symbols FeE and WgC). The Tinn soil unit (map symbol Ts) is associated with the floodplains of the larger drainages across the study area, and typically floods more than once a year. None of the listed soils are considered hydric soils according to the USDA Soil Data Mart. However, the database shows that the Tinn Soils, frequently flooded unit and the Mabank loam 0-1% slopes unit contain unnamed minor components located in depressions that may meet hydric criteria, based on ponding and/or flooding.

3.1.3 Aerial Photography

Infrared aerial photographs from 1996, and true color aerial photographs from 2010 and 2012 (**Appendix A, Figure A-3** through **Figure A-5**), show the study area in different climatic conditions. Consistent with the USGS topographic map, all aerial photographs show several stream courses across the study area along with a large on-channel impoundment and several scattered off-channel impoundments. In the 1996 photograph (**Figure A-3**), densely wooded areas are mostly limited to narrow riparian areas along the major drainages across the study area, while the remainder of the wooded areas appears to be sparse, younger tree growth. The remainder of the study area appears to be open pasture land with some apparent terracing of hillside slopes readily observable. The 1996 aerial photograph shows the study area with the large on-channel impoundment of Dry Creek at a higher capacity, compared to noticeably lower water surface levels in the more recent photographs. The 1996 aerial photograph also indicates the general location of the headwater streams suggested on the USGS map in the remainder of the study area. The 2010 aerial photograph (**Figure A-4**) shows denser woody growth than the 1996 photograph, especially in the western portion of the study area, and also shows the apparent succession of scrub/shrub growth in observed terraced areas. The 2012 aerial photograph (**Figure A-5**) shows the Dry Creek on-channel impoundment at its lowest water surface elevation, even when compared to the 2010 photograph. Headwater streams are not as readily observable on the 2010 or the 2012 aerial photographs.

3.1.4 Floodplain Information

According to the Flood Insurance Rate Map (FIRM) published by the National Flood Insurance Program, Dry Creek is mapped with a wide floodplain across the length of the study area. The secondary tributary system to Dry Cry lacks a substantial floodplain, while the remaining tributary systems have a narrow floodplain consistent with their stream courses as observed on aerial photography. The overbank areas of the Dry Creek and its tributaries are located within the 1% chance annual flood hazard zone with base elevations not determined (Zone A). The remainder of the study area is mapped as outside of the 0.2% annual chance flood zone (Zone X). **Figure A-6** shows the limits of flood zones on 2012 aerial photography.

3.2 Field Conditions

3.2.1 Streams

Three distinct tributary systems were identified in the study area (Dry Creek, IS-1, and ES-9). The limits of the streams were based on the presence of a discernible OHWM consistent with physical characteristics outlined in USACE Regulatory Guidance Letter 05-05. The OHWM of each bank was flagged and surveyed at regular intervals to adequately characterize the sinuousity of the stream. Observed physical characteristics used to delineate the OHWM generally included the following: destruction of terrestrial vegetation; leaf litter washed away; scour; and/or bed and banks. A brief description of each of the tributary systems is provided below and descriptions are followed by a summary of pertinent physical characteristics in **Table 2** through **Table 5**. The locations of these streams are shown on **Figure 3.1** through **Figure 3.6**.

Dry Creek System

Dry creek enters the study area from the east via box culverts under Homannville Trail. Stream flow is from north to south through a channel varying from 5 to 20 feet wide. Dry Creek flows within a narrow riparian corridor consisting of green ash (*Fraxinus pennsylvanica*), cedar elm (*Ulmus crassifolia*), pecan (*Carya illinoensis*), hackberry (*Celtis laevigata*), and chinaberry (*Melia azeradach*). Throughout much of the stream course, the riparian corridor generally extends less than 25 feet from the top of the channel bank and is absent along portions of Dry Creek closer to the outfall into OW-1. With the exception of cattle and game crossings and one vehicular low-water crossing, the channel within the study area shows little signs of alteration and there are multiple types of instream habitat features (e.g., overhanging vegetation, woody debris, etc.). Dry Creek has intermittent pools throughout its course within the study area, but no active stream flows were observed; Dry Creek has been classified as an intermittent tributary. One ephemeral stream (ESD-1) enters the study area from the east and outfalls into Dry Creek upstream of its outfall into OW-1 and two additional headwater ephemeral streams (ESD-2 and ESD-3) outfall into Dry Creek from the north. None of the ephemeral streams associated with Dry Creek had standing or flowing water at the time of site investigations.

Secondary to the Dry Creek system, the ESD-4 stream system is a series of headwater streams (ESD-4A, ESD-4B, ESD-4C, and ESD-4D) that originate in the northeastern portion of the study area and flow generally north to south before outfalling into Dry Creek. Tributary ESD-4 is in the approximate location of the unnamed tributary suggested on the USGS topographic map (**Figure A-1**) in the eastern portion of the study area. The headwater channels are generally 2 to 4 feet wide with a cobble bottom and flowed north to south within an upland corridor consisting primarily of mesquite (*Prosopis glandulosa*) trees. After the headwater channels converge into one main channel (ESD-4), the OHWM widens to an average of 6 to 8 feet and surrounding woody vegetation is dominated by post oak (*Quercus stellata*) and cedar elm with some green ash near the confluence with Dry Creek. The shallow channel shows no sign of incision and the channel area shows little signs of alteration.

Table 2 - Summary of Dry Creek Stream Segments

Name	Figure Location	Stream Classification	Length (ft)	OHWM Width (ft)
Dry Creek	3.2, 3.4, 3.6	Intermittent	6,264	5-20
ESD-1	3.4	Ephemeral	1,878	8-10
ESD-2	3.4	Ephemeral	1,065	8
ESD-2A	3.4	Ephemeral	89	6
ESD-3	3.4	Ephemeral	419	4-8
ESD-4	3.2	Ephemeral	3,912	6-8
ESD-4A	3.2	Ephemeral	420	4-7
ESD-4B	3.2	Ephemeral	1,638	5
ESD-4C	3.2	Ephemeral	115	4
ESD-4D	3.2	Ephemeral	570	4

Intermittent Stream 1 (IS-1)

This stream segment, located in the central portion of the study area, is a larger stream which outfalls into Dry Creek at OW-1. Stream flow is from north to south through a channel approximately 10-15 feet wide. The riparian corridor is historically narrow based on available aerial photography. However, the surrounding post oak woodland has contributed to a wider corridor in recent years. Stream banks were incised, particularly in the downstream areas, but there was very little evidence of cattle grazing near or crossing the stream, and there are multiple types of instream habitat features (e.g., overhanging vegetation, woody debris, etc.). This feature is classified as an intermittent stream because it was dry for much of its reach, but multiple deep pools and signs of inundation within the channel were common. Twelve additional ephemeral tributaries associated with IS-1 are included in this system. Five of these ephemeral tributaries (ES-5, ES-5A, ES-5B, ES-7, and ES-7A) flow west to east into IS-1, and two tributaries (ES-8 and ES-6) flow north to south into IS-1. Tributaries ES-10, ES-11, ES-12 are short feeder tributaries that flow into IS-1 from the east. Tributaries ES-3 and ES-4 do not outfall into IS-1 within the study area, but likely had a historic OHWM connection with IS-1 prior to construction of the Soil Conservation Service impoundment along Dry Creek and IS-1. Currently, the historic courses are maintained as grassland pasture. ES-3 has an on-channel pond (OW-6) with a fringe wetland (EW-40) along the overhead utility easement. Tributaries ES-1, ES-2, and ES-2A are actually direct tributaries to Dry Creek and outfall to Dry Creek south of the study area. They were included within the discussion of the IS-1 system because of their geographic location within the study area. Additionally, due to their location within the landscape, they were characteristically more similar to the tributaries observed within the IS-1 system than the tributaries to Dry Creek on the eastern portion of the study area.

Table 3 - Summary of IS-1 Stream Segments

Name	Figure Location	Stream Classification	Length (ft)	OHWM Width (ft)
IS-1	3.1, 3.3, 3.6	Intermittent	10,017	10-15
ES-1	3.5	Ephemeral	567	5
ES-2	3.5, 3.6	Ephemeral	3,452	5-6
ES-2A	3.6	Ephemeral	116	3
ES-3	3.3	Ephemeral	1,393	3
ES-4	3.3	Ephemeral	1,245	3
ES-5	3.3	Ephemeral	3,258	4
ES-5A	3.3	Ephemeral	532	4
ES-5B	3.3	Ephemeral	135	3
ES-6	3.3	Ephemeral	959	3-6
ES-7	3.1	Ephemeral	1,414	7-10
ES-7A	3.1	Ephemeral	226	4-8
ES-8	3.1	Ephemeral	432	5-10
ES-10	3.3	Ephemeral	105	4-6
ES-11	3.3	Ephemeral	117	2-4
ES-12	3.3	Ephemeral	127	4-6

Ephemeral Stream 9 (ES-9)

This is a smaller stream system located in the southwestern portion of the study area. The main ES-9 channel is an 8 to 10 foot wide cobbled channel flowing north to south within dense post oak woodland. The channel was smaller and less incised in comparison with IS-1 and there was little evidence of cattle grazing in this portion of the study area. ES-9 is joined by a smaller headwater stream system from the west, which included one on-channel open water pond (OW-7) and an on-channel emergent wetland (EW-45) downstream of the pond dam. Near the southern study area boundary, ES-9 outfalls into a culvert under FM 1185 and multiple emergent and forested wetlands (EW-43, EW-44, and FW-8) were observed adjacent to the channel in this area.

Table 4 - Summary of ES-9 Stream Segments

Name	Figure Location	Stream Classification	Length (ft)	OHWM Width (ft)
ES-9	3.5	Ephemeral	2,453	8-10
ES-9A	3.5	Ephemeral	306	3-10
ES-9B	3.5	Ephemeral	605	3-10
ES-9C	3.5	Ephemeral	96	4-5
ES-9D	3.5	Ephemeral	78	3
ES-9E	3.5	Ephemeral	187	3
ES-9F	3.5	Ephemeral	148	3-6

3.2.2 Open Water

A total of eight open water features were observed in the study area. Of these eight, three (OW-1, OW-6, and OW-7) were considered to be on-channel impoundments. During the July 2013 field investigation, OW-4, OW-5, and OW-8 were determined to be isolated impoundments, in upland areas, that are not associated with defined channels. For OW-6 and OW-7, Halff observed channel segments (ES-3 and ES-9B), with defined ordinary high water marks upstream and downstream of the impoundments. The same cannot be said for OW-2 and OW-3; however, evidence of historic drainages may have been affected by the construction of OW-1. Based on the proximity to OW-1 and its associated wetland complex, it is reasonable to conclude these may have been impoundments of some past tributary. OW-1 was the largest water feature observed within the study area and is an on-channel impoundment of Dry Creek.
During the July 2013 site investigation, the open water features within the study area exhibited varying water levels. The on-channel impoundments (OW-6 and OW-7) appeared to be full, while the isolated stock ponds in uplands were several feet low. OW-1 has a much greater capacity than was observed during the field investigation. However, the limits of the pond that were mapped in the field are consistent with recent aerial imagery. **Table 5** provides a summary of all mapped open water areas. The locations of open water features are shown on **Figure 3.1** through **Figure 3.6**.

Table 5 - Summary of Open Water Features

Name	Figure Location	On-channel Impoundment	Area (Acres)
OW-1	3.4, 3.6	Yes	20.32
OW-2	3.4	No	0.42
OW-3	3.4	No*	0.28
OW-4	3.2	No*	0.28
OW-5	3.3	No	0.17
OW-6	3.3	Yes	0.22
OW-7	3.5	Yes	0.15
OW-8	3.4	No	0.18

* - Although there is no discernible evidence of a tributary, evidence supports that there at times may be a hydrologic connection to OW-1.

3.2.3 Wetlands

As noted in **Section 2.0**, Halff established multiple transects perpendicular to the hydrological gradient of the different drainages located in the study area, along which multiple data points were sampled (**Figure B-1, Appendix B**). Consistent with the delineation manual, data points were taken along each transect to characterize the different vegetation communities encountered. Initially, data points were collected in wetland and non-wetland areas to establish the various vegetation communities within the study area. Once sufficient data was collected within each community, reference data points (including representative photography) were used to delineate the boundaries between vegetation communities, as well as the wetland/non-wetland boundaries. Based on guidance from the USACE Fort Worth District, an evaluation of soils and hydrology was not necessary at data points that did not meet hydrophytic vegetation criteria.

The following discussion provides a general summary of each of the vegetation communities observed within the study area. For communities associated with wetland areas, a discussion of the hydric soil indicators and wetland hydrology indicators observed is included. **Appendix B** contains copies of wetland data sheets completed for each area. Photographs from representative data point locations are provided following the data sheets for each transect. A summary table of mapped aquatic features is included following the narrative for each vegetation community in which wetlands were encountered. The locations of these wetland features are shown on **Figure 3.1** through **Figure 3.6**.

Mesquite Grassland Mosaic

The mesquite grassland mosaic was one of the most frequently encountered vegetation communities within the study area. Tree canopy was absent from this community and dominant vegetation was a relatively homogenous mix of scrub brush and various grasses and forbs. Dominant woody species observed included mesquite, agarita (*Mahonia trifoliolata*), allthorn goatbush (*Castela erecta*), and Texas persimmon (*Diospyros texana*). Dominant herbaceous species included Texas wintergrass (*Nassella leucotricha*), Texas prickly pear (*Opuntia engelmannii var. lindheimeri*), pencil cactus (*Cylindropuntia leptocaulis*), lemon bee balm (*Monarda citriodora*), and plains coreopsis (*Coreopsis tinctoria*). Because the mesquite grassland mosaic was dominated by facultative upland vegetation, soils and hydrology were not documented at data points within this community.

Mesquite Woods

The mesquite woods community typically occurred within transition areas between the mesquite grassland mosaic and post oak or cedar elm woods. Generally, species composition was similar to the mesquite grassland mosaic, with larger mesquites, post oak, cedar elm, and hackberry comprising a sparse canopy layer. Because the mesquite woods community was dominated by facultative upland vegetation, soils and hydrology were not documented at data points within this community.

Sumpweed Depressions

The sumpweed depressions vegetation community was typically observed within terraced areas of the mesquite grassland mosaic landscape. These communities were very distinct from the surrounding vegetation and represented clear shift in local hydrology. Due to their geomorphic position, and the presence of moderately slow draining soils, these depressions appeared to experience shallow inundation with frequency and duration sufficient to support hydrophytic vegetation in a landscape otherwise dominated by upland species. A pronounced shift in vegetation was observed at each depression and, in conjunction with presence or absence of soil and hydrology indicators, was utilized to delineate the wetland/non-wetland boundary. Dominant herbaceous vegetation within the sumpweed depressions community included sumpweed (*Iva annua*), common spikerush (*Eleocharis palustris*), shortbeak sedge (*Carex brevior*), giant ragweed (*Ambrosia trifida*), savannah panicgrass (*Phanopyrum gymnocarpon*), and lanceleaf frogfruit (*Phyla lanceolata*). Tree canopy was absent from this community, as woody vegetation was limited to mesquite, agarita, and Texas persimmon located at the edges of the depressions in the mesquite grassland mosaic community.

Soils observed within the sumpweed depressions community were relatively homogenous and consisted of a shallow layer (4 to 8 inches thick) of black clay, atop a hard layer of dense cobble and claypan. Though matrix color and texture were consistent with the surrounding upland soils, discernible redoximorphic features were observed within each of the sumpweed depressions. The most common hydric soil indicator observed within these soils was F6-Redox Dark Surface. Other hydric soils observed included F3-Depleted Matrix and F7-Depleted Dark Surface.

Wetland hydrology indicators observed within the sumpweed depressions community included D2-Geomorphic Position, C9-Saturation Visible on Aerial Imagery (see 1996 CIR aerial photography), and C3-Oxidized Rhizospheres on Living Roots. The presence or absence of the C3-Oxidized Rhizospheres on Living Roots indicator was frequently used to determine the wetland/non-wetland boundary. See **Table 6** below for a summary of the emergent wetlands that were mapped within the sumpweed depressions vegetation community.

Table 6 - Summary of Emergent Wetlands in Sumpweed Depressions

Name	Figure Location	Data Point	Type	Area (Acres)
EW-21	3.2	T1-DP1	Emergent Wetland (Sumpweed Depressions)	0.07
EW-22	3.2	T1-DP2	Emergent Wetland (Sumpweed Depressions)	0.02
EW-23	3.1	T3-DP3	Emergent Wetland (Sumpweed Depressions)	0.03
EW-24	3.1	T3-DP4	Emergent Wetland (Sumpweed Depressions)	0.09
EW-25	3.1	T3-DP5	Emergent Wetland (Sumpweed Depressions)	0.04
EW-26	3.1	T3-DP6	Emergent Wetland (Sumpweed Depressions)	0.08
EW-27	3.1	T3-DP7	Emergent Wetland (Sumpweed Depressions)	0.03
EW-28	3.1	T4-DP7	Emergent Wetland (Sumpweed Depressions)	0.02
EW-29	3.1	T4-DP8	Emergent Wetland (Sumpweed Depressions)	0.02
EW-30	3.1	T4-DP10	Emergent Wetland (Sumpweed Depressions)	0.02
EW-31	3.1	T4-DP11	Emergent Wetland (Sumpweed Depressions)	0.02
EW-32	3.1	T4-DP12	Emergent Wetland (Sumpweed Depressions)	0.04
EW-33	3.1	T6-DP2	Emergent Wetland (Sumpweed Depressions)	0.05

Post Oak/Cedar Elm Woods

The majority of the western portion of the study area was comprised of the post oak and cedar elm woods vegetation community. This community was dominated by post oak and cedar elm in the canopy layer, and mesquite, agarita, Texas persimmon, yaupon holly (*Ilex vomitoria*), deciduous holly (*Ilex decidua*), and hackberry in the understory layer. Herbaceous vegetation observed within this community included slimleaf panicgrass (*Dicanthelium linearifolium*), wild oat (*Avena fatua*), Virginia wildrye (*Elymus virginicus*), pencil cactus, Texas prickly pear, Texas wintergrass, pink thoroughwort (*Eupatorium incarnatum*), and perennial ryegrass (*Lolium perenne*). Because the post oak and cedar elm woods vegetation community was dominated by facultative upland vegetation, soils and hydrology were not documented at data points within this community.

Riparian Woods

The riparian woods vegetation complex occurred along the riparian corridors of the intermittent and ephemeral streams within the study area. Two distinct riparian vegetation communities were observed within this complex. The first community occurred at higher elevations, along ephemeral streams, and along the upper reaches of intermittent streams. This community was dominated by cedar elm, post oak, hackberry, and live oak (*Quercus virginiana*) in the canopy layer, and mesquite, littlehip hawthorn (*Crataegus spathulata*), chittamwood (*Bumelia lanuginosa*), and yaupon holly in the understory layer. Herbaceous vegetation in this community was generally sparse and dominant species included giant ragweed (*Ambrosia trifida*), Virginia wildrye, pencil cactus, blackeyed susan (*Rudbeckia hirta*), Texas wintergrass, prairie croton (*Croton monanthogynus*), pink thoroughwort, ironweed (*Vernonia baldwinii*), itchgrass (*Rottboellia cochichenensis*), and lean flatsedge (*Cyperus setigerus*).

The second vegetation community in the riparian woods complex occurred at lower elevations along the stream corridor of the two primary drainages within the study area. Dominant woody vegetation within this community included hackberry, green ash, pecan, and cedar elm. Herbaceous vegetation in this community was generally sparse and dominant species included Virginia wildrye and giant ragweed.

While hydric soil and wetland hydrology indicators were observed within portions of the riparian woods complex within the study area, they were typically accompanied by a transition in dominant vegetation and located in topographical depressions. Therefore, wetland features that occurred within the vicinity of the riparian woods complex were categorized according to the shift in vegetation community and topography, and the soil and hydrology characteristics are described within the context of the forested wetland community.

Floodplain Meadows

The floodplain meadows vegetation complex occurred along the floodplain of Dry Creek in the eastern portion of the study area. This complex was dominated by herbaceous vegetation and was bordered by riparian forest along the stream corridor and the mesquite grassland mosaic in the adjacent uplands. Woody vegetation was mostly absent within this community and was limited to patches of southern dewberry (*Rubus trivialis*) and scattered cedar elm and bois d' arc (*Maclura pomifera*). Dominant herbaceous vegetation included Virginia wildrye, common ragweed (*Ambrosia artemisifolia*), giant ragweed, ironweed, bermudagrass (*Cynodon dactylon*), shortbeak sedge, buffalograss (*Buchloe dactyloides*), Carolina canarygrass (*Phalaris caroliniana*), annual canarygrass (*Phalaris canariensis*), and rough cocklebur (*Xanthium strumarium*).

Within this complex, emergent wetland communities were encountered within topographic depressions. Dominant vegetation in these communities included the aforementioned species along the fringe and topographic transitions, and emergent wetland communities in the interior of the depressions. Species observed in the emergent communities within this complex included flat-stemmed spike rush (*Eleocharis compressa*), lanceleaf frogfruit, common spikerush, and common carpetgrass (*Axonopus fissifolius*).

Soils within the floodplain meadows complex were comprised of very dense, dark brown clay. Within the topographic depressions hydric soil indicators F3-Depleted Matrix and F-6 Redox Dark Surface were observed. Wetland hydrology indicators for the emergent wetland features observed within this complex included C3-Oxidized Rhizospheres on Living Roots, B7-Inundation Visible on Aerial Imagery, C9-Saturation Visible on Aerial Imagery, and D2-Geomorphic Position. See **Table 7** below for a summary of the emergent wetland features mapped within the floodplain meadows vegetation complex.

Table 7 - Summary of Emergent Wetlands in Floodplain Meadows

Name	Figure Location	Data Point	Type	Area (Acres)
EW-16	3.4	T11-DP3	Emergent Wetland (Floodplain Meadows)	0.11
EW-17	3.4	T11-DP2	Emergent Wetland (Floodplain Meadows)	0.23
EW-18	3.4	T9-DP10	Emergent Wetland (Floodplain Meadows)	0.13

Forested Wetlands

Forested wetlands within the study area generally occurred at lower elevations, within the floodplain of the two primary drainages (Dry Creek and IS-1), and near the shoreline of the large lake (OW-1) in the southern portion of the study area. The vegetation observed was similar to that of the riparian woods vegetation complex, but was accompanied by hydric soil and wetland hydrology indicators. Dominant woody species included green ash, black willow (*Salix nigra*), cedar elm, hackberry, and Chinese tallow (*Triadica sebifera*). Herbaceous vegetation was sparse within this community and dominant species included giant ragweed, sumpweed, balloonvine (*Cardiospermum halicacabum*), and bentawn flatsedge (*Cyperus reflexus*).

Soils within the forested wetlands were comprised of very dense, dark brown clay. Hydric soil indicators observed included F6-Redox Dark Surface and F7-Depleted Dark Surface. Wetland hydrology indicators included B1-Water Marks, B3-Drift Deposits, C3-Oxidized Rhizospheres on Living Roots, B6-Surface Soil Cracks, B8-Sparsely Vegetated Concave Surface, B10-Drainage Patterns, and D2-Geomorphic Position. See **Table 8** for a summary of mapped forested wetlands within the study area.

Table 8 - Summary of Forested Wetlands

Name	Figure Location	Data Point	Type	Area (Acres)
FW-1	3.4	T15-DP6	Forested Wetland	0.40
FW-2	3.4	T15-DP7	Forested Wetland	0.16
FW-3	3.4	T15-DP9	Forested Wetland	0.13
FW-4	3.4	T15-DP8	Forested Wetland	0.07
FW-5	3.4	T14-DP12	Forested Wetland	0.10
FW-6	3.2	T8-DP4	Forested Wetland	0.15
FW-7	3.2	T8-DP5	Forested Wetland	0.03
FW-8	3.5	T27-DP3	Forested Wetland	0.20

Other Emergent Wetlands

In addition to the previously discussed sumpweed depressions emergent wetland community and the floodplain meadows emergent wetland communities, several other distinct emergent communities were observed within the study area. These communities included lacustrine fringe emergent wetlands surrounding OW-1, pond fringe emergent wetlands surrounding many of the upland stock ponds, and various other emergent wetland communities that did not fit into any of the aforementioned categories.

The lacustrine fringe emergent community was observed along the perimeter of OW-1 in the southern portion of the study area. Woody vegetation was mostly absent from this community with the exception of scattered sesbania (*Sesbania drummondii*). Dominant herbaceous vegetation included common spikerush, Engelman's spikerush (*Eleocharis engelmannii*), Pennsylvania smartweed (*Persicaria pennsylvanicum*), upright burhead (*Echinodorus berteroi*), broadleaf arrowhead (*Sagittaria latifolia*), squarestem spikerush (*Eleocharis quadrangulata*), and water-clover (*Marsilea vestita*).

Soils within the lacustrine fringe emergent wetland community were comprised of very dense, dark brown clay. F6-Redox Dark Surface was the only hydric soil indicator observed within this community. Wetland hydrology indicators observed within this community included C3-Oxidized Rhizospheres on Living Roots, B8-Sparsely Vegetated Concave Surface, C9-Saturation Visible on Aerial Imagery, D2-Geomorphic Position, and D5-FAC-Neutral Test.

The pond fringe emergent wetland community was observed along the perimeter of many of the stock ponds within the study area. These wetlands are heavily affected by the variable water levels within the ponds and may vary significantly in size and species composition depending on seasonal climatic conditions. Woody vegetation was mostly absent from these communities and was limited to scattered sesbania and occasional upland species (hackberry, cedar elm, mesquite) at the wetland/non-wetland boundary. Dominant herbaceous vegetation included flat-stemmed spikerush, manyspike flatsedge (*Cyperus polystachyos*), knotgrass (*Paspalum distichum*), Engelman's spikerush, camphor pluchea (*Pluchea camphorata*), and water-pepper (*Persicaria hydropiper*).

Soils within the pond fringe emergent wetland community were comprised of very dense, dark brown clay, and at some data points, depleted, light gray, dense clay. Hydric soil indicators observed within this community included F3-Depleted Matrix, F2-Loamy Gleyed Matrix, and F6-Redox Dark Surface. Wetland hydrology indicators observed included A1-Surface Water, A3-Saturation, B7-Inundation Visible on Aerial Imagery, C3-Oxidized Rhizospheres on Living Roots, B6-Surface Soil Cracks, C8-Crayfish Burrows, C9-Saturation Visible on Aerial Imagery, and D2-Geomorphic Position.

Other emergent wetland communities observed within the study area included depressions along drainages, dry stock ponds, and in-channel portions of ephemeral streams that did not exhibit an ordinary high water mark. Vegetation in these communities was similar to vegetation observed in other emergent wetlands within the study area. Dominant species included cedar elm, green ash, and black willow scrub at the fringe of the emergent wetlands, and swamp smartweed (*Persicaria hydropiperoides*), flat-stemmed spikerush, spotted lady's-thumb (*Persicaria maculosa*), shortbeak sedge, Engleman's spikerush, common spikerush, Pennsylvania smartweed, manyspike flatsedge, and needle spikerush (*Eleocharis acicularis*) in the herbaceous layer.

Soils within these emergent wetlands were composed of very dense, dark brown clay, and at some data points, depleted, light gray, dense clay. Hydric soil indicators observed within this community included F3-Depleted Matrix and F6-Redox Dark Surface. Wetland hydrology indicators observed included B1-Water Marks, C3-Oxidized Rhizospheres on Living Roots, B6-Surface Soil Cracks, B8-Sparsely Vegetated Concave Surface, B10-Drainage Patterns, and D2-Geomorphic Position. See **Table 9** below for a summary of the mapped emergent wetlands that were encountered in these communities.

Table 9 - Summary of Other Emergent Wetlands

Name	Figure Location	Data Point	Type	Area (Acres)
EW-1	3.6	T16-DP11	Emergent Wetland (Lacustrine Fringe)	0.04
EW-2	3.4	T15-DP1	Emergent Wetland (Lacustrine Fringe)	0.62
EW-3	3.4	T14-DP1	Emergent Wetland (Pond Fringe)	0.18
EW-4	3.4	T14-DP4	Emergent Wetland (Lacustrine Fringe)	1.71
EW-5	3.4	T15-DP5	Emergent Wetland (Lacustrine Fringe)	1.63
EW-6	3.4	T15-DP7	Emergent Wetland (Lacustrine Fringe)	0.38
EW-7	3.4	T14-DP10	Emergent Wetland (Lacustrine Fringe) / Upland Complex	2.10
EW-8	3.4	T15-DP9	Emergent Wetland (Lacustrine Fringe)	1.18
EW-9	3.4	T15-DP10	Emergent Wetland (Lacustrine Fringe)	0.21
EW-10	3.4	T16-DP8	Emergent Wetland (Lacustrine Fringe)	0.11
EW-11	3.4	T16-DP8	Emergent Wetland (Lacustrine Fringe)	0.37
EW-12	3.6	T16-DP9	Emergent Wetland (Lacustrine Fringe)	0.04
EW-13	3.6	T16-DP10	Emergent Wetland (Lacustrine Fringe)	0.37
EW-14	3.4	T15-DP11	Emergent Wetland (Pond Fringe)	0.06
EW-15	3.4	T13-DP1	Emergent Wetland (On-Channel)	0.17
EW-19	3.4	T11-DP4	Emergent Wetland (Dry Pond)	0.11
EW-20	3.2	T4-DP16	Emergent Wetland (Pond Fringe)	0.24
EW-34	3.3	T9-DP5	Emergent Wetland (Pond Fringe)	0.08
EW-35	3.3	T9-DP6	Emergent Wetland (Depressions)	0.03
EW-36	3.3	T9-DP2	Emergent Wetland (Depressions)	0.01
EW-37	3.3	T9-DP3	Emergent Wetland (On-Channel)	0.14
EW-38	3.1	T19-DP1	Emergent Wetland (On-Channel)	0.21
EW-39	3.3	T20-DP3	Emergent Wetland (On-Channel)	0.13
EW-40	3.3	T20-DP2	Emergent Wetland (Pond Fringe)	0.16
EW-41	3.6	T16-DP4	Emergent Wetland (Depressions)	0.03
EW-42	3.6	T16-DP3	Emergent Wetland (Depressions)	0.26
EW-43	3.5	T27-DP2	Emergent Wetland (Depressions)	0.07
EW-44	3.5	T27-DP1	Emergent Wetland (Depressions)	0.33
EW-45	3.5	T26-DP2	Emergent Wetland (On-Channel)	0.16
EW-46	3.5	T26-DP1	Emergent Wetland (Pond Fringe)	0.16

Scrub/Shrub Wetlands

The scrub/shrub wetland community was observed at four locations around the perimeter of OW-1 in the southern portion of the study area. Dominant vegetation included sesbania, green ash and cedar elm saplings, as well as common spikerush, Engleman's spikerush, and sumpweed in the herbaceous layer.

Soils within these wetlands were comprised of very dense, dark brown clay, and at some data points, depleted, light gray, dense clay. Hydric soil indicators observed within this community included F3-Depleted Matrix and F6-Redox Dark Surface. Wetland hydrology indicators observed included C3-Oxidized Rhizospheres on Living Roots, C9-Saturation Visible on Aerial

Imagery, D2-Geomorphic Position, and D5-FAC-Neutral Test. See **Table 10** below for a summary of the mapped scrub/shrub wetlands encountered within the study area.

Table 10 - Summary of the Scrub/Shrub Wetlands

Name	Figure Location	Data Point	Type	Area (Acres)
SSW-1	3.6	T16-DP11	Scrub/Shrub Wetland	0.01
SSW-2	3.6	T16-DP9a	Scrub/Shrub Wetland	0.16
SSW-3	3.4	T16-DP9b	Scrub/Shrub Wetland	0.22
SSW-4	3.4	T14-DP6	Scrub/Shrub Wetland	0.55

4.0 CONCLUSION

Federal regulations (33 CFR § 328.3(a)) define waters of the United States to include intrastate rivers and streams, including impoundments and other waters. In response to a Supreme Court decision (Rapanos v. U.S., 547 *S. Ct.* 715 [2006]) addressing the limits of federal jurisdiction, the USACE and Environmental Protection Agency (EPA) have issued further guidance, and require additional documentation to support jurisdiction. The USACE continues to assert jurisdiction over traditionally navigable waters and non-navigable tributaries of traditionally navigable waters where the tributaries are relatively permanent waters (i.e., tributaries that typically flow year round or have continuous flow at least seasonally). All streams in the study area are tributaries of Dry Creek which is part of the Guadalupe River (a traditionally navigable water) tributary system. Field and photographic evidence supports that Dry Creek and the intermittent tributary on the western half of the study area (IS-1) are both relatively permanent water features, that as a tributary of a navigable water would be considered waters of the United States.

Further evaluation of water features is provided below to support conclusions of jurisdictional status for the remainder of the aquatic features in the study area. The current USACE guidelines require a jurisdictional evaluation to determine if the features have a significant nexus to traditionally navigable waters for: (1) waterbodies and tributaries that are not relatively permanent waters, including adjacent wetlands if present; and, (2) wetlands adjacent to, but not directly abutting, a relatively permanent tributary. A significant nexus exists if the feature has more than a speculative or insubstantial effect on the chemical, physical, and/or biological integrity of a traditionally navigable water. Establishment of a significant nexus is necessary to establish jurisdiction as a water of the United States.

As non-permanent waters, all ephemeral streams in the study area require a significant nexus determination. As demonstrated herein, portions of the study area have been modified in the past and are dominated by dense invasive tree and shrub growth. However, the ephemeral streams and associated riparian areas by comparison have remained relatively undisturbed. The byproduct is a natural stratification between the herbaceous, shrub, and tree layers which allows for distinct corridors that are important as forested connectors between habitats for wildlife. On some portions of the study area, riparian corridors provide substantial edge at the interface between stream channel and riparian vegetation and at the transition from natural woodland communities to invasive upland plant communities. The interface is of great value to wildlife because both density and diversity of species tend to be higher at this ecotone than in adjacent uplands. Field observations of wildlife (e.g., deer, coyote, feral hogs) support these notions, as most wildlife observed during the field investigation was in close association with these riparian corridors. Additionally, sediment carried by overland flow from adjacent uplands is generally intercepted by the riparian area, where it settles out. Nutrients that could be transported with sediment, as may be expected in areas where cattle or wildlife concentrate, would also be trapped in the riparian area. These would then be broken down by physical or biochemical processes, and reduced to harmless forms. In sum, Halff believes that all ephemeral tributaries have more than a speculative effect on the chemical, physical, and/or biological integrity of the Dry Creek tributary system, and in turn, the eventual receiving navigable water. Halff believes that all ephemeral streams in the study area would be considered waters of the United States.

The USACE Fort Worth District interpretation of "adjacent" generally begins with aquatic features located within the 100-year floodplain (referred to as "1% annual chance flood hazard zone" on **Figure A-6**). The majority of the mapped wetland features are located within the 100-year floodplain of Dry Creek, IS-1, and its tributaries, and each feature would be considered an adjacent wetland. As noted above, wetlands adjacent to a relatively permanent tributary or other previously defined water of the United States, require a determination of significant nexus to establish jurisdiction. An argument for significant nexus can be made for these features in that they function in the same manner as the previously described riparian corridors. In sum, these features would be considered waters of the United States.

In contrast, several wetland features are located well beyond the mapped floodplains displayed on **Figure A-6**. All of these appear to be the result of man-made modifications and would otherwise be expected to absent in the landscape at their locations. These are listed as follows:

- EW-21
- EW-22
- EW-23
- EW-24
- EW-25
- EW-26
- EW-27
- EW-28
- EW-29
- EW-30
- EW-31
- EW-32
- EW-33

Features EW-21 and EW-22 are located in the far northeastern corner of the study area, both of which appear to be excavated, perhaps as past stock ponds, or to facilitate drainage from the interior access road. Both of these features are near the peak of the local drainage basin, and are likely never sufficiently full to overflow from their depressions. Features EW-23 through EW-33 are the result of terracing along a natural slope. Given the discontinuous nature of the mapped wetlands, it is reasonable to conclude that none of the features are sufficiently full to overflow to even the next terrace. An inspection of the adjacent landscape did not show any evidence suggesting that these features would be connected to any tributary by surface flow, even during the wettest of conditions. In sum, a case can be made that these features are isolated. Isolated aquatic features the degradation or destruction of which could affect interstate trade or commerce, are still regulated under CFR § 328.3(a)(3). However, given the remote location of and restricted access to these features, it is unlikely these features would meet these regulatory criteria and it is Halff's opinion that they should not be considered waters of the United States.

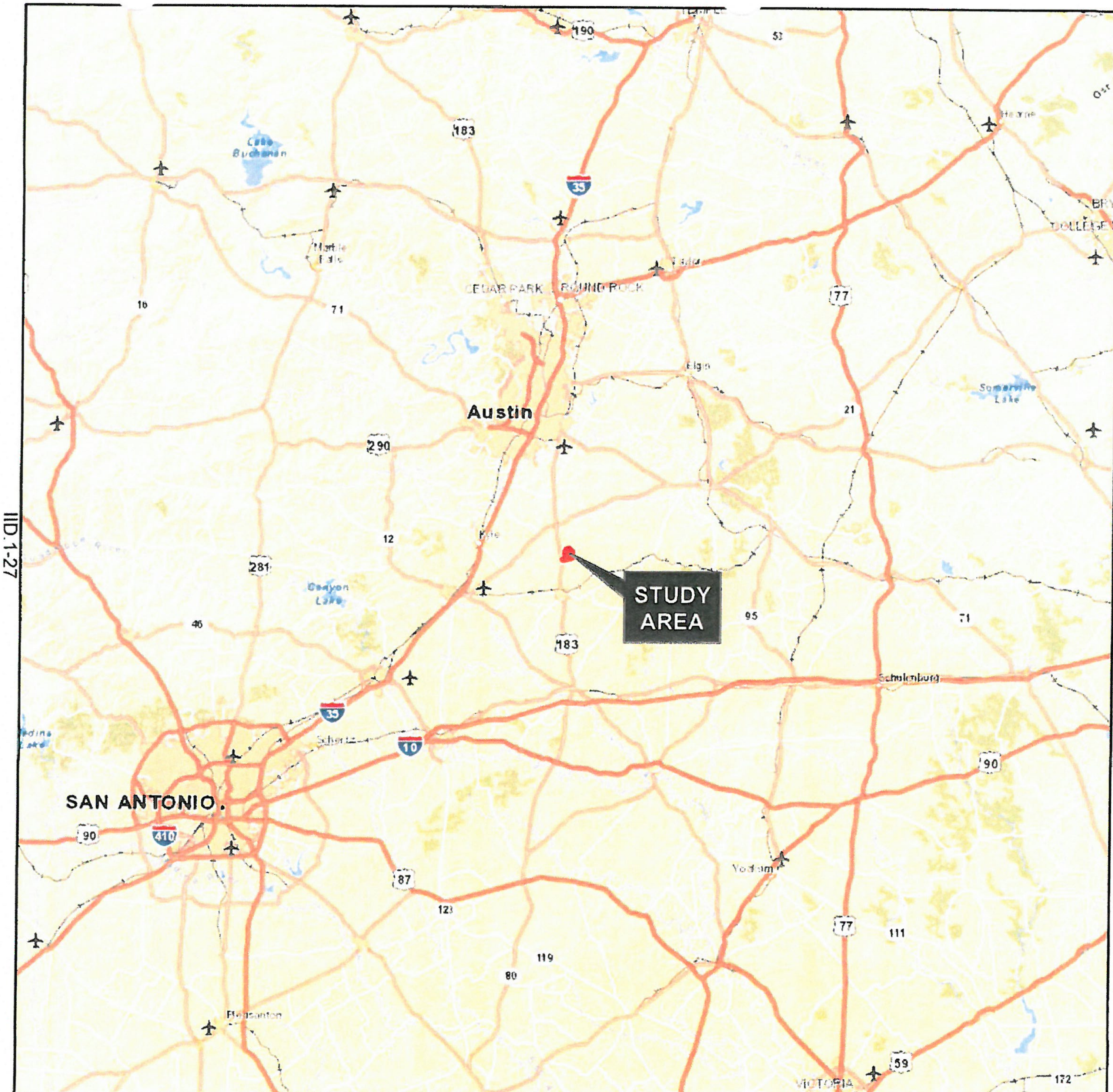
Open water classifications continue to be regulated under 33 CFR § 328.3(a)(4), which states that waters of the United States include "all impoundments of waters otherwise defined as waters of the United States" under 33 CFR § 328.3(a)(1)-(3). Review of available background information from USGS quadrangle maps, soil survey maps, and historical aerial photographs supports a conclusion that most features were constructed as an impoundment of the surface tributary system. As these impoundments are considered waters of the United States, the wetland classifications associated with the littoral fringes from these impoundments would also be considered waters of the United States under 33 CFR § 328.3(a)(7) which includes abutting (i.e. adjacent) wetlands of other defined waters within the definition of waters of the United States.

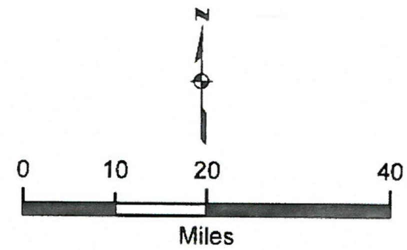
For features OW-4, OW-5, and OW-8, historical data suggest no association with a past tributary system, and it is unclear from any data whether or not vegetated swales in the vicinity of these features ever had a discernible OHWM to establish regulatory jurisdiction. Moreover, no discernible OHWM, or vegetated swale meeting wetland criteria, is present today to sufficiently satisfy the definition of waters of the United States under 33 CFR § 328.3(a)(4). In sum, these remaining open water features on the study area are not considered impoundments of the current surface tributary system and rather appear to have been excavated to capture and retain surface runoff for livestock use. As these features are not on-channel impoundments, they are typically not regulated by the USACE Fort Worth District, and it is Halff's opinion that they should not be considered waters of the United States. The wetland fringes mapped with these features (EW-20, EW-34, and EW-35) are interim conditions that are present as the result of drawdown conditions of each impoundment. As a condition of a non-regulated impoundment, the USACE Fort Worth District does not consider these features waters of the United States.

Feature EW-19 is an interim condition which is likely an open water habitat for the greater part of the year. Excavated and constructed as an impoundment for livestock, the feature also appears to be constructed in the absence of any mapped tributary (i.e. off-channel). As an off-channel impoundment intended for watering livestock, Halff believes that EW-19 should not be considered a water of the United States under 33 CFR § 328.3(a)(4), and as an interim condition, should not be separately evaluated and considered a jurisdictional wetland.

Based on the foregoing descriptions and analyses, **Appendix C** summarizes the classification, proposed jurisdictional determination, and physical characteristics for mapped water features in the study area (shown in **Figures 3.1** through **3.6**).

FIGURES





Legend

Study Area

Notes:
1. Source/Year of Base Map: ESRI, World Street Map/2013
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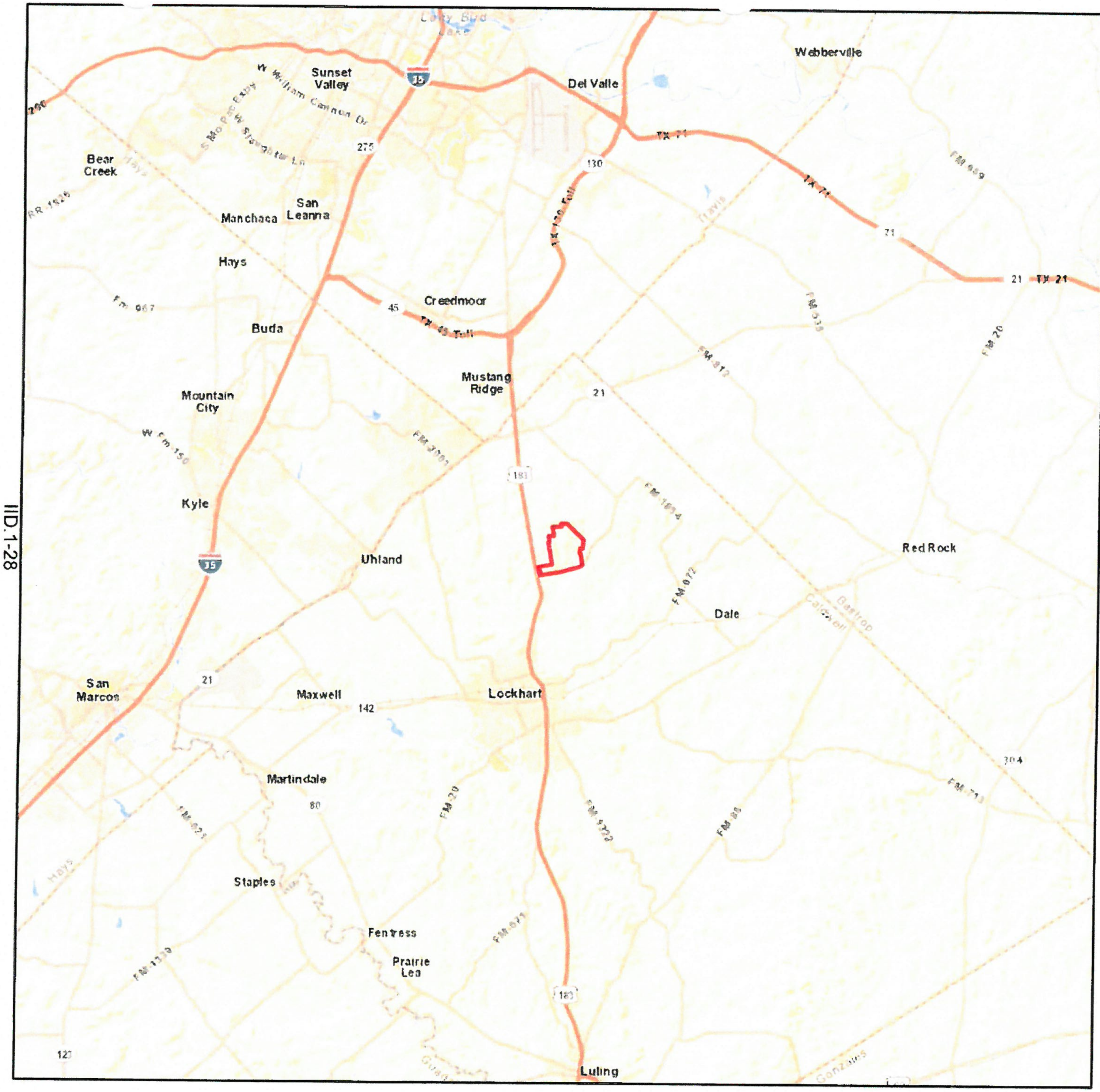
Project Number: <USACE #>	
Date: 08/2013	AVO: 29520
Sheet Title: PROJECT LOCATION MAP	
Sheet Number: FIGURE 1	

HALFF



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Study Area

Notes:
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Project Number: <USACE #>	
Date: 08/2013	AVO: 29520
Sheet Title: PROJECT VICINITY MAP	
Sheet Number: FIGURE 2	

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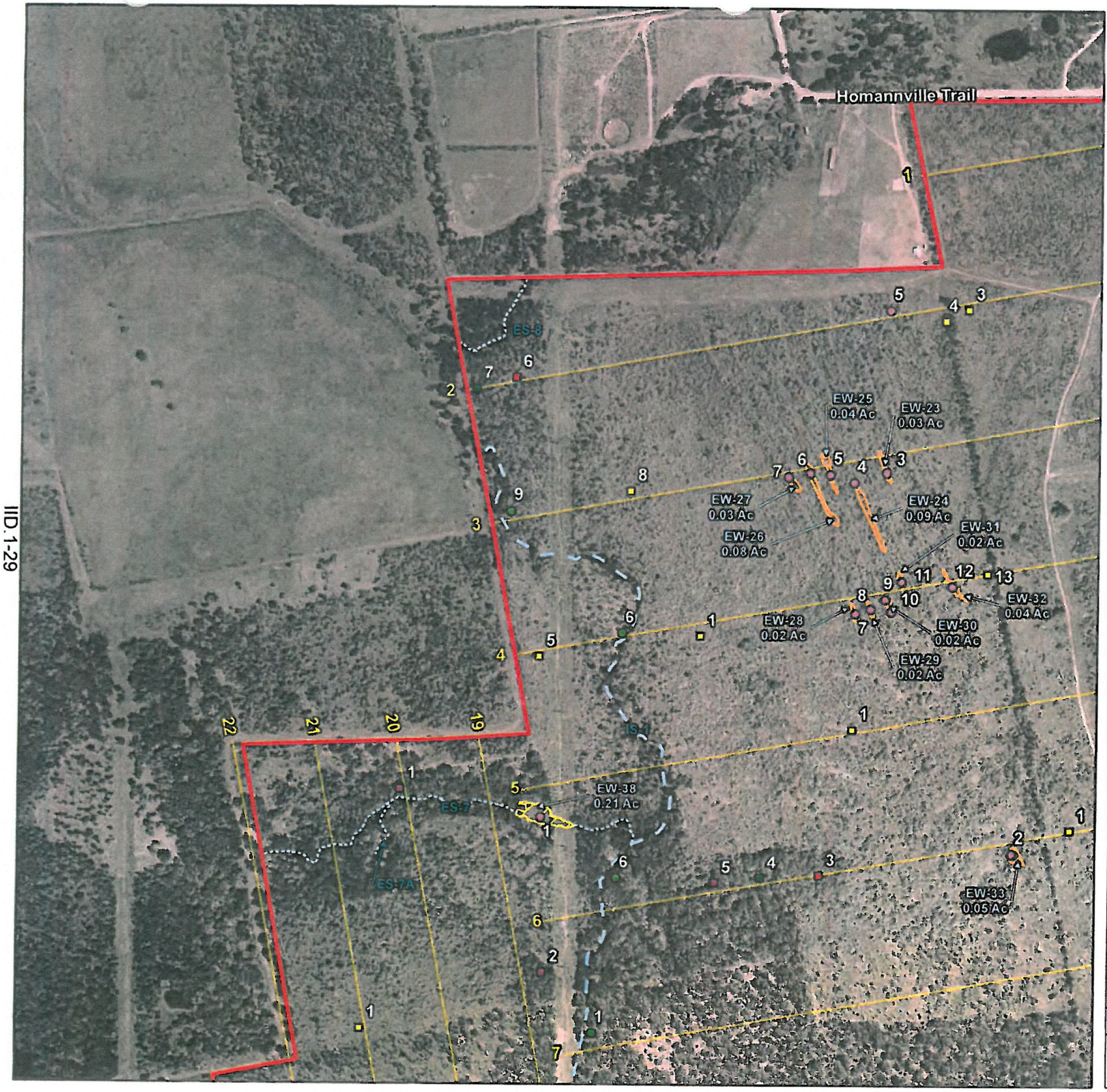

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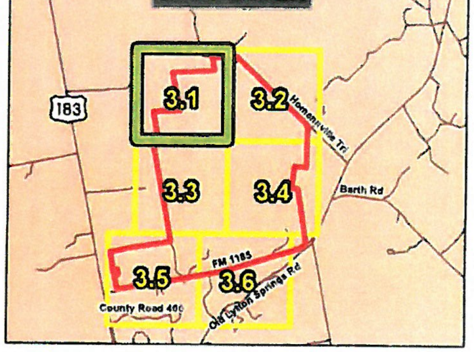
Feet

Legend

- Study Area
- Transects
- Intermittent Stream (water of the US)
- Ephemeral Stream (water of the US)
- Emergent Wetland (water of the US)
- Forested Wetland (water of the US)
- Scrub Shrub Wetland (water of the US)
- Open Water (water of the US)
- Open Water (non-water of the US)
- Emergent Wetland (non-water of the US)

Aerial photo from Dallas Aerial Service flown May 13, 2013

GRID INDEX



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Project Number:
Date: 08/2013 AVO: 29520
Sheet Title: WATERS OF THE UNITED STATES MAP
Sheet Number: FIGURE - 3.1
HALFF

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Feet

Legend

- Study Area
- Transects
- Intermittent Stream (water of the US)
- Ephemeral Stream (water of the US)
- Emergent Wetland (water of the US)
- Forested Wetland (water of the US)
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Aerial photo from Dallas Aerial Service flown May 13, 2013

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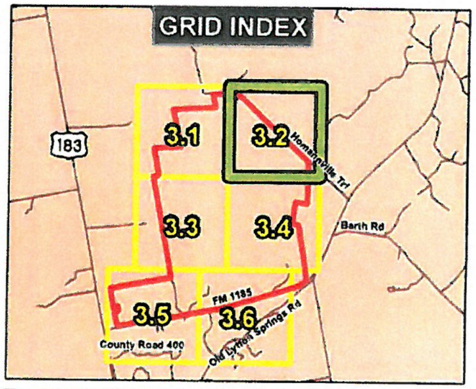

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Sheet Number: FIGURE - 3.2

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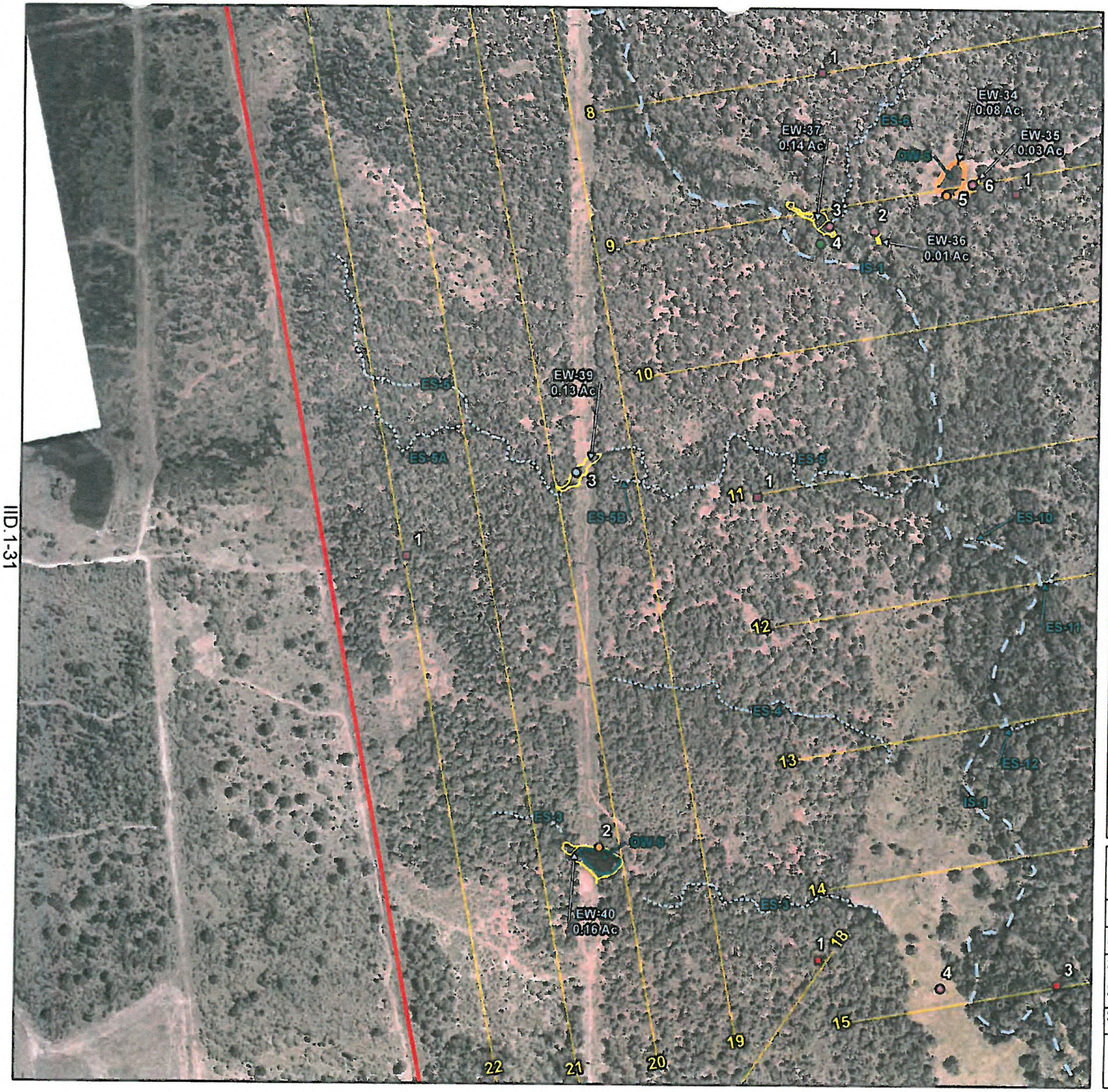

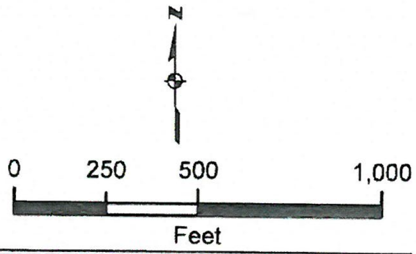

Legend

- Study Area
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- Ephemeral Stream (water of the US)
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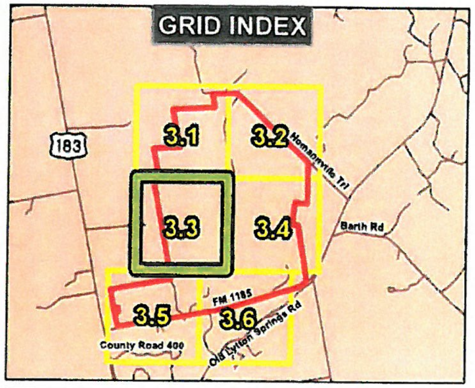
- Open Water (non-water of the US)
- Emergent Wetland (non-water of the US)

Aerial photo from Dallas Aerial Service flown May 13, 2013



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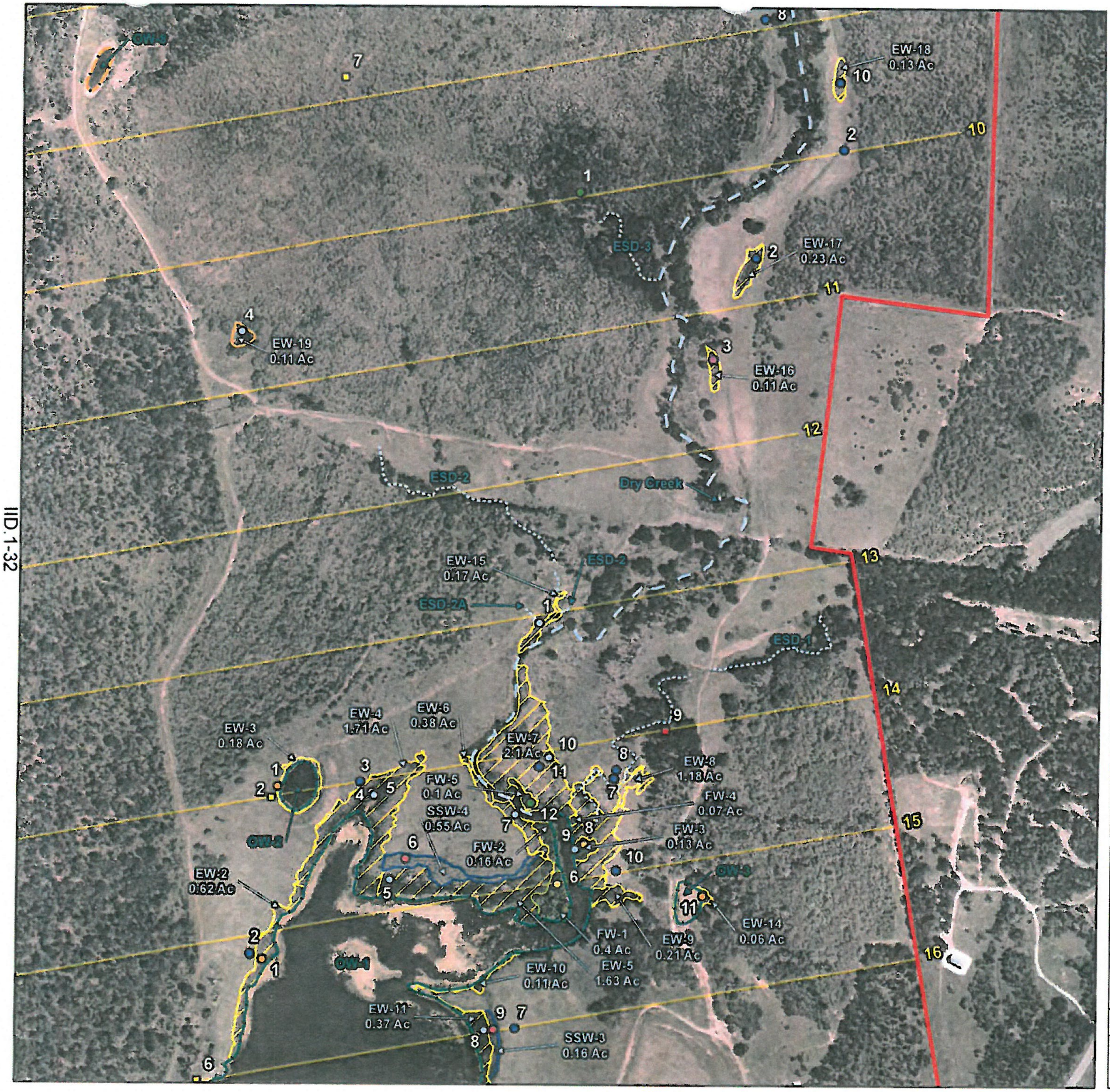

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Feet

Legend

- Study Area
- Transects
- Intermittent Stream (water of the US)
- Ephemeral Stream (water of the US)
- Emergent Wetland (water of the US)
- Forested Wetland (water of the US)
- Scrub Shrub Wetland (water of the US)
- Open Water (water of the US)
- Open Water (non-water of the US)
- Emergent Wetland (non-water of the US)

Aerial photo from Dallas Aerial Service flown May 13, 2013

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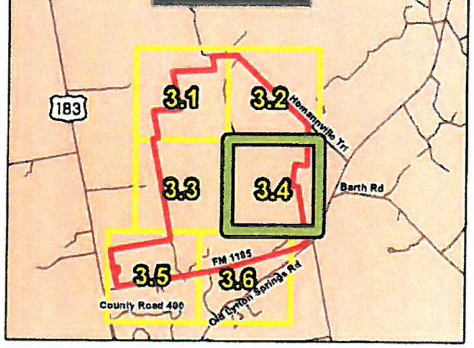

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Sheet Number: FIGURE - 3.4	

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Project Number:
Date: 08/2013 AVO: 29520
Sheet Title: WATERS OF THE UNITED STATES MAP
Sheet Number: FIGURE - 3.5

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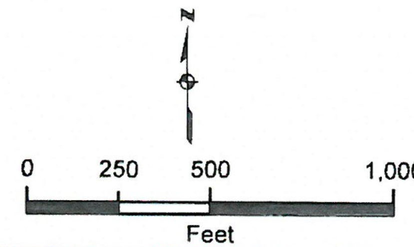

Legend

- Study Area
- Transects
- Intermittent Stream (water of the US)
- Ephemeral Stream (water of the US)
- Emergent Wetland (water of the US)
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- Open Water (water of the US)
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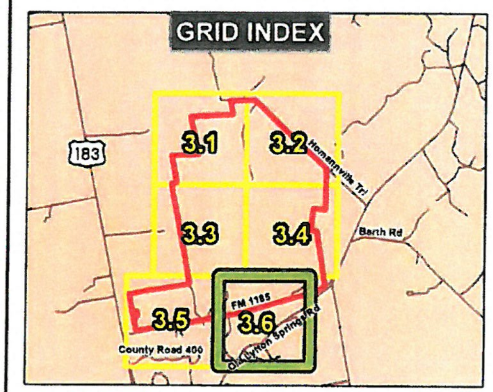
Aerial photo from Dallas Aerial Service flown May 13, 2013



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Sheet Number: FIGURE - 3.6	

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