Playas and Wetlands Database

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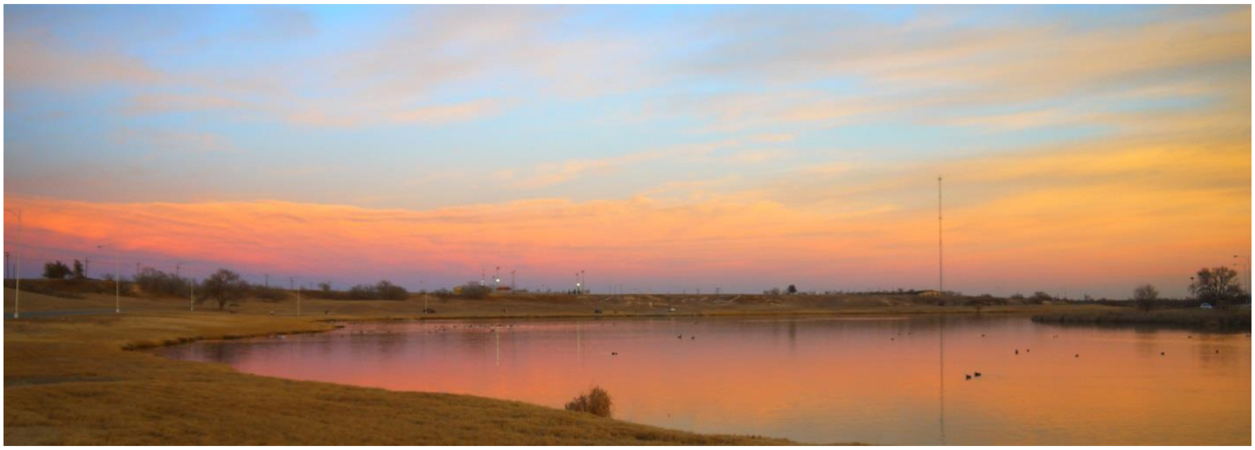
Introduction



Santosh Seshadri. *Sunset on a Playa, Lubbock, Texas*. 2014

Playas are small, shallow intermittent lakes situated in topographic depressions (Cowardin et al., 1979) and are characterized by an underlying hydric soil (Zartman and Fish, 1992). They form when rainwater fills clay-lined basins providing critical habitat for wildlife. Playas are common wetland features on the Southern High Plains region of West Texas, Eastern New Mexico and the Oklahoma panhandle.

Playas represent a source of groundwater recharge to the Ogallala Aquifer through playa basins (Zartman, 1987) and through the annular area surrounding playas (Wood and Osterkamp, 1984). The amount of recharge that playas contribute to the aquifer is the subject of ongoing research supported by the Ogallala Aquifer Program. The field studies are focused on the dynamics of groundwater recharge and attempt to quantify recharge rates. These studies have also focused on understanding detailed hydrologic characteristics of playa lakes and the role of sedimentation in changing the natural hydro-periodicity of playa lakes. Sedimentation in playas is the result of soil erosion from adjacent tilled croplands (TPWD, 2003). As sediments increase playas become shallower and evaporate more quickly which limits recharge. To scale the results from these detailed field studies to the broader regional or landscape level, a detailed playa geodatabase is essential.

The purpose of this project was to design and develop a new Playa and Wetlands Database (PWD) and web application for wetlands principally overlying the Ogallala Aquifer regions of Texas, Oklahoma and New Mexico. Together the geodata and web application can be used as an information resource and management tool. The wetlands data contained in the geodatabase were developed to support ongoing research concerned with the hydrology of the Ogallala Aquifer. The web application was developed as an interactive tool to support decisions concerned with water management and wetlands preservation. To support this research it was important to develop a comprehensive database of playas. This database categorizes playas by the immediate and surrounding land use and manmade impacts directly affecting them.

The database was developed using GIS technology coupled with aerial imagery and pre-existing data to capture geometry and attributes relevant to understanding the condition and characteristics of each playa or wetland. The features in the database include playas and other wetlands common to the region. A simplified classification system was developed for wetland features that could be identified on 1-meter resolution 2004 National Aerial Imagery Program (NAIP) images.

Estimates of the number of playas are highly variable and depend upon the area referenced. Previous research has estimated the number of playas on the Southern High Plains in the tens of thousands. An early estimate of about 19,241 playas was made for the 27 counties on the Texas high plains by Schwiesow (1965) based on counts and sampling. Walker (1978) placed the number of Southern High Plains playa basins at 37,000. Wood and Osterkamp (1987) estimated the number of playas in the high plains of Texas and New Mexico at 30,000. Sabin and Holliday (1995) estimated about 20,000 playas in Texas. In 1998 Fish et al. published a digital database of 20,557 playas in the southern High Plains of Texas with detailed geomorphic characteristics. Comis (2008) provided a range from 22,000 to 40,000 for the Southern High Plains playas. More recently the Playa Lakes Joint Venture estimates the number of probable playas in the entire Great Plains region at approximately 75,000 to 80,000 (PLJV, 2013). While these databases and estimates are useful, they do not categorize playas in terms of the land use setting nor impacts imposed on them over time.

The PWD is a comprehensive database that incorporates playas and other wetland features common to the Southern High Plains region. The database covers a 52-county area that overlies the Ogallala Aquifer in Texas, Oklahoma and New Mexico (Figure 1 and Table 1).

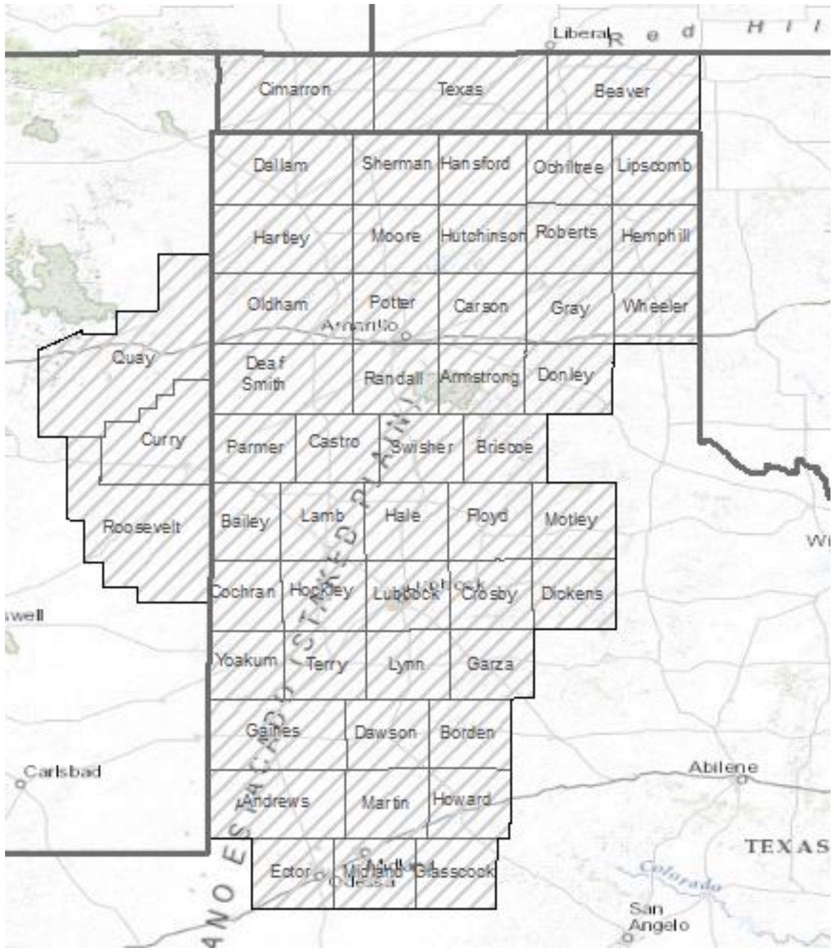


Figure 1. PWD Study area

All wetland features in the PWD were individually evaluated and classified into one of eight wetland types. Wetland features types include ‘Playa’, ‘Unclassified Wetland’, ‘Lake’, ‘Saline Lake’, ‘Riparian’, ‘Impoundment’, ‘Manmade’ or ‘Scrub or Other’ (Table 2).

On the Southern High Plains playas are characterized by an underlying hydric or clayey soil (Zartman and Fish, 1992). Hydric soils were originally mapped by the Soil Conservation Service now known as the National Resource Conservation Service (NRCS). Soil data were originally available on black and white aerial imagery and later became available in digital format in the Soil Survey Geographic database (SSURGO).

Andrews	Dawson	Hemphill	Oldham
Armstrong	Deaf Smith	Hockley	Parmer
Bailey	Dickens	Howard	Potter
Beaver	Donley	Hutchinson	Quay
Borden	Ector	Lamb	Randall
Briscoe	Floyd	Lipscomb	Roberts
Carson	Gaines	Lubbock	Roosevelt
Castro	Garza	Lynn	Sherman
Cimarron	Glasscock	Martin	Swisher
Cochran	Gray	Midland	Terry
Crosby	Hale	Moore	Texas
Curry	Hansford	Motley	Wheeler
Dallam	Hartley	Ochiltree	Yoakum

Table 1. Fifty-two (52) study area counties.

PWD Wetland Classification	Description
Playa	Shallow depressional wetland, typically rounded and characterized by a hydric soil that represent a place of potential aquifer recharge
Unclassified Wetland	Typically rounded, playa-like wetland feature showing evidence of a hydric soil, but without characteristic hydric soil represented in the SSURGO dataset
Lake	Fresh water body, natural or manmade, as a result of obstruction of a riparian feature. Larger than impoundments, typically 30 acres or larger
Saline Lake	Large, isolated wetlands in contact with groundwater creating a saline condition
Riparian	Natural watercourse, channel or body of water
Impoundment	Small confined pooling or potential pooling of water within a riparian zone due to the creation of an earthen dam or structure
Manmade	Typically small excavations with straight sides
Scrub or Other	Area with scrub, trees or other vegetation with evidence of saturated soil

Table 2. PWD wetland classes.

Based on the distinguishing property that playas have an associated hydric soil, PWD wetlands resembling rounded, shallow depressional wetlands were initially segregated into two features types; ‘Playa’ and ‘Unclassified Wetland’. Features associated with a previously-mapped hydric soil were classified as a ‘Playa’. In many cases a wetland exhibited all of the appearances of a playa feature except it did not show evidence of a previously-mapped SSURGO hydric soil. However these wetlands showed evidence of a hydric area on 2004 NAIP color-infrared imagery. These wetlands were categorized as an ‘Unclassified Wetland’.

The PWD contains 64,726 wetland features identified as one of the eight wetland types categorized in the database (Figure 2). A total of 36,348 PWD features were identified as either a 'Playa' or an 'Unclassified Wetland'. Features classified as a 'Playa' numbered 21,893 while 14,455 were identified as an 'Unclassified Wetland'. The number of each wetland category by state and the total number of each feature type is shown in Table 3.

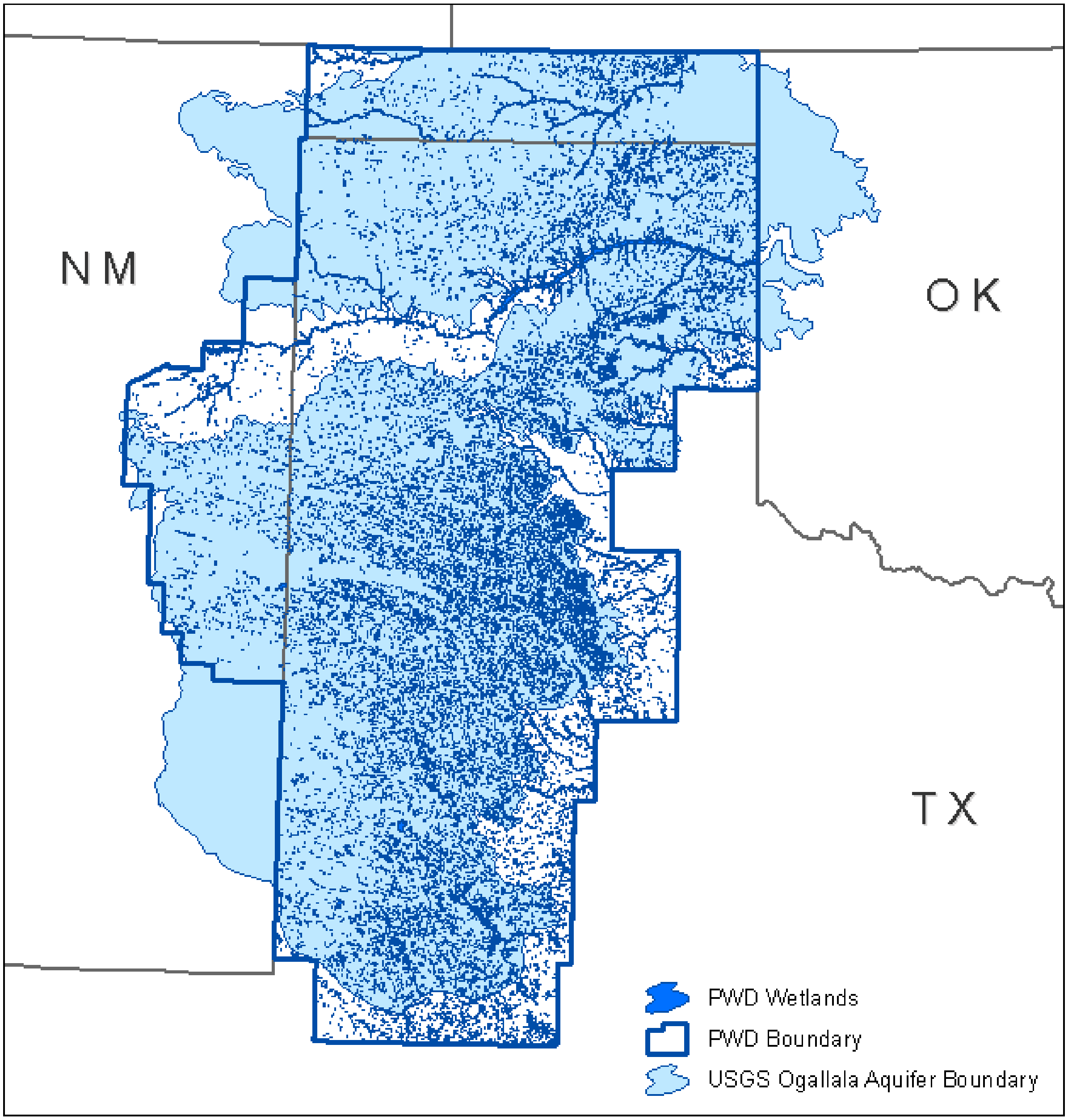


Figure 2. PWD wetlands.

PWD Wetland Classification	Texas	Oklahoma	New Mexico	Total Identified
Playa	20,704	538	651	21,893
Unclassified Wetland	11,407	2,455	593	14.455
Impoundment	547	317	7,536	8,400
Lake	81	6	10	97
Manmade	5,572	346	297	6,215
Riparian	12,976	338	128	13,442
Saline Lake	39	0	0	39
Scrub or Other	142	42	1	185
Total PWD wetlands				**64,726**

Table 3. All PWD wetlands classes and number of wetlands identified.

In Texas the number of 'Playa' and 'Unclassified Wetland' features was 32,111. New Mexico had 1,244 of these features while the count was 2,993 in the Oklahoma panhandle. The mean size of these features is about 13 acres. The mean size of 'Playa' features was 18.6 acres, and 'Unclassified Wetland' features was 4.4 acres.

In addition to categorizing wetlands into eight wetland types, PWD attribution was designed to characterize impacts to a wetland. These impacts included being affected by a road, excavation, dike or drain, farming or proximity to farming activity. Other characteristics or comments were incorporated that might support research, preservation or restoration.

Of the 21,893 playa features identified with a hydric soil, 12,652 or 57.8% showed evidence of some type of modification. The remaining 9,241 features did not show evidence of any obvious modification (Table 4). Of the 14,455 'Unclassified Wetland' features 4,190 or 29% showed evidence of some type of modification, while 10,255 did not (Table 4). In all 16,842 or 46.3% of these wetland features exhibited some type of modification.

	Visible Modification	No Visible Modification	Total
Playa - Hydric Soil Present	12,652	9,241	21,893
Unclassified Wetland - Hydric Soil Not Present	4,190	10,255	14,455
Total	**16,842**	**19,796**	**36,348**
Percent Modified	**46.3%**	**53.7%**	**100%**

Table 4. Playas and Unclassified Wetland features by visible modification.

‘Playa’ features were most commonly impacted by farming with 8,584 features or 39.2% farmed. However only 1,570 or 10.8% of the ‘Unclassified Wetland’ features exhibited a farming impact (Table 5). In all 10,154 or 27.9% of these features were farmed.

	Farm Impact	**No Farm Impact**	**Total**
Playa - Hydric Soil Present	8,584	13,309	21,893
Unclassified Wetland - Hydric Soil Not Present	1,570	12,885	14,455
Total	**10,154**	**26,194**	**36,348**
Percent Farmed	**27.9%**	**72.1%**	**100%**

Table 5. Playas and Unclassified Wetland features by farming impact.

The degree to which a ‘Playa’ or ‘Unclassified Wetland’ feature was impacted by farming was also captured. Three classes of farming impact were identified for each feature. These classes included ‘Wetland 25% or less farmed’, ‘Wetland 25% or more farmed’ but not entirely farmed, and ‘Wetland 100% farmed’. The data show that if one of these wetland types was farmed it was most likely to be 100% farmed (Table 6). In all 1,402 features or 13.8% had 25% or less of their areas farmed. A total of 2,288 or 22.5% had 25% or more of their areas farmed. While 6,464 or 63.7% of these wetlands had 100% of their areas farmed.

	Wetland 25% or less farmed	**Wetland 25% or more farmed**	**Wetland 100% farmed**	**Total**
Playa - Hydric Soil Present	1,362	2,094	5,128	8,584
Unclassified Wetland - Hydric Soil Not Present	40	194	1,336	1,570
Total	**1,402**	**2,288**	**6,464**	**10,154**
Percent farmed by degree of impact	**13.8%**	**22.5%**	**63.7%**	**100%**

Table 6. Playas and Unclassified Wetland features by degree of farming impact.

‘Playa’ and ‘Unclassified Wetland’ features were also impacted by roads. The number of ‘Playa’ features impacted by roads is 3,305 or 15.1%. ‘Unclassified Wetland’ features impacted by roads numbered 547 or about 3.8%. In all 3,852 or 10.6% of these features were impacted by a road (Table 7).

	Road Impact	**No Road Impact**	**Total**
Playa - Hydric Soil Present	3,305	18,588	21,893
Unclassified Wetland - Hydric Soil Not Present	547	13,908	14,455
Total	3,852	32,496	**36,348**
Percent Road Impacted vs Not Road Impacted	**10.6%**	**89.4%**	**100%**

Table 7. Playas and Unclassified Wetland features by road impact.

Excavations, dikes, and drains also affected 'Playa' and 'Unclassified Wetland' features. 'Playa' feature were more likely to have been excavated while 'Unclassified Wetland' features were more likes to have been diked. The most common type of dike impact was due to a road built through or adjacent to the wetland. While 29,991 or 82.5% of these features did not show evidence of an excavation, dike or drain a total of 6,357 or 17.5% did. A total of 3,280 features were excavated and also possibly diked and/or drained. Dike and/or drain impacts were found on 2,780 or 7.6% of the features. Drain only impacts were identified on 297 or less than 1% of the features (Table 8).

	Not Excavated	**Excavated and possibly Diked or Drained**	**Diked and possibly Drained**	**Drained only**	**Total**
Playa - Hydric Soil Present	17,904	2,615	1,099	275	21,893
Unclassified Wetland - Hydric Soil Not Present	12,087	665	1,681	22	14,455
Total	**29,991**	**3,280**	**2,780**	**297**	**36,348**
Percent Excavated, Diked, Drained Impacts	**82.5%**	**9.0%**	**7.7%**	**0.8%**	**100%**

Table 8. Playas and Unclassified Wetland features by excavation, diked or drained status.

The wetland classes were organized into seven data layers and made available for download. Impoundments and manmade-classified wetland features were combined into one layer. The downloadable layers include: Playas_UnclassifiedWetlands, Lakes, Saline Lakes, Riparian, Impoundments_Manmade, Scrub_Other and AllWetlands (Table 9). These GIS layers are available in three different formats. The data formats include shapefile, geodatabase, and layer package. Shapefiles are accompanied by a layer file to provide a pre-defined symbology.

Downloadable GIS Layers		
Layer	**Data Layer Name**	**Description**
1	Playas_UnclassifiedWetlands	Any type of playa or wetland that might or might not have a hydric indicator soil
		Lakes
2	Lakes	Saline Lakes
3	SalineLakes	Riparian features
4	Riparian	Impoundments and Manmade features
5	Impoundments_Manmade	Scrub areas no longer wet and other miscellaneous wetlands
6	Scrub_Other	
		All Playa and wetland features from all layers
7	AllWetlands	

Table 9. Layers available for download.

The PWD is available for download at http://gis.ttu.edu/PWD/index.html. Additionally an interactive web mapping application was designed as tool to view the data and to support decisions concerned with wetland research, management and preservation. The web mapping application is available at http://gis.ttu.edu/PWD/viewer.html. The original PLDD data is also available for download from this site.

The PWD was developed using Esri ArcGIS version 10.0 Service Pack 5 and 10.1 Service Pack 1.

Data Background

The PWD was principally developed using feature geometry from two datasets: the United States Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) (USFWS 2004) and the Playa Lakes Digital Database (PLDD) (Fish et al., 1998). Previously unmapped playas or wetlands apparent on the 2004 NAIP imagery were incorporated by Texas Tech University, Center for Geospatial Technology (TTU) to complete the database. Each wetland in the dataset was individually evaluated, reshaped as necessary, and attributed to produce a comprehensive database that maintained the data original source information.

In 1998 Dr. Ernest Fish of the Department of Range, Wildlife and Fisheries Management of Texas Tech University published a GIS shapefile of 20,557 playa lakes. This data source is referred to as the Playa Lakes Digital Database or PLDD. Playas were digitized from the Soil Conservation Service (SCS) (now Natural Resource Conservation Service) photomosaic sheets contained in the county soil surveys. The photomosaic sheets were photocopied from the SCS county soil surveys, affixed to digitizing tables, and registered to real-world coordinates using United States Geological Survey (USGS) topographic 7 ½ minute quad maps (Fish, 2014 pers. comm). Manual digitizing of playas involved interpreting the soil survey images and identifying appropriate soil mapping unit descriptions of hydric soils considered to underlie playa lakes (Fish, et al. 1998).

Playas were digitized for 65 Texas counties with each county consisting of approximately 25 to 30 aerial images. The date range of the soil survey imagery spanned a 40-year time period between 1959 and 1998 as imagery became available (Fish et al.1998). The PLDD project extended over a 10-year period. The final product was published in shapefile format and distributed on CD. The study area for the PLDD is shown in Figure 2 and is compared with the PWD project area.

Between 2006 and 2010 the Center for Geospatial Technology completed two NWI projects encompassing 52 counties located over the Ogallala Aquifer region of the Southern High Plains. Three of these counties were in New Mexico; three were in Oklahoma with the remaining 46 counties in Texas. The NWI counties define the PWD project area shown in Figure 3. The PLDD counties located east of the PWD study area were excluded since they did not overly the Ogallala Aquifer.

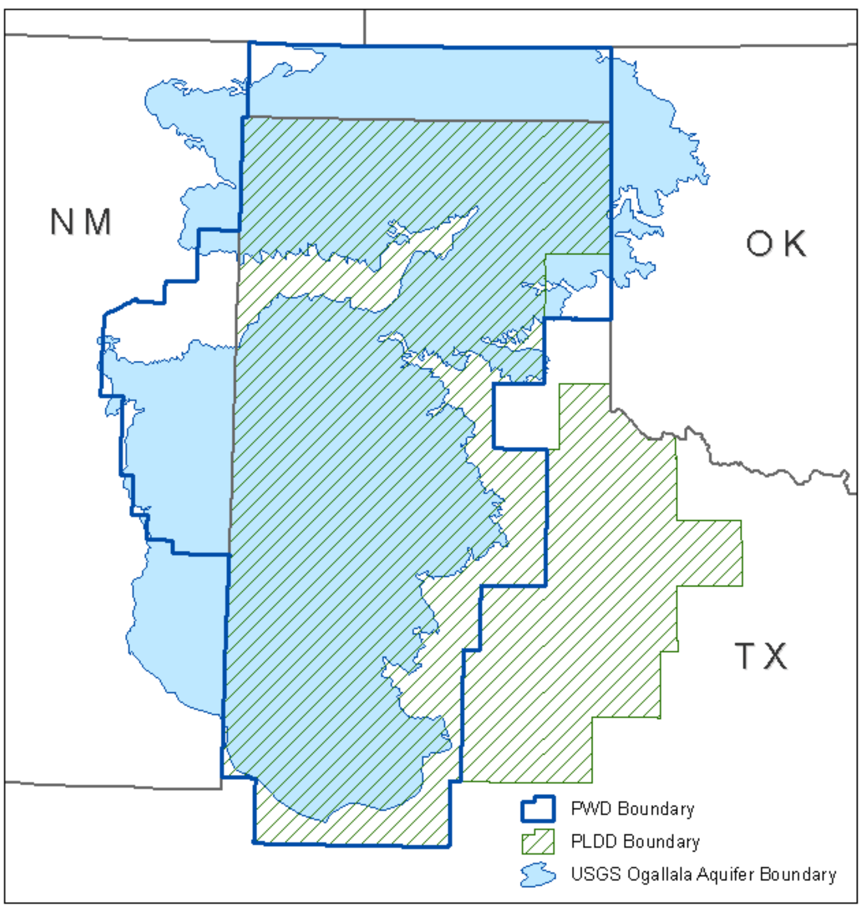


Figure 3. Comparison of PWD, PLDD and Ogallala Aquifer Boundaries for New Mexico, Oklahoma

and Texas.

The initial data source used to map NWI features included the hydric soil polygons extracted from the SSURGO database and hydric signatures identified on 2004 color-infrared National Aerial Imagery Program (NAIP) imagery. Color-infrared imagery has the property that wet or hydric areas contrast more with surrounding dryer areas making identification of wetlands easier than using natural color images (Figure 4a to 4d).

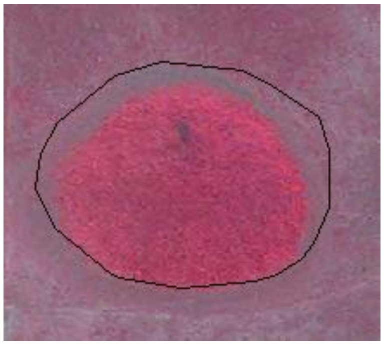


Figure 4a. Wetland with emergent vegetation shown on 2004 color-infrared NAIP image.

Figure 4b. Same wetland as 4a shown on 2005 true color NAIP image.

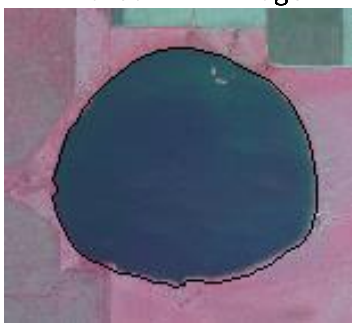


Figure 4c. Wetland filled with water shown on 2004 color-infrared NAIP image.

Figure 4d. Same wetland a 2c shown on 2005 true color NAIPimage.

Figure 4a to 4d. Comparison of wetland features on 2004 color-infrared NAIP and true color image.

To map the NWI wetlands a team of Texas Tech University students and staff worked with Jim Dick, Regional Wetlands Coordinator, of the National Wetlands Inventory Region 2 of the USFWS in Albuquerque in this effort. An Internet communications forum was developed to submit questions and responses regarding wetland classification to facilitate feature-level quality control. The completed NWI database for the region contained 79,475 wetland polygons based on the Cowardin classification system. The Cowardin classification system is used by the USFWS NWI to describe wetland habitats. It is the national standard for any federally-based wetland mapping. Cowardin-classified wetlands can result in many polygons required to represent a single wetland (Figure 5).

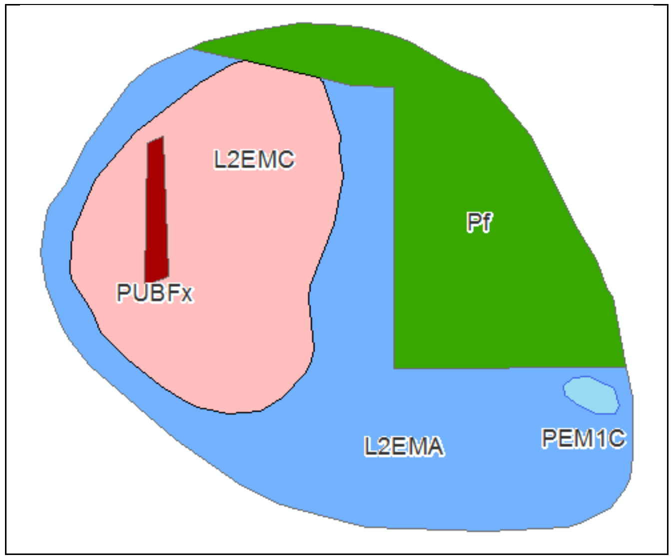


Figure 5. Example of a Cowardin-classified wetland.

Methodology

The main objective of the PWD was to capture the boundaries of playa and wetland features interpreted from the 2004 NAIP imagery, classify features according to the PWD classification system, and assign attributes to each wetland according the PWD database design. The PWD project was initiated in January 2012. The database, web mapping application and website were completed in March 2014. The PWD took approximately 5,777 man-hours to complete.

To prepare the data for interpretation and classification, The NWI data were obtained from the U.S. Fish and Wildlife Service NWI Regional Office in Albuquerque, NM to ensure the final and most current database would be incorporated. The PLDD database was obtained from the TTU Department of Range, Wildlife and Fisheries Management (now Department of Natural Resources Management).

The principal layer used to develop the PWD was the NWI database. Since the PWD and NWI data were developed from 2004 NAIP as a basemap, NWI feature geometry took precedent over PLDD features. The initial production layer consisted of NWI features and only those PLDD features that were not already represented by an NWI polygon. To identify PLDD features that were not in the NWI database, a select by location using the centroid method was used to select PLDD polygons that were common to NWI wetlands. The select by location process was repeated for NWI features with centroids inside PLDD features using the 'add to the current selection' option with a search distance of 50 meters. This second selection process was required for two reasons. First several hundred PLDD playas in several counties were offset from the hydric areas that corresponded to NWI polygons on the NAIP images. This offset was typically 50 meters to 150 meters (Figure 6a) from the center of each feature. In some cases the offset was as much as 450 meters to 750 meters (Figure 6b) where no hydric soil was located under the PLDD. In one case the offset was 1,900 meters.

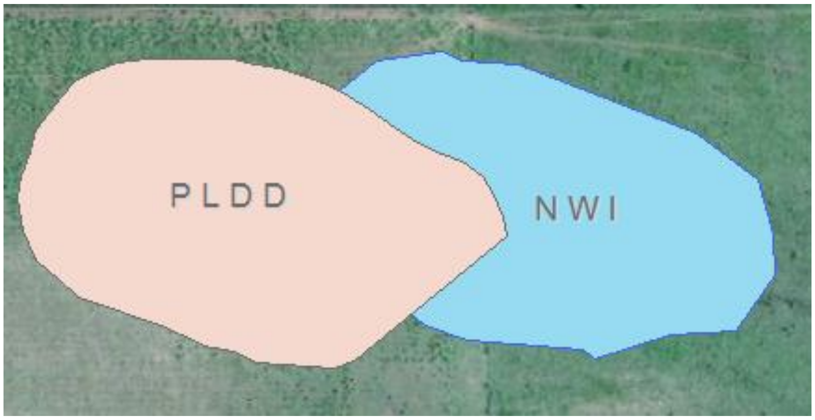


Figure 6a. Example of a PLDD feature offset from NAIP hydric area and NWI feature by 175 meters.

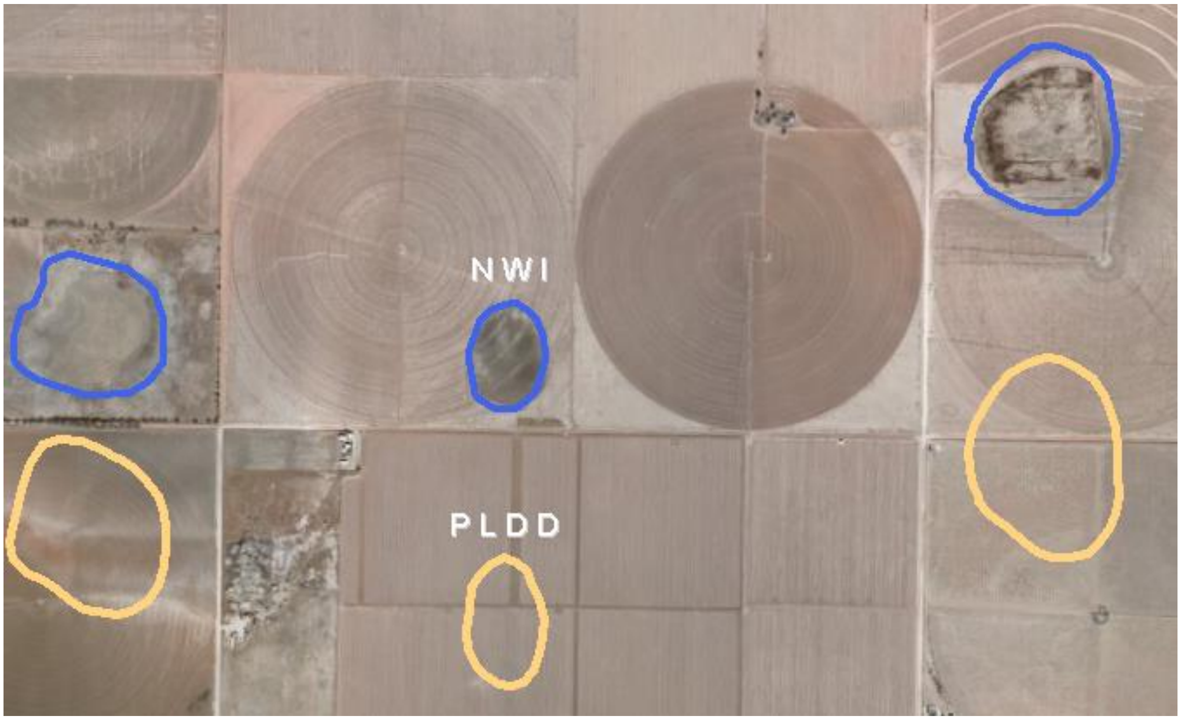


Figure 6b. PLDD features offset from NAIP hydric area and NWI feature between 450 meters and 750 meters in Lubbock County.

The second reason to select PLDD polygons using the search distance is that it was possible for a playa in the NWI database to have been significantly modified to the point where it no longer resembled a playa in the PLDD, and the PLDD centroid was no longer contained inside the NWI wetland (Figure 7).

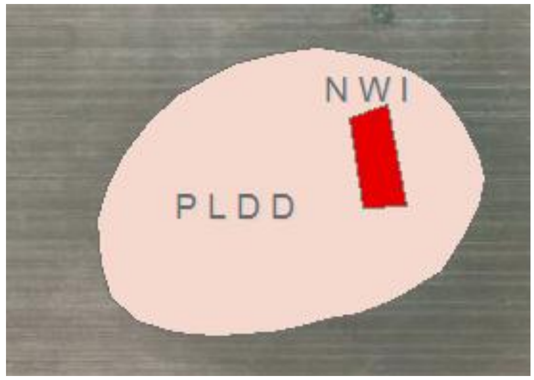


Figure 7. PLDD playa modified to a PWD significantly-modified playa that has been excavated.

Once PLDD and NWI features in common were selected, the record selection was switched to obtain PLDD playas that were not present in the NWI. PLDD playas not common with NWI features were appended to the NWI dataset to complete the initial PWD production layer.

This production methodology captured the significant majority of PLDD polygons that were not present in the NWI. However during final quality assurance processes 94 wetlands had been classified as 'Unclassified Wetlands'. When compared with the SSURGO soil layer, the PLDD polygons were the same size and shape as the hydric soil polygons, but with a large offset. This resulted in these PLDD features not being assigned to a hydric soil and initially misclassified as an 'Unclassified Wetland' rather than as a 'Playa' feature.

During another quality assurance process to ascertain database completeness an additional 29 PLDD polygons were found to have been omitted from the PWD. These polygons were manually copied to the PWD and individually attributed as 'Playa' features.

Projected Coordinate System

PWD features were captured in the Texas Centric Mapping System NAD 83 Albers projected coordinate system which was the same coordinate system used to capture original NWI features (Table 10). PLDD features were stored in an Albers Conic Equal-Area projection using the Clarke 1866 Spheroid for the NAD 1927 datum (Fish et al., 1998). Therefore the PLDD required projecting to the Texas NAD 1983 Albers coordinate system for processing with the PWD production geodatabase.

NAD_1983_Albers Projection: Albers False_Easting: 0.000000 False_Northing: 0.000000 Central_Meridian: -96.000000 Standard_Parallel_1: 29.500000 Standard_Parallel_2: 45.500000 Latitude_Of_Origin: 23.000000 Linear Unit: Meter GCS_North_American_1983 Datum: D_North_American_1983

Table 10. Projected Coordinate System for capturing PWD features

Reference Imagery and Reference Data

Two image data sources were used to verify the presence of a wetland or hydric soil. These included 2004 NAIP imagery and the USGS Digital Raster Graphic (DRG). The NAIP 2004 imagery was used principally to delineate PWD features. The DRG was used as a reference map to locate wetland features not be easily visible on NAIP images. The DRG imagery was accessed using National Geographic Society NGS_Topo_US_2D map service. This service has been since updated to the Esri USA Topo Maps map service. The World Imagery map service was also used to verify the presence or absence of wetland features. This map service contained then current one meter resolution satellite and aerial imagery

County SSURGO shapefiles from the NRCS were used to identify the presence of hydric soils. The most currently available SSURGO data were used during development of the 2004 NWI database. The USDA NRCS Soil Survey map service was not available until December 2010, which was published after the development of the NWI mapping projects.

Although a 2004 NAIP map service was available through the Texas Natural Resources Information System, it was more efficient to access individual 2004 NAIP images. At the time display performance was poor for the image services referenced from the network, and it took considerably longer to pan and zoom. To the extent possible the 2004 NAIP reference imagery was stored locally to minimize network time required to pan and zoom.

The PWD data was developed on PC workstations. The data were uploaded to a server daily for routine backups.

PWD Pre-Processing

To facilitate data capture, the study area was divided into seven production zones (Figure 8). The production zones were developed to enable student GIS analysts to efficiently complete the database.

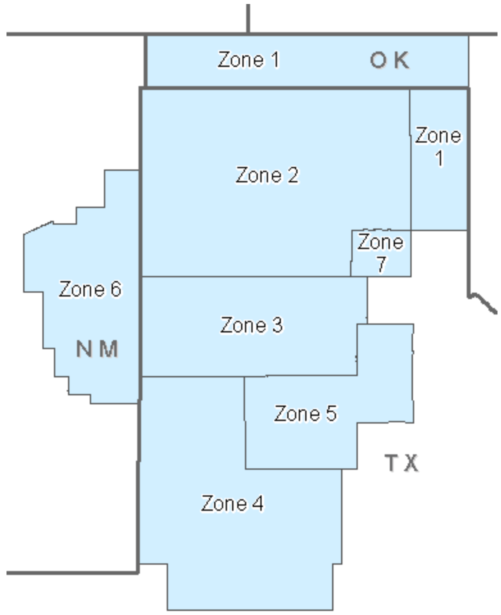


Figure 8. PWD production zones to capture wetland geometry

Digitally capturing PWD wetlands involved several geoprocessing and interpretive processes. The first process required identifying Cowardin-classified polygons representing a single wetland. Next the polygons representing a single wetland were selected and then merged into one feature (Figure 9). The production PWD database contained 62,575 merged NWI wetland features compared to the original 79,475 NWI polygons. An additional 2,014 PLDD features were incorporated into the PWD; while 86 TTU–identified wetlands were added to the PWD.

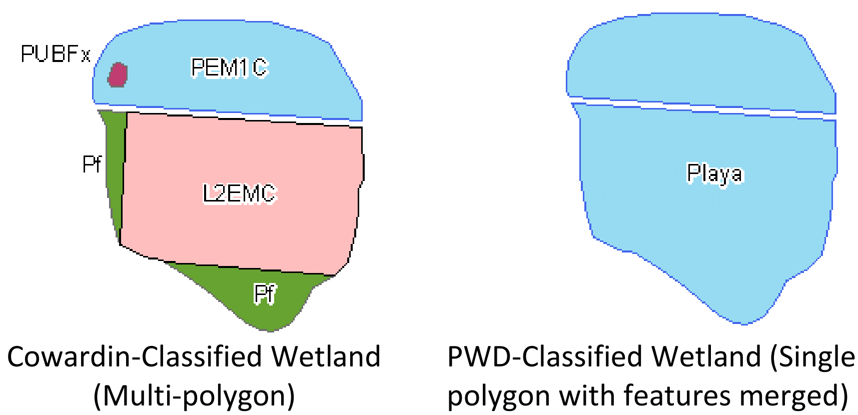


Figure 9. Comparison of NWI Cowardin-classified and PWD-classified wetland.

Capturing Wetland Geometry

Each PWD wetland feature was examined and reshaped as needed to better match hydric areas represented on the 2004 NAIP imagery. The scale used to edit features was typically 1:5,000. Viewer windows were used to assist GIS analysts to zoom closer when needed. Areas on the

2004 NAIP images that exhibited a hydric signature with neither an NWI nor PLDD polygon present were digitally captured by TTU and incorporated into the PWD.

Excluding merged riparian features, the mean size of all other PWD features is 10.4 acres. The range is 0.01 to 6,300.3 acres. The average size of Playa features is 12.9 acres with a range from 0.01 acres to 915.9 acres. The PWD contains approximately 2,000 wetlands between 0.01 and 0.1 acre. The smallest wetland feature stored in the NWI database is approximately 0.1 acre.

Wetland Classification and Attribution

The PWD was designed with twenty-seven attributes that describe each wetland. These attributes are described in detail in Appendix I - Data Dictionary (Tables A-1 and A-2). Individual interpretation of each wetland was required to assign values to seven of these attributes (Table 11). GIS analysts followed a set of rules and descriptions to aid in wetland interpretation and attribution. The methods to populate the remaining twenty attributes are described in the section *Attributes Populated by Geoprocessing or Calculation*.

Attributes Requiring Individual Interpretation

The process to manually assign attributes to each wetland is described in this section.

Attribute	Description
WetType	PWD wetland classification (Playa, Unclassified Wetland, Lake, Saline Lake, Riparian, Impoundment, Manmade, Scrub or Other)
ShpSource	Indicates originating data source for the wetland feature
RoadImpact	Indicates a wetland has been impacted by a road running through it or impacted by a road immediately adjacent to it
FrmdStatus	Indicates a classification of percentage of wetland farmed or if wetland was not farmed
Excavated	Indicates if wetland was modified by an excavation, dike, or drain
LandUse	Land use classification concerning whether or not farming practice was identified within a half mile of the wetland or if wetland was located in a built-up area or if it had been farmed
Comment	Comments describing landscape context of wetland (ex. Golf Course, Industrial Area, Oil Field)

Table 11. Attributes requiring manual interpretation to populate values for PWD features.

Attribute Precedence Rules

When more than one defining characteristic was present for a feature, precedence rules were applied to classify features and assign attributes. The rules were defined to ensure GIS analysts consistently assigned correct attributes. This section describes the precedence rules for three attributes: *Excavated*, *FrmdStatus* and *LandUse.*

WetType Attribute

PWD wetlands were categorized into one of eight wetland classes. The *WetType* field stores the values used to classify wetlands in the PWD (Table 2, A-2). An additional twenty-five attributes were designed to further describe each wetland.

Since playas are characterized by an underlying hydric soil, NRCS SSURGO data was processed to extract soil polygons indicative of hydric features in to a separate layer. These hydric soil features were used to support classification of playas. Although the SSURGO map unit descriptions for hydric soils varied by county, the most common soil associated with playas was Randall Clay. Of the 21,893 playas identified with a hydric soil, approximately 13,306 or about 61% were associated with a soil type named Randall Clay. Due to variability in soil classification in each county, the soil symbol for Randall Clay varied (eg. Ra, RaA, Rc, Ro, 34, 38, 42, 44). The processes used to classify each wetland feature type are described in the following sections.

Playa Classification

Playa features in the PWD are defined as a shallow depressional wetland, typically rounded and characterized by a hydric soil. If a hydric SSURGO soil polygon was present with this type of feature, then the *WetType* field was classified a value of 'Playa'. Figure 10a shows the symbology used to identify hydric soils from the SSURGO database. Since the PLDD used a hydric soil to identify playas, any wetland found in the PLDD was also classified as a 'Playa' feature (Figure 10b and 10c).

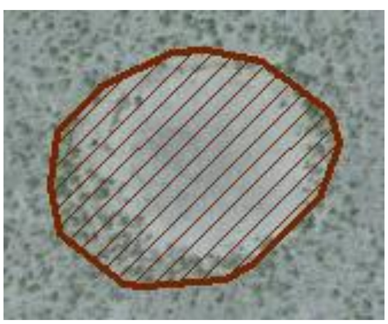


Figure 10a. Symbology for a hydric SSURGO soil used to classify Playa wetlands

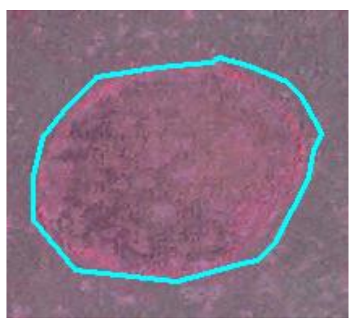


Figure 10b. Playa feature shown on 2004 color infrared NAIP in Floyd County.

Figure 10c. Playa feature shown on 2005 NAIP natural color image in Floyd County.

Unclassified Wetland

If the wetland had the appearance of being a playa but did not have an associated hydric soil in the SSURGO, and the wetland was not indicative of a riparian, manmade or impoundment feature, then the *WetType* field was assigned a value of 'Unclassified Wetland' (Figures 11a and 11b).

Figure 11a. Unclassified Wetland shown on natural color image with no hydric soil in Yoakum County.

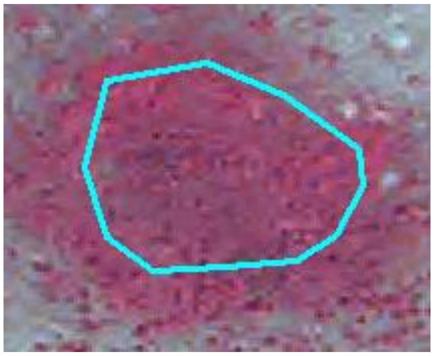


Figure 11b. Unclassified wetland shown on 2004 color infrared NAIP with no hydric soil in Yoakum County.

Lake Classification

Lake features represent fresh water wetlands that can be natural or manmade and are located in large depressional areas within a drainage basin (Figure 12). A total of 94 features were classified as lakes in the PWD. Lake features are typically twenty acres or larger, and are typically formed by obstructing a riparian feature. A few smaller lakes are located on golf courses. The average size of the lake features is 302 acres.

Figure 12. Lake feature.

Saline Lake Classification

Saline lakes are large, isolated wetlands that are in contact with groundwater creating a saline condition (Figures 13a and 13b). A total of 39 features were classified as saline lakes in the PWD of which 18 were assigned names on a USGS topographic map. The average size of the saline lakes is 521 acres. The largest saline lakes are found in Gaines, Terry, Andrews and Bailey Counties and are greater than 800 acres.

Figure 13a. Saline lake.

Figure 13b. Saline lake.

Riparian Classification

Riparian features are represented by a natural watercourse, channel or body of water. If a wetland was located within a riparian zone and did not have a corresponding polygon in the SSURGO soil or PLDD layer, then the WetType was classified as "Riparian". The features in Figure 14 were classified with a *WetType* value of "Riparian".

Figure 14. Riparian features.

Impoundment Classification

Small wetlands that have been diked for the purpose of creating water storage areas are classified as impoundments (Figures 15a and 15b). Impoundment features are typically formed by blocking a natural drainage corridor. Impoundments can be small confined pooling or potential pooling of water within a riparian zone as a result of an earthen dam or structure. Impoundments are type of manmade wetland averaging slightly less than 1 acre in size. Impoundments located on the caprock of the Llano Estacado might or might not have a hydric indicator soil. An example of an impoundment with an underlying hydric soil is a feedlot holding facility that might have been a former playa. Impoundments located in areas off the caprock or located in eroded areas that drain into a river system typically do not have a hydric indicator soil.

Figure 15a. Impoundment showing a straight earthen dam structure.

Figure 15b. Impoundment with delineated polygon.

Manmade Classification

Although Impoundments are a type of manmade features, the ‘Manmade’ classification is differentiated by their formation as a result of excavation rather than being dammed. Features in the ‘Manmade’ classification are typically small excavations that average about one acre in size (Figures 16a and 16b). In areas where cattle are grazed it is common to find manmade features in low lying areas where the animals can easily access the water. Another common manmade feature is an excavation made to drain water from a wetland.

In many cases it is difficult to ascertain the difference between an impoundment that was diked and a manmade feature that was excavated. Features unique to an area such as stock tanks, ponds, and pools are assigned the ‘Manmade’ classification. For example, in grazed range, non-farmed, arid areas windmills can be found to pump water from the aquifer and fill low-lying areas into a pool of water. These types of features are also included in the ‘Manmade’ category.

Manmade feature can be identified if a feature is bounded by at least two straight sides. Also, the Cowardin classification for excavated NWI wetland features often ended with an “x” making ‘Manmade’ features easier to identify. Often these ‘Manmade’ excavations are all that remain of a former playa system. Other ‘Manmade’ features are found in urban areas where a former playa was excavated and the shorelines significantly modified to prevent local flooding. These features are not considered to be a ‘Lake’ because they are not formed by damming a riparian feature.

Figure 16a. Manmade excavated feature.

Figure 16b. Manmade feature in an urban area.

Scrub or Other Classification

Scrub or Other features are represented by areas with dense scrub, trees or other vegetation with evidence of saturated soil and no water. On the Southern High Plains the NWI Cowardin classification identified features with a hydric soil, but having dense brush, scrub or trees as “palustrine scrub shrub”. These features are typically located in areas that appear to be in riparian or former riparian areas and appear to be islands of vegetation or trees (Figure 17) rather than a wetland. The PWD classified 184 features in the ‘Scrub or Other’ category. These features are relatively small and average about 6 acres in size.

Figure 17. Scrub or Other feature with hydric soil in former wetland area.

Not Reviewed and Unsure Classification

During the development of the PWD the *WetType* field was assigned a default value of 'Not Reviewed' prior to interpreting and assigning a classification to any wetlands. This value was changed as each feature was classified. If after one or more classification attempts, a GIS analyst was not confident in assigning a *WetType* value; a classification of "Unsure" was assigned. Wetlands classified as "Unsure" were reviewed by at least two GIS analysts and a supervisor to assign a classification. Any features remaining with an "Unsure" were reviewed during final quality assurance stages when the *WetType* values were finalized

ShpSource Attribute

The *ShpSource* or shape source attribute is used to indicate the data source from where the wetland feature originated. There are three possible data source values; 'NWI' (National Wetlands Inventory), 'PLDD' (Playa Lakes Digital Database) and 'TTU' (Texas Tech University).

ShpSource values were populated using two methods. The first method involved calculating an attribute value on the original NWI and PLDD data sources. These values were incorporated into the PWD when the data sources were combined. If a hydric area was recognized on the 2004 NAIP, but there was no NWI feature present, the PLDD was checked to see if a polygon feature was available. If a polygon was present in the PLDD, the feature was copied to the PWD. In this case the Shp*Source* attribute was set to 'PLDD'.

The second method involved manually updating the attribute value to 'TTU' when a new feature was added to the database that was not originally present in either the NWI or PLDD databases. In areas where a hydric soil was visible on the NAIP, but there was neither a PLDD nor NWI feature, a new wetland polygon was created. The Shp*Source* field was assigned a value of 'TTU' and the wetland was classified using the standard procedures. A total of 86 wetlands were added to the PWD with a 'TTU' source.

RoadImpact Attribute

The *RoadImpact* attribute was used to identify if a 'Playa' or 'Unclassified Wetland' was directly impacted by a road. The impact was typically due to a paved road. This type of impact ranges from a road dividing a playa into two or more parts to a road located adjacent to the playa. This type of modification was so significant that the parts of the wetland have been permanently separated, and flooding would not typically flow over the road (Figures 18a, 18b, and 18c). Attributes values for *RoadImpact* are 'N' and 'Y' representing No or Yes. Minor disturbances such as cow trail, small manmade trails, small dirt farm roads or turn rows running through a wetland that would not impede the wetland from easily flooding over the disturbance are not considered road impacted. For all other *WetType* values the *RoadImpact* value was not applicable and the values were assigned '-9'.

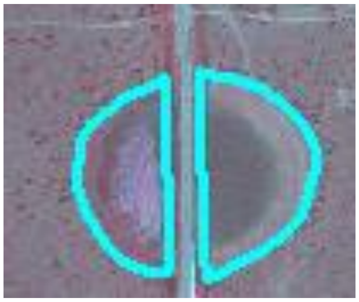


Figure 18a. Playa that has been impacted by a road

Figure 18b. Road modified playa with excavations

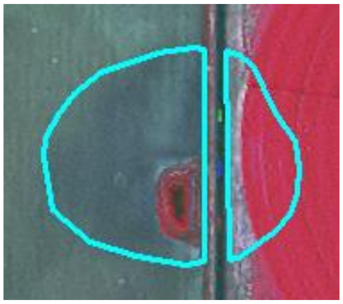


Figure 18c. Playa impacted by a road, farmed and excavated

FrmdStatus Attribute

The *FrmdStatus* attribute is used to indicate whether or not a wetland was farmed, and if so the relative percentage of the wetland farmed was specified. Evidence of having been farmed included visible furrow rows or center-pivot irrigation going through the wetland. The *FrmdStatus* values include 'Not Farmed', 'Wetland 25% or less farmed', 'Wetland 25% or more farmed' and 'Wetland 100% farmed'. If a wetland did not show any evidence of being farmed, then the *FrmdStatus* attribute was assigned a value of 'Not Farmed' (Figure 19a). If a wetland showed evidence of being farmed, the *FrmdStatus* attribute was assigned a value representing the percent area of the wetland that was farmed.

If less than a quarter of total wetland area was farmed, regardless of whether it was road modified, excavated, diked, or drained, then the *FrmdStatus* was assigned 'Wetland 25% or less farmed' (see Figures 19b and 19c).

Figure 19a. Wetland that is not farmed

Figure 19b. Wetland 25% or less farmed

Figure 19c. Wetland 25% or less farmed and excavated

If more than a quarter of total area of a wetland was farmed, but it was not 100% farmed, regardless of whether it was road modified, excavated, diked, or drained, the *FrmdStatus* attribute was assigned a value of ‘Wetland 25% or more farmed’ (see Figures 20a, 20b, and 20c).

Figure 20a. “Wetland 25% or more farmed” with an excavation

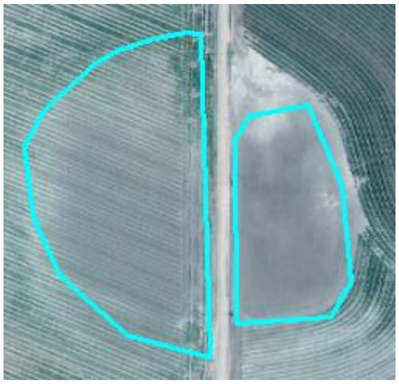


Figure 20b. “Wetland 25% or more farmed” that is diked

Figure 20c. “Wetland 25% or more farmed” that is drained

If 100% of the wetland was farmed, regardless of whether it was road impacted, excavated, diked or drained then the *FrmdStatus* attribute was assigned the value ‘Wetland 100% farmed’ (Figures 21a to 21c). This designation was used instead of the “Wetland 25% or more farmed” value because the wetland was completely farmed except for the road or excavated area that was unable to be farmed.

Figure 21a. Playa that is 100% farmed.

Figure 21b. Playa that is 100% farmed and road impacted.

Figure 21c. Playa that is 100% farmed and excavated.

Excavated Attribute

The *Excavated* attribute indicates if a wetland was modified by a specific type of physical impact within, touching or adjacent to the wetland. Attribute values include ‘Excavated’, ‘Diked’, ‘Drained’. Wetlands that were not altered by excavations, dikes or drains were assigned a value of ‘Not Excav’.

It was not uncommon for wetland features to show evidence of one or more impacts. Precedence rules were defined to prioritize impacts and assign the appropriate value to the *Excavated* field. If a wetland showed evidence of more than one activity an excavation was given a higher priority over a dike and drain impact. If a wetland was not excavated but was either diked or drained, the diked value was given priority over the drained status when assigning the attribute.

Wetlands exhibiting an excavation, dike, and/or drains were assigned an *Excavated* attribute values in the following priority order:

1. Excavated
2. Diked
3. Drained

If an excavation was clearly visible on the 2004 NAIP image the wetland was assigned a value of 'Excavated' (Figure 22a). An excavation often appeared as lighter-colored mound of non-vegetated material adjacent to the feature (Figure 22b). The 'Excavated' value was assigned if the wetland was excavated and also exhibited evidence of being diked, drained or both. The majority of manmade features were assign the 'Excavated' attribute value.

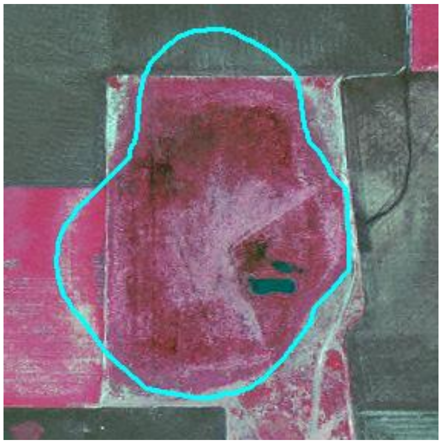


Figure 22a. Playa with excavations.

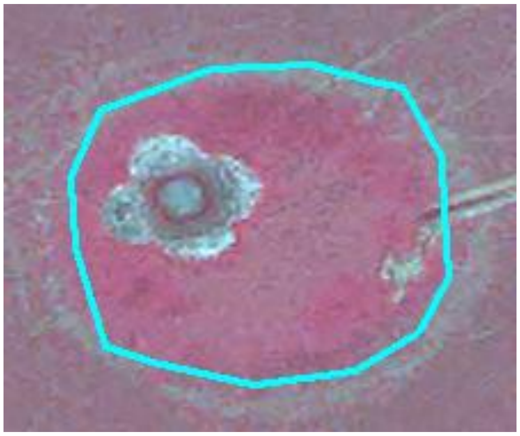


Figure 22b. Unclassified Wetland with excavation.

Dikes were most commonly built to block the flow of water onto a road or to impound water in a natural channel (Figure 23). Since dikes were typically constructed from material excavated from the wetland, a dike was considered a greater impact to the wetland than a drain. Impoundments were commonly assigned a value of 'Diked' when the feature was formed by blocking a riparian zone or natural drainage corridor. In some cases the 'Excavated' value was used if the GIS analyst determined that the most significant impact to the wetland was due to excavation.

Figure 23. Impoundment showing a straight earthen dam structure.

Drains were visible on the 2004 NAIP image as straight lines directing water away from the wetland (Figure 24). If the only impact to the wetland was from a drain, then the *Excavated* attribute was assigned a value of 'Drained'. If a drain emptied into an excavation in the same wetland, a value of 'Excavated' was assigned since that impact had a higher priority.

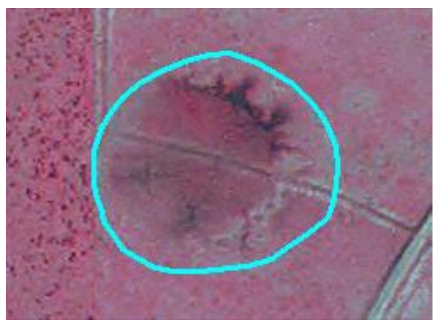


Figure 24. Playa that is drained.

To aid in the assignment of the *Excavated* attribute if the Cowardin classification for an NWI wetland was classified with an "x" modifier, the wetland was examined on the 2004 NAIP image to verify if it was excavated. If the wetland was classified with an "h" modifier, the wetland was examined on the NAIP image to verify if it was diked. If the wetland had a Cowardin classification with a "d" modifier, the wetland was examined on the image to verify if it was drained.

Excavations in Proximity to a Playa

In Figure 25, an excavated polygon shown in red was located outside of a playa. The SSURGO soil polygon shown in brown shows the excavation is within the soil polygon. The PLDD polygon shown in yellow and brown stripe shows the excavation at the boundary of the wetland. The NWI wetland shown in magenta stripe is smaller than the others and separated from the excavation. Since the excavated wetland was located outside of the playa and was not immediately adjacent to it, the excavation feature was not merged with the playa polygon. However, the playa was still classified as "Significantly Modified Playa" with the Excavated attribute assigned as "Excavated". The excavated polygon itself was classified as "Manmade".

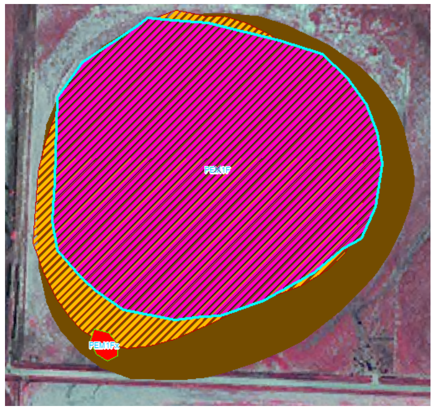


Figure 25. Significantly modified playa shown in magenta stripe was attributed as "Excavated" without being merged with the excavated polygon (shown in red). The orange and brown striped polygon was from the PLDD and the brown area was the SSURGO soil polygon.

In the Figure 25, even though the playa did not appear significantly modified, this classification was applied to honor the "h" modifier of the Cowardin classification and presence of drains.

LandUse Attribute

As part of the PWD database, it was particularly important to note the landscape context of individual playas with respect to the proximity to farming activity. The landscape context of a playa has a direct bearing on the sedimentation, hydro-period and hydrology. Sedimentation causes playa wetlands to become shallower and increase in area resulting in increased evaporation. Wetlands in close proximity to farmed areas experience different impacts than those in urban or built-up areas. In built-up areas wetlands can be significantly modified due to changes made to the shorelines, street runoff, excavation, and draining.

Therefore, at the time of mapping it was important to identify whether or not farming practice was identified within half mile of each wetland or if the wetland was located in a built-up area. A 2,640 foot buffer layer was created to facilitate interpretation of the imagery to determine whether farming activity was within this distance of the wetland.

Manually-entered *LandUse* attribute values included one of three values; 'Farming within half mile of wetland', 'No farming within half mile of wetland', and 'Wetland in built-up area'. Any wetland that did not fall into one of these three categories was 'Farmed' by definition. The 'Farmed' value was calculated for all other records in a later step (see *Attributes Populated by Geoprocessing or Calculation*). An example of a wetland with a *LandUse* value of 'Farmed' is shown in Figure 26a.

If the wetland was not farmed, but farming activity was present within one half mile, then the *LandUse* attribute value was assigned the value "Farming within half mile of wetland" (Figure 26b). This condition applied to land that showed evidence of having been farmed but the imagery also indicated it as currently fallow. To ascertain if farming was practiced within half a mile, a buffer layer was created. The GIS analysts used the buffer perimeter to identify if any farming activity was present within it.

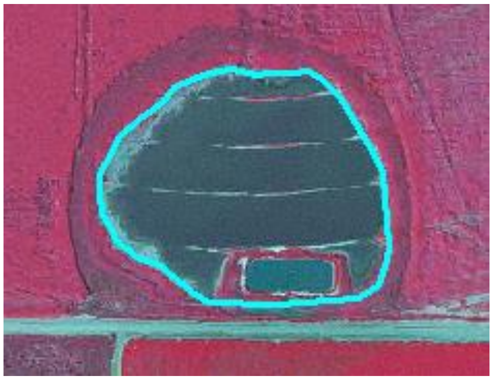


Figure 26a. Playa showing evidence of having been farmed also excavated and road impacted.

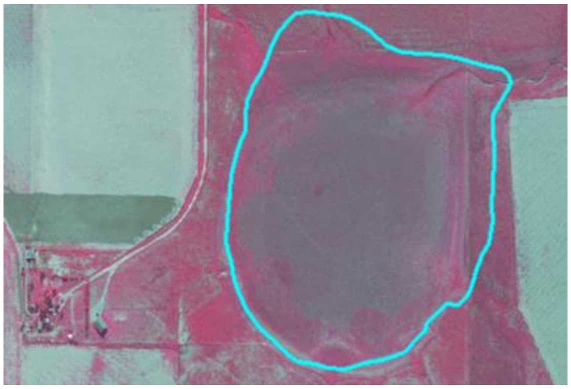


Figure 26b. Playa that is not farmed but within half mile of farming.

If there was no evidence of farming within half mile, the attribute value was assigned “No farming within half mile of wetland” (Figure 27a). If the wetland was located within or in close proximity to an urban or suburban area, then the *LandUse* attribute value was assigned “Wetland in built-up area” (Figure 27b).

Figure 27a. Playa in a built-up area.

Figure 27b. Playa that is not within half mile of farming.

If the wetland was in a built-up area and there was evidence of farming within half mile of a wetland, then the *LandUse* value was assigned “Wetland in built-up area” since that resulted in the greater impact. Only when a wetland was located near a built-up area and it appeared that farming practices would have a greater impact on the wetland was the *LandUse* value assigned “Farming within half mile of wetland” instead of the built-up area value.

LandUse attribute values were assigned based on the following precedence order:

1. Farmed (if not in a built-up area)
2. Farming within a half mile or Wetland in built-up area (see explanation above)
3. No farming within half mile

Comment Attribute

A ‘Comment’ field was used to supplement land use information by assigning various attributes indicative of manmade impacts When the other attributes could not accommodate a particular wetland characteristic, the *Comment* attribute was used to identify a special or unusual quality or describe the landscape context of the wetland (ex. Golf Course, Industrial Area, Oil Field).

A wetland as assigned a Comment of ‘Feed Lot’ if it was located within or in close proximity to a feed lot or confined animal feeding operation (Figure 28a). An unusual condition of a manmade filled-in area on a center pivot irrigation field to prevent erosion into a center pivot was assigned a comment ‘Filled-in Riparian’ (Figure 28b).

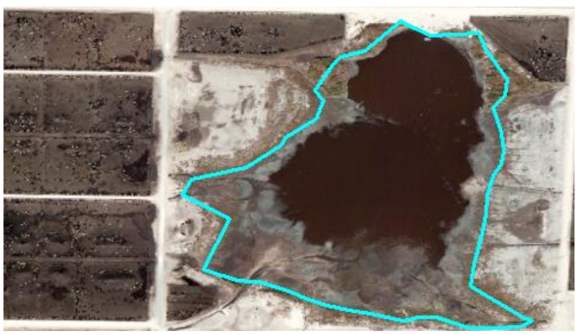


Figure 28a. Playa with comment ‘Feed Lot’.

Figure 28b. Manmade feature with comment ‘Filled-in Riparian’.

In Sherman County a few cases were identified where there was no evidence of a playa feature in the NWI database nor on the 2004 imagery, but a playa was present in the PLDD (Figure 29a). Instead the NWI data contained areas classified as small, separate manmade excavations as evidenced on the imagery for the same area (Figure 29b).

In these cases the PLDD polygon was not copied to the PWD. The excavation features present in the NWI data were retained. To maintain a record of the existence of an historic playa, the *Comment* field was assigned a value of ‘Former Playa’.

Figure 29a. Highlighted PLDD playa with imagery showing excavations.

Figure 29b. Hydric areas captured as several excavations in the NWI for the 2004 imagery assigned comment 'Former Playa'.

Figure 29c shows another example of a manmade feature identified in the NWI as an excavation, but also present in the PLDD as a playa. This feature was assigned the *Comment* 'Former Playa' to preserve the historic presence of the playa feature.

Figure 29c. Manmade feature with comment 'Former Playa'.

Typically small wetland features in the vicinity of a golf course were assigned the *Comment* value ‘Golf Course’. The wetland features found in a golf course could be of various *WetType* values including ‘Playa’, ‘Unclassified Wetland’, ‘Lake’, or ‘Manmade’ depending upon their particular characteristics (Figure 30).

Figure 30. Unclassified wetlands with comment ‘Golf Course’.

A hydric soil located on the Pantex facility in Carson County was assigned a comment ‘Government Facility’ (Figure 31a). The lines running though the hydric soil area on the government facility is a stack yard. The *Comment* could be assigned ‘Industrial Area’ if the area immediately surrounding the wetland was located in close proximity to any type of industrial or agricultural industrial area (Figure 31b).

Figure 31a. Playa with comment ‘Government Facility’ located in Pantex facility with a stack yard through wetland.

Figure 31b. Wetland with comment ‘Industrial Area’.

The *Comment* could be assigned ‘Near Built-up Area’ if the area immediately surrounding the wetland was located in close proximity to a small town or built-up area (Figure 32a). If the wetland was completely surrounded by an urban or residential development, then the *LandUse* was assigned ‘Wetland in built-up area, and it was not necessary to use the ‘Near Built-up Area’ comment.

A *Comment* of ‘Near Farm Buildings’ was assigned if the area immediately surrounding the wetland was located in close proximity to a small town, sparsely spaced homes, ranches or farm buildings (Figure 32b).

Figure 32a. Playa with comment ‘Near Built-up Area’.

Figure 32b. Playa with comment ‘Near Farm Buildings’.

If a wetland was located in an oil field, then the *Comment* attribute was assigned a value of ‘Oil Field’ (Figure 33). Other *Comment* values include ‘Pond’ (Figure 34a) and ‘Pool’ (Figure 34b).

Figure 33. Playa feature located in an oil field.

Figure 34a. Manmade feature with ‘Pond’ comment.

Figure 34b. Manmade feature with ‘Pool’ comment.

A *Comment* of ‘Quarry’ was assigned where significant excavation in an area had taken place (Figure 35a). A *Comment* of ‘Race Track’ was used when the wetland was located in a track used for automotive or horse racing (Figure 35b).

Figure 35a. Manmade wetland with comment ‘Quarry’.

Figure 35b. Unclassified wetland with ‘Race Track’ comment.

A *Comment* of ‘Runway’ was assigned where the wetland was located in proximity to an airport runway (Figure 36a). A *Comment* of ‘Relic saline lake’ was used when the wetland was located in an area of a former saline lake. This feature was corroborated with Jim Dick (pers. Commun.) of the National Wetlands Inventory (Figure 36b).

Figure 36a. Unclassified wetland with ‘Runway’ comment.

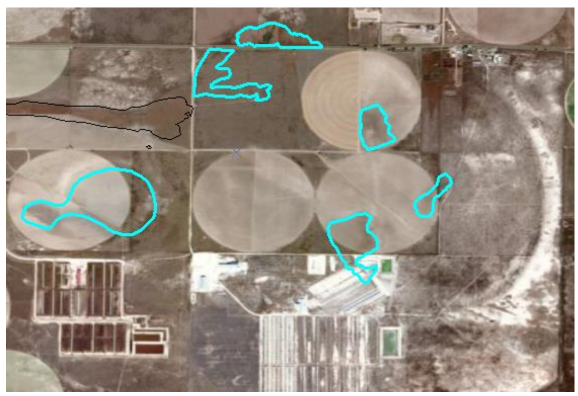


Figure 36b. Scrub or Other features identified in an area of a former saline lake with ‘Relic saline lake’ comment.

Small wetlands were often found in areas where cattle are grazed. These wetlands were assigned a *Comment* of ‘Stock water’ to indicate where water is accumulated for cattle. Sometimes a windmill was located nearby that indicates the source of water was from the aquifer (Figure 37a). A wetland was assigned the *Comment* of ‘Wind Turbines’ when it was located in a wind farm area (Figure 37b).

Figure 37a. Manmade feature with comment ‘Stock water’ provided by pumping from windmill.

Figure 37b. Playa with comment “Wind Turbines”

In a few cases a water feature in the NWI was identifed with the *Comment* ‘Water Treatment’ to identify the feature in a water treatment plant (Figure 38).

Figure 38. Manmade features with comment ‘Water Treatment’.

Playas could be assigned comments of ‘Feed Lot’, ‘Former Playa’, ‘Golf Course’, ‘Government Facility’, ‘Industrial Area’, ‘Near Built-up Area’, ‘Near Farm Buildings’, ‘Oil Field’ or ‘Quarry’, ‘Runway’ or ‘Wind Turbines’.

Unclassified Wetland features could be assigned comments of ‘Feed Lot’, ‘Golf Course’, ‘Industrial Area’, ‘Near Built-up Area’, ‘Near Farm Buildings’ or ‘Oil Field’.

Comments for Lakes include ‘Former Playa’ and ‘Golf Course’.

Saline Lakes were assigned a name if it was published on a USGS topographic map.

Riparian features could be assigned comments of ‘Feed Lot’ or ‘Oil Field’.

Comments for Impoundments included 'Feed Lot', 'Former Playa', 'Industrial Area', 'Near Built-up Area', 'Near Farm Buildings', and 'Oil Field'.

Manmade features could be assigned a comment of 'Feed Lot', 'Filled-in Riparian', 'Former Playa', 'Golf Course', 'Government Facility', 'Industrial Area', 'Near Built-up Area', 'Oil Field', 'Pond', 'Pool', 'Quarry', 'Race Track', 'Stock Water' or 'Water Treatment'.

Scrub or Other features were assigned comments of 'Near Built-up Area', 'Near Farm Buildings', 'Oil Field', 'Quarry', 'Relic Saline lake' or 'Road Modified'.

Other comments used to further describe a wetland are specified in Appendix I Data Dictionary Table A-2.

Attributes Populated by Geoprocessing or Calculation

In contrast to the seven manually-interpreted attributes (Table 11), the design of the PWD included twenty additional attributes whose values were either calculated or incorporated by performing a geoprocessing procedure (Table 12).

Attribute	*Description*
IDByCnty	Unique identification number for each wetland by county beginning with 1
WetlandID	Unique Playa ID composed of StFIPS, CoFIPS and unique number from the IDByCnty field
WetCode	Two-character code representing a WetType value
ShpSource	Identifies data source organization
Modified	Indicates if wetland was modified
Farmed	Indicates if wetland was farmed
CntroidSoil	SSURGO map unit symbol located at centroid of each playa or unclassified wetland
MajrtySoil	SSURGO map unit symbol of most commonly occurring soil in each wetland
PlayaSoil	Indicates if feature has a hydric soil
Ogallala	Indicates if feature is within Ogallala Aquifer boundary
SqMeters	Area of wetland in square meters
Acres	Area of wetland in acres
StAbbr	State abbreviation
StFIPS	State Federal Information Processing Standard code
CountyName	County Name
CoFIPS	County Federal Information Processing Standard code
LonNAD83	Longitude coordinate of wetland in NAD 1983
LatNAD83	Latitude coordinate of wetland in NAD 1983
PLDD_ID	Unique identifier from the PLDD
PLDD_Soil	Soil type description from the PLDD

Table 12. Calculated and geoprocessed attributes.

IDByCnty Attribute

The *IDByCnty* attribute contains a unique value for each wetland in a county beginning with the number 1. This attribute was calculated by first selecting all features in a county, and then running Python code in the field calculator to set a counter and increment it (Figure 39). Once the values were calculated for one county, the records for the next county were selected and the process was repeated. The purpose of the *IDByCnty* attribute was two-fold, first to provide a quick way to determine the number of each type of wetland in a county, and second to use the value to generate a unique wetland ID for each feature in the PWD.

```
Counter = 0
def uniqueID():
global counter
counter += 1
return counter
```

In the Bottom field calculator window enter

```
uniqueID()
```

Figure 39. Python code to populate a unique value for each feature in a county.

WetlandID Attribute

The *WetlandID* attribute was designed to uniquely identify each wetland in the PWD. First the *StFIPS* (State Federal Information Processing Standard code) and *CoFIPS* (County FIPS code) fields were concatenated into a temporary production field named *StCoFIPS*. The *WetlandID* values were calculated by concatenating the *StCoFIPS* and *CoFIPS*, a dash separator, and the *IDByCnty* value appended with leading zeros (Figure 40).

Once again a Python script was written to perform the concatenation. The script appends four leading zeros to the *IDByCnty* values, trims all except the last five characters, then concatenated this value to the temporary *StCoFIPS* field. Example *WetlandID* values are shown in Table 13.

```
!CoStFIPS! + '-' + ('0000'+ str( !IDByCnty! ))-5:]
```

Figure 40. Python code to calculate WetlandID

Example WetlandID	***Description***
35009-0001	First wetland feature (0001) in Curry County (009), New Mexico (35)
35041-00746	Last wetland feature (00746) in Roosevelt County (009), New Mexico (35)
40007-00001	First wetland feature (0001) in Beaver County (007), Oklahoma (40)
40139-01410	Last wetland feature (01410) in Texas County (139), Oklahoma (40)
48003-00001	First wetland feature (0001) in Andrews County (003), Texas (48)
48501-00694	Last wetland feature (0694) in Yoakum County (501), Texas (48)

Table 13. Example WetlandIDs and descriptions.

WetCode Attribute

The *WetCode* attribute was assigned a two-character code beginning from 01 to 08 to represent the eight *WetType* values. This attribute was initially designed during the production data capture phase to store a two-byte text field with an assigned domain (that displayed descriptions for each code). This attribute was retained in the final database. During final quality assurance procedures each *WetType* value was selected (ex. ‘Playa’) and the *WetCode* values were calculated to the corresponding value in the Data Dictionary.

ShpSource Attribute

The *ShpSource* attribute was initially populated with pre-calculated values from the production NWI and PLDD databases. During the manual wetland interpretation process GIS analysts manually input the 'TTU' source value or updated the values as required. The manual input process is described in the *Attributes Requiring Individual Interpretation* section.

Modified Attribute

The *Modified* attribute was calculated by selecting *WetType* values of 'Impoundment' or 'Manmade, *RoadImpact* values equal to 'Y', *Excavated* values not equal to 'Not Excav', and *FrmdStatus* values not equal to 'Not Farmed'. Once these records were selected the *Modified* attribute was calculated to 'Y'. To populate the remaining records the record set was switched and the *Modified* values were calculated to 'N'.

Farmed Attribute

The *Farmed* attribute was calculated by selecting records where the *FrmdStatus* values were not equal to 'Not Farmed'. Once these records were selected the *Farmed* attribute was calculated to 'Y'. To populate the remaining records the record set was switched and the *Farmed* values were calculated to 'N'.

CntroidSoil Attribute

Only 'Playa' wetlands are associated with a characteristic hydric soil. The *CntroidSoil* field was assigned the SSURGO map unit symbol located at the centroid of playa features. Since all other wetland features were not characterized by a hydric soil, the centroid soil was assigned a value of '-9' for not applicable.

The SSURGO map unit symbol was populated using a spatial join geoprocessing procedure. To prepare for the spatial join the SSURGO layers for all counties in the study area were merged into one continuous layer. The spatial join process assigned the map unit symbol value of the soil layer to each playa feature based on their spatial relationship. The process used the 'Centroid' option to ensure the soil symbol found at the center of the playa would be assigned. A summary of playa soil types revealed 505 SSURGO unique soil symbol values were associated with 'Playa' features. The most commonly occurring soil map unit values represented the Randall Clay which comprised about 61% of the assigned playa soils.

MajrtySoil Attribute

The *MajrtySoil* attribute represents the most commonly occurring SSURGO soil type or the soil with the largest area for every wetland in the PWD. This value was calculated using a zonal statistics process. The zonal statistics process calculates statistics on values of a raster within the zones of another dataset. In this case the layer of PWD wetland features represented the zones and the SURGO soil layer represented the raster from which the 'Majority' statistic was calculated for each zone. To prepare for the processing the merged SSURGO soil layer was converted to an integer raster. Initially raster was output with 25-meter resolution to capture a statistic for each wetland. The soil raster contained the attributes *MUSYM* which stored the soil map unit symbol and a *VALUE* attribute which stored an incremental number for each soil map unit symbol.

The output of the zonal statistics process was a table that contained the unique *WetlandID* for each feature and a *MAJORITY* attribute. The *MAJORITY* attribute contained the incremental number from *VALUE* attribute of the raster that represented the map unit symbol of the soil that comprised the soil with the largest area for the wetland.

The *VALUE* attribute of the soil raster table was joined to the *MAJORITY* field in the zonal statistics table. This join process resulted in a table that contained both the numeric value in the *MAJORITY* attribute and the descriptive soil map unit symbol from the *MUSYM* attribute.

Next this joined table was joined once again to the PWD wetlands layer by the *WetlandID* fields. This second join process associated the *MUSYM* value of the largest soil type with each wetland feature in the PWD. Finally the *MajrtySoil* field was calculated with the value from the *MUSYM* field.

This zonal statistics process using the 25-meter resolution soil raster resulted in soil symbol values for 96% of the wetland features. At the end of this process approximately 2,000 wetlands had Null values in the *MajrtySoil* field.

To assign the remaining *MajrtySoil* values a new soil raster was recreated at 5-meter resolution. Next a subset of the PWD layer containing the 2,000 features with Null soil values was output. The zonal statistics process was repeated using the smaller PWD layer and 5-meter soil raster. This second process produced soil symbol values for all but 13 wetlands. These 13 wetlands were located immediately outside of the study area counties and therefore were not further processed.

PlayaSoil Attribute

The *PlayaSoil* attribute reflects the presence a hydric indicator soil for 'Playa' features only. If the *CntroidSoil* value represented one of the hydric soil types identified for playa feature, then a value of 'Y' for yes, was calculated in the *PlayaSoil* attribute. The hydric indicator soil was not present for other wetland types including 'Unclassified Wetland'. So the assignment of a playa soil was not valid for any other wetland types, and therefore the *PlayaSoil* attribute was calculated to '-9' representing 'not applicable'.

Ogallala Attribute

The *Ogallala* attribute contains values of 'Y' or 'N' indicating if the wetland is located over the Ogallala Aquifer and might represent potential points of recharge. These values were calculated by first performing a 'Select By Location' process to locate all wetlands within the Ogallala Aquifer boundary. The Ogallala boundary used to select wetlands was a modified boundary produced by the Center for Geospatial Technology at TTU for the Ogallala Aquifer Program (gis.ttu.edu/ogallala). Once selected the *Ogallala* attribute was calculated to 'Y'. The record set was switched and the remaining values were calculated to 'N'.

SqMeters and Acres Attribute

The *SqMeters* and *Acres* attributes were calculated using the 'Calculate Geometry' tool. To prepare the PWD for this calculation the feature class was projected to Texas Centric Mapping System NAD 83 Albers projected coordinate system. This is an equal area projection appropriate for calculating square meters and acres. Once in this projection the *SqMeters* and *Acres* fields were calculated for all wetland features.

The final dataset was converted to NAD 1983 geographic coordinates for distribution.

StAbbr Attribute

The *StAbbr* attribute was calculated using a combination of 'Select By Location' and 'Field Calculator' tools. First wetland features were selected by their location with respect to a layer of states. Once features were selected for a state, the appropriate *StAbbr* value of 'NM', 'OK', or 'TX' was calculated.

StFIPS Attribute

The *StFIPS* attribute was calculated using the 'Select By Attribute' and 'Field Calculator' tools. First wetland features with a *StAbbr* of 'NM' were selected and the *StFIPS* values calculated to '35'. The same process was used for 'OK' and 'TX' assigning values of '40' and '48' respectively.

CountyName Attribute

The *CountyName* attribute was calculated using spatial join and field calculator processes. A layer of study area counties was spatially joined to the PWD layer of all wetlands. All attributes from the PWD and only the *NAME* and *FIPS* fields were retained. The *CountyName* attribute was calculated using the value of the *NAME* field from the study counties layer using the 'Field Calculator' tool. Finally the *NAME* field was deleted.

CoFIPS Attribute

The *CoFIPS* attribute was calculated using the value of the *FIPS* field that was spatially joined while processing the *CountyName* attribute.

LonNAD83 and LatNAD83 Attributes

When the PWD was stored in the GCS North American 1983 coordinate system, the *LonNAD83* attribute was populated using 'Calculate Geometry' tool with the 'X Coordinate of Centroid' property. Likewise the *LatNAD83* attribute was populated using 'Calculate Geometry' tool with the 'Y Coordinate of Centroid' property.

PLDD_ID and PLDD_Soil Attributes

The purpose for incorporating the *PLDD_ID* attribute is to allow features in the PWD to be associated with PLDD features to examine historical change in playa geometry or use.

The *PLDD_ID* and *PLDD_Soil* attributes were populated by spatially joining the PLDD polygons to the centroid of each PWD feature. Only the *Playa*_ID and *Soil_Type* attributes from the PLDD database were retained in the output. The *PLDD_ID* and *PLDD_Soil* attributes were populated using the values from the *Playa*_ID and *Soil_Type* attributes respectively. After the *PLDD_ID* and *PLDD_Soil* attributes were calculated the *Playa*_ID and *Soil_Type* attributes were deleted.

Additional Data Processing Considerations

Separating Riparian from Wetland Features

In cases where a long riparian feature was connected to a wetland, the two features were separated into two features. Separating the features permitted them to be classified as an individual riparian and another appropriately-classified wetland feature (Figure 41).

Figure 41. Riparian polygon separated from other wetland feature so features could be individually classified.

Symbology for Wetlands

A standardized symbology was developed to ensure classification consistency among GIS analysts. To assist the classification process an information sheet was developed that contained the symbology, attribute interpretation and precedence rules (Figure 42). All other attribute were calculated at a later time. An additional set of figures showing example classifications was developed as a reference (Figure 43).

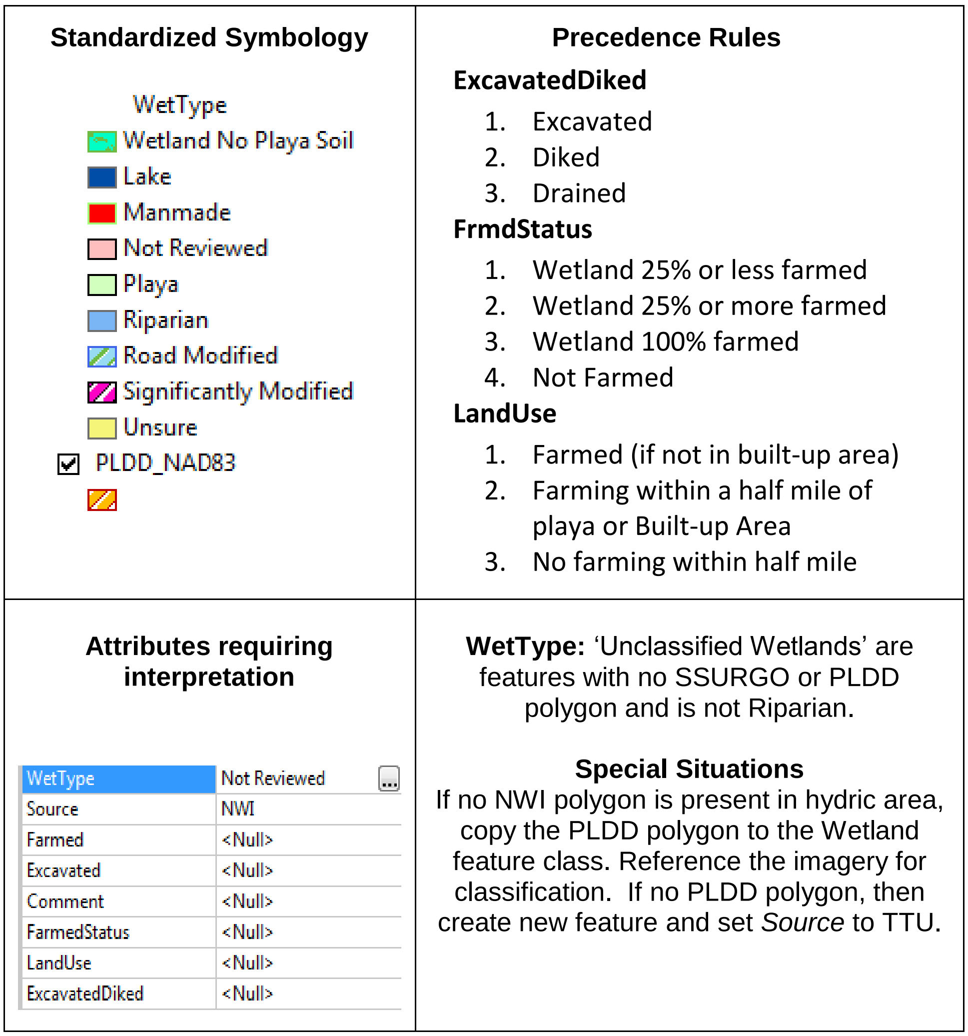


Figure 42. Information sheet for classification support for GIS analysts.

Examples of Wetlands with Various Attributes

Example images of that typified wetland characteristics for each attribute were used by GIS analysts to maintain consistency with wetland classification.

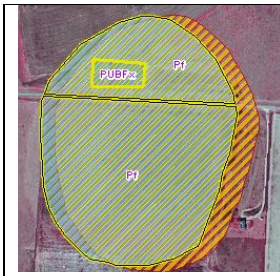
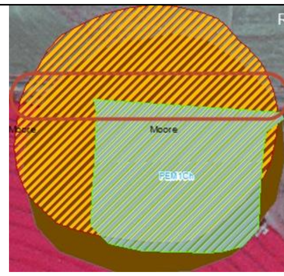
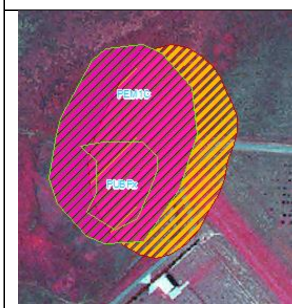
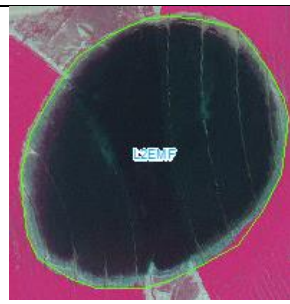
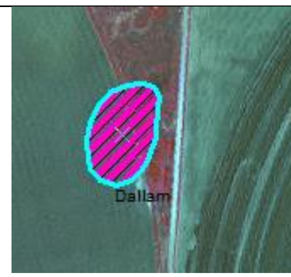
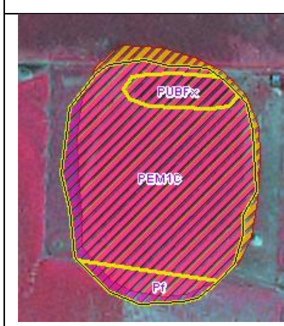
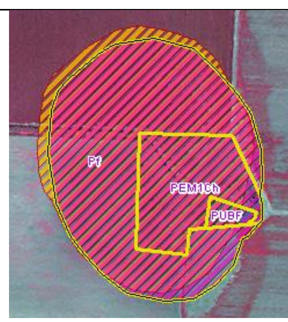
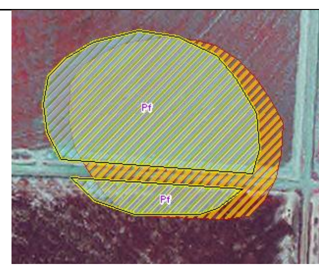
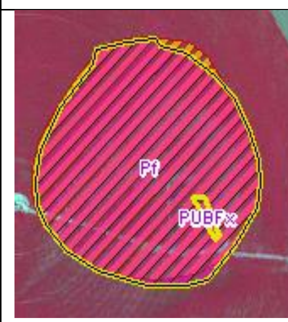
			
Playa 100% farmed and Excavated	Playa, Diked Farming within half mil	Playa, Road Impacted Farming within half mile	RoadImpacted, Farmed = Yes 25% or less farmed in playa
			
Playa, Excavated, Near Built-Up Area	Playa, 25% or more farmed	Playa 25% or more farmed in playa	Playa, Drained
			
Playa, 25% or less farmed, Excavated	Playa, 25% or more farmed, Diked	Playa, Road Impacted, 100% farmed	Playa, 100% playa farmed

Figure 43. Master sheet with example wetland interpretations for GIS analysts.

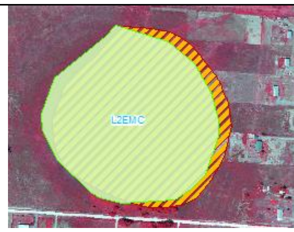
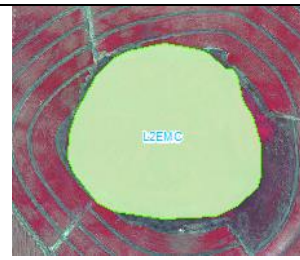
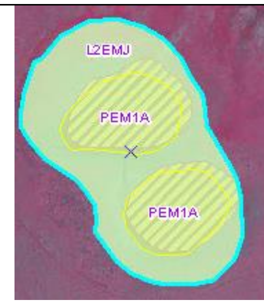
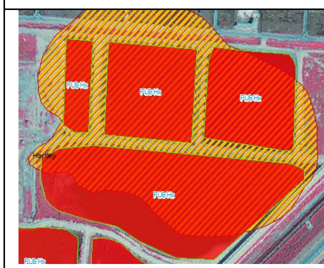
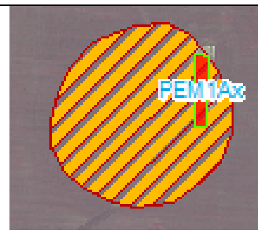
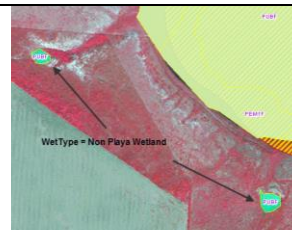
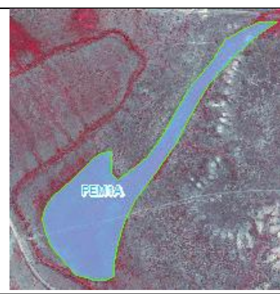
			
Playa, Farming within a half mile of playa	Playa, Near Farm Buildings	Playa, Farming within half mil	Playa (Two separate polygons in SSURGO and PLDD – One polygon in final layer)
			
Manmade, Excavated Comment = Former Playa	Manmade, Excavated Comment = Former Playa	Unclassified Wetland, Farming within half mil	Unclassified Wetland, 100% playa farmed
			
Riparian, diked	Riparian	Riparian, diked	Manmade, Excavated

Figure 43 (cont). Master sheet with example wetland interpretations for GIS analysts.

Quality Assurance and Quality Control

During PWD development quality assurance checks were incorporated though out the data capture process to maximize consistency and minimize errors in wetland classification, capture of geometry and attribution. Each GIS analyst followed the same set of procedures and worked on a map with consistent symbology and layers. Production attributes and values were incorporated to encourage questions and concerns regarding wetland classification.

Initially all the *WetType* values were assigned "Not Reviewed". This value was changed when a wetland was classified. If a GIS analyst was not confident in classifying a wetland, the WetType attribute was assigned "Unsure". A review process involving two GIS analysts and a supervisor was conducted periodically to ensure consistency when updating an "Unsure" classification to one of the standard wetland classes.

During the development of the PWD 'Impoundment' features were the last wetland type defined. Impoundments were incorporated in the wetland classification to distinguish them from riparian zones which are characterized by free-flowing water or potential for water to flow. Impoundments represent a confined pooling or potential pooling of water within a riparian zone due to the creation of an earthen dam. The introduction of 'Impoundment' features occurred after several production zones were completed. GIS analysts were tasked to re-visit features in their production zones and identify features that were more appropriately classified as an 'Impoundment' and change the attribute value.

The quality control phase was initiated after GIS analysts completed all parts of the database and the parts were merged into a single layer. Quality control involved identifying errors in the PWD particularly as regards wetland classification and to ensure all playas were correctly captured. One GIS analyst was assigned the quality control task to review and reassign wetland classifications and attribution. It was desirable to have the same person evaluate the wetland classification throughout the database to maximize interpretation consistency. In particular, 'Playa', 'Unclassified Wetlands' and 'Impoundment 'features were examined for accurate interpretation.

To facilitate the quality assurance effort, a one-mile grid was created for the study area. Grid areas without features were selected, attributed and symbolized to allow the GIS analyst to focus on grids that contained features. As each grid was completed for quality assurance it was flagged and automatically re-symbolized. Areas that remained to be checked were clearly visible which made it easy to track progress and know where to start.

Logical Consistency

Wetland features are inherently variable in their characteristics and thus their interpretation can be subjective. Since GIS analysts had seven attributes to interpret, a series of queries were developed to identify inconsistency in attribution for wetland features.

A table defining the valid attribute combinations for PWD-classified wetlands is presented in Table 14. Examples of some of the queries developed to locate logical inconsistency in attribution are shown in Table 15.

WetType	ShpSource	Road Impact	FrmdStatus	Excavated	Landuse
Playa	NWI, PLDD, TTU	N, Y	Not Farmed, -/+ 25% farmed or 100% farmed	Diked, Drained, Excavated or Not Excav	Farmed, Farming within ½ mile, No Farming within ½ mile, In built-up area
Unclassified Wetland	NWI, TTU	N, Y	Not Farmed, -/+ 25% farmed or 100% farmed	Diked, Drained, Excavated, or Not Excav	Farmed, Farming within ½ mile, No Farming within ½ mile, In built-up area
Lake	NWI, TTU	-9	Not Farmed	Diked, Excavated, or Not Excav	Farming within ½ mile, No Farming within ½ mile, In built-up area
Saline Lake	NWI	-9	Not Farmed	Diked, Excavated, or Not Excav	Farming within ½ mile, No Farming within ½ mile
Riparian	NWI, TTU	-9	Not Farmed, -/+ 25% farmed or 100% farmed	Diked, Drained, Excavated, or Not Excav	Farmed, Farming within ½ mile, No Farming within ½ mile, In built-up area
Impoundment	NWI, PLDD, TTU	-9	Not Farmed	Diked, Excavated, or Not Excav	Farming within ½ mile, No Farming within ½ mile, In built-up area
Manmade	NWI, TTU	-9	Not Farmed	Diked, Excavate	Farming within ½ mile, No Farming within ½ mile, In built-up area
Scrub or Other	NWI, PLDD, TTU	-9	Not Farmed, -/+ 25% farmed or 100% farmed	Diked, Excavated, or Not Excav	Farmed, Farming within ½ mile, No Farming within ½ mile, In built-up area

Table 14. Legal PWD attribute value combinations of manually-entered fields.

Query	Description
Unclassified Wetland with *ShpSource* of PLDD	Unclassified Wetlands by definition do not have a hydric soil and would not be present in the PLDD. Records identified with this combination were checked to determine 1) if the feature had a hydric soil in the SSURGO data and should be changed to a 'Playa' *WetType* or 2) if the feature was so significantly modified that it was no longer a PLDD 'Playa' and the *WetType* re-evaluated to Manmade with a *Comment* 'Former Playa'.
Lake feature that has been farmed	Lake features are not expected to show evidence of farming activity. Records identified with this combination were checked to see if 1) farming activity is indeed present on the feature and if so 2) re-evaluated the *WetType*. If no farming is present, then update the *FrmdStatus* value to 'Not Farmed'
Riparian feature with *ShpSource* of PLDD	Riparian features were not intended to be collected in the PLDD. Records identified with this combination were checked to see if 1) had a hydric soil in the SSURGO data and should be changed to a Playa feature or 2) the feature has been significantly modified and the *WetType* re-evaluated.

Table 15. Example queries to evaluate logical consistence in attribute value combinations.

Finalizing the PWD

To finalize the PWD, geodatabase was compacted using the ArcGIS Catalog function to better arrange how the data were stored on disk, reduce geodatabase size and improve performance. Four Model Builder models were developed to export the master AllWetlands feature class into separate geodatabase feature classes (Table 9). The models also exported the geodatabase feature classes to shapefile format in a separate folder structure.

A second model was developed to export a suggested symbology used to display the various wetland layers. These layer files were stored with the shapefiles and reference the shapefile so users can directly add the layer file to ArcGIS and immediately display pre-symbolized layers.

A third model exported each feature class into geodatabase layer packages that contain the data and symbology in geodatabase format. Finally a fourth model exported each geodatabase feature class into separate geodatabases so they could be downloaded individually if desired. Finally the geodatabases, shapefiles and layer packages were zipped and referenced on the Playas and Wetlands Research website for downloading.

Future Modification to PWD

Release 1.0 of the PWD was completed in March 2014. It is unknown at the present time if or when a future update of the PWD will be made.

Appendix I – Data Dictionary

Playas and Wetlands Database

The data dictionary represents the attributes and values distributed in the final PWD GIS database. The production geodatabase was designed for maximum efficiency with integer fields and domains to allow GIS analysts to select values from standardized lists. Since shapefiles do not support domains, the integer fields were replaced with text fields and the integer values replaced with descriptions. In the final geodatabases, the domains were removed from the fields for consistency with the shapefile feature classes. Production attributes and values are not included in this data dictionary.

The PWD was made available for download on the Playa and Wetlands Research website and also on CD. The content specification of the final PWD is provided in this data dictionary.

GeoDatabase: PWD_v1.gdb

Feature Data Set: None

Feature Class Name: Playas_Wetlands

Geometry Type: Polygon

Feature Class Description: The Playas and Wetlands GeoDatabase (PWD) was developed as a comprehensive resource for mapping playa-lake and wetland features in 52 counties overlying the Ogallala Aquifer on the Southern High Plains of the United States. The primary data source was the National Wetlands Inventory (NWI) geodatabase. The NWI wetlands were developed using SSURGO soil data to identify hydric soils and air photo interpretation using 2004 NAIP imagery. In addition, the Playa Lakes Digital Database (Texas Tech University, Department of Natural Resources Management) was used to incorporate features that were not included in the NWI. Lastly, wetland features not identified in either the NWI or PLDD were incorporated by the Center for Geospatial Technology.

In the original NWI database, wetland features were classified based on the Cowardin Classification System and multiple polygons were frequently used to map a single wetland. In the PWD geodatabase, these polygons were merged to create unique playa or wetland features and selected features were edited to refine feature geometry. A simplified classification system was developed to assess the functional condition of playas and physical environment of wetlands. Additional attributes incorporate information regarding modifications to the wetland, land use, soil type, and a unique wetland identification number.

All features in this database are available in the AllWetlands layer. Data are also available in separate layers according to the major wetland classifications: Playas_UnclassifiedWetlands, Lakes, Saline Lakes, Impoundments_Manmade, Riparian, Scrub and Other Features.

The PWD production layer was captured using the Texas Centric Mapping System NAD83 Albers in meters which was consistent with the projected coordinate system used to capture the original NWI database. The final PWD data was output in Geographic Coordinate System North American 1983.

The wetland features are not intended for use at a scale larger than 1:5,000

The data dictionary tables that define the attributes and values in the final feature class are presented in tables A-1 and A-2.

Production Notes: The PWD was designed as a feature class in a file geodatabase using ArcGIS 10.1 SP1. A series of domains were created to facilitate data entry using dropdown lists that supported data integrity. Since the shapefile format does not support domains, the final geodatabase feature class was modified by removing the domains and incorporating descriptive values to make the tabular data more user-friendly.

The final GDB shortened field names to 10 characters. This facilitated conversion from geodatabase to shapefile format without truncation of field names. This also prevented the metadata from being deleted for fields more than 10 characters.

Attributes:

NAME	KEY	DATA TYPE	FIELD FORMAT	DESCRIPTION
OBJECTID		Object ID	5,5,0	Unique record identifier maintained by the GIS software for each feature
Shape		Geometry		Defines the geometry type of all features
IDByCnty		Short	2,2,0	Unique value for each WetType value beginning with 1 by county
WetlandID	Primary	Text	12,12,0	Unique Wetland ID calculated using StAbbr CoFIPS and incremental number IDByCnty] within a county
WetType		Text	30,30,0	Wetland type classification
WetCode		Text	2,2,0	Two-character code value representing the WetType
ShpSource		Text	4,4,0	The data source for the shape or geometry from which the feature was captured
Modified		Text	1,1,0	Wetland has been modified by a road, farming, excavation or any combination of modifications
RoadImpact		Text	2,2,0	Indicates if the wetland has been impacted by a road either running through or adjacent to wetland altering its shape
Farmed		Text	1,1,0	Indicates if wetland was farmed
FrmdStatus		Text	26,26,0	Provides a classification of the degree to which the wetland farmed or if the wetland was not farmed
Excavated		Text	11,11,0	Indicates if wetland was modified by an excavation, dike, or drain
LandUse		Text	35,35,0	Land use classification of wetland
CntrdSoil		Text	3,3,0	SSURGO map unit symbol at the centroid of playa - assigned using spatial join process
MajrtySoil		Text	3,3,0	SSURGO map unit symbol of the most commonly occurring raster soil value in each wetland (zonal statistics)
PlayaSoil		Text	2,2,0	Indicates the presence or absence of a hydric soil identifiable in the SSURGO dataset
Ogallala		Text	1,1,0	Indicates if wetland centroid is inside Ogallala Aquifer boundary
Comment		Text	20,20,0	Comments describing landscape context of the wetland
SqMeters		Float	4,8,7	Area of wetland in square meters

Acres		Float	4,8,7	Area of wetland in acres
StAbbr		Text	2,2,0	State Abbreviation
StFIPS		Text	2,2,0	State Federal Information Processing Code
CountyName		Text	12,12,0	County name
CoFIPS		Text	3,3,0	County Federal Information Processing Code
LonNAD83		Double	4,8,7	Wetland centroid NAD83 longitude
LatNAD83		Double	4,8,7	Wetland centroid NAD83 latitude
PLDD_ID		Text	16,16,0	Unique Identifier from the PLDD
PLDD_Soil		Text	25,25,0	Soil type associated with playa at time of development of PLDD
Shape_Length		Double	8,7,6	Stores feature perimeter in units of decimal degrees
Shape_Area		Double	8,7,6	Stores feature area in units of decimal degrees

Table A-1. Attribute definitions.

Attribute values:

NAME	SAMPLE VALUES	DESCRIPTION
OBJECTID	1234	Unique record identifier for each boundary line.
Shape	Polygon	All wetland features have polygon geometry
IDByCnty	1…n	Unique ID for each WetType
WetlandID	48303-00005 48303-01234 40101-xxxxx	Unique Playa ID concatenation of FIPS for State and County with unique id for each playa within a county
WetType	Playa	Shallow depressional wetland, typically rounded and characterized by a hydric soil that represent a place of potential aquifer recharge
	Unclassified Wetland	Wetland has appearance of a playa but without a hydric indicator soil
	Lake	Fresh water body, natural or manmade, as a result of obstruction of a riparian feature, typically 30 acres or larger
	Saline Lake	Large, isolated wetland in contact with groundwater creating a saline condition
	Riparian	Natural watercourse, channel or body of water

	Impoundment Manmade Scrub or other	Small confined pooling or potential pooling of water within a riparian zone due to the creation of an earthen dam or structure Typically small excavations with straight sides Area with scrub, trees or other vegetation with evidence of saturated soil
WetCode	01 02 03 04 05 06 07 08	Playa Unclassified Wetland Lake Saline Lake Riparian Impoundment Manmade Scrub or other
ShpSource	NWI (default) PLDD TTU	National Wetlands Inventory Playa Lakes Digital Database Texas Tech University
Modified	N Y	No, playa was not modified Yes, playa was modified
RoadImpact	N Y -9	No, playa was not impacted by a road Yes, playa was impacted by a road Not applicable to assign RoadImpact
Farmed	N Y	No, playa was been farmed Yes, playa was farmed
FrmdStatus	Wetland 25% or less farmed Wetland 25% or more farmed Wetland 100% farmed Not Farmed	Feature is 25% or less farmed Feature is 25% or more farmed Feature is 100% farmed Feature is not directly impacted by farming
Excavated	Excavated Diked Drained Not Excav	Feature was excavated as the principle impact and also possibly diked, drained or diked and drained Feature was diked and also possibly drained, but not excavated Feature was drained, but neither excavated nor diked Feature was not excavated or modified by a dike or drain
LandUse	Farmed Farming within half mile of wetland No farming within half mile	Feature has been farmed Feature is located within half mile of farming activity No farming activity located within half mile of feature

	Wetland in built-up area	Feature is located in or impacted by a built-up area
CntrdSoil	Various SSURGO map unit symbol codes -9	SSURGO map unit code at centroid of features Playa and Unclassified Wetland feature types only Not applicable to assign a SSURGO map unit symbol
MajrtySoil	Various SSURGO map unit symbols	SSURGO map unit symbol of the soil with the most commonly occurring raster value in each wetland (zonal statistics)
PlayaSoil	Y -9	Yes –hydric indicator soil present to identify wetland as a playa feature Not applicable to assign a SSURGO map unit code to non-playa wetland features
Ogallala	N Y	Wetland centroid is not inside Ogallala Aquifer boundary Wetland centroid inside Ogallala Aquifer boundary
Comment	Feed Lot Former Playa Filled-in Riparian Golf Course Government Facility Industrial Area Near Built-up Area Near Farm Buildings Oil Field Pond Pool Quarry Relic saline lake Race Track Runway	Feature is in close proximity to a feed lot Feature originated as a playa but has been significantly modified where it no longer resembles a playa Manmade feature filled in riparian area Feature is located in a golf course Feature is located in a government facility area Feature is in an industrial area or facility, could be agricultural Feature is near a built-up area Feature is near farm buildings or widely-spaced houses or ranches Feature is in an oil or gas field Manmade feature in built-up area Swimming pool Feature is located in a quarry Feature shows small hydric areas inside a once larger, but now dry area representative of a former saline lake Feature in or near a race track Feature is impacted by or in close proximity to an aviation runway

	Stock Water Wind Turbines Water Treatment *Name of lake*	Feature is a stock tank or pooled water built for cattle Feature is impacted by or in close proximity to a wind turbine Water treatment area The name of a feature from USGS map typically a lake name
SqMeters	55.00 to 96825000	Area of wetland in square meters
Acres	0.013 to 23925.98	Area of wetland in acres
StAbbr	NM OK TX	New Mexico Oklahoma Texas
StFIPS	35 40 48	New Mexico Oklahoma Texas
CountyName	Andrews Beaver Curry … Yoakum	County names
CoFIPS	 003 007 009 … 501	County FIPS Code Andrews Beaver Curry …. Yoakum
LonNAD83	-100.000551 to -104.129301	Wetland centroid longitude
LatNAD83	31.650303 to 36.999808	Wetland centroid latitude
PLDD_ID	313905-1013425 353358-1003817 -9	Concatenated latitude and longitude of feature centroid Feature did not originate from PLDD
PLDD_Soil	Lipan Clay, Lubbock and Randall Soils, Ness Clay, Randall Clay, etc. -9	Soil type associated with playa at time of development of PLDD Not applicable to assign a soil type to non-playa feature
Shape_Length	0.000274 to 5.83179	Feature perimeter in decimal degrees
Shape_Area	0 to 0.009654	Feature area in decimal degrees

Table A-2. Attribute value definitions.

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* Last issue of journal, author's name omitted, therefore not corrected.