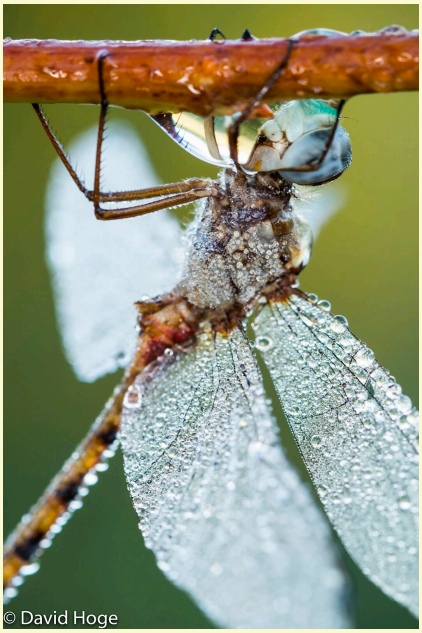

City Of Fayetteville, Arkansas
2016 Woolsey Wet Prairie
Adaptive Management Strategy & Monitoring Report No. 10

The City of Fayetteville ARKANSAS

Environmental Consulting Operations
ECO, INC.
"Integrating ECOnomy and ECOlogy, since 1990"

DECEMBER 2016

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"Special Thanks" to Jeff Hickle of CH2MHill and Isaac Ogle of CBS for their "on the ground" team work in site adaptive management.

Cover Photograph Credits:
David Hoge, University of Arkansas Entomology Club BioBlitz at Woolsey Wet Prairie September 10-11, 2016

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WOOLSEY WET PRAIRIE
ADAPTIVE MANAGEMENT STRATEGY & MONITORING REPORT NO. 10

1.0 – INTRODUCTION & PROJECT BACKGROUND

The City of Fayetteville, Arkansas' Wastewater System Improvement Project (WSIP) was designed to improve the City's sewer collection system, upgrade the Paul Noland Wastewater Treatment Plant (WWTP), and construct a new (Westside) WWTP. The project's primary purpose was to implement corrective actions to eliminate/reduce odor and overflow problems associated with the Noland Plant and collection system, and to provide wastewater treatment to areas currently outside the treatment area while reducing the total hydraulic loading to the system. The WSIP involved discharges of fill into "Waters of the U.S." within the Illinois River Watershed (within the Arkansas River Basin) and the Beaver Reservoir Watershed (within the White River Basin); therefore, permitting under Section 404 of the Clean Water Act (CWA) was required.

1.1 – Individual Section 404 Permit No. 14207

On March 10, 2005, the City of Fayetteville received Individual Section 404 Permit No. 14207 from the U.S. Army Corps of Engineers (COE) Little Rock District for the portion of the WSIP in the Illinois River Watershed (west side) that involved 36 stream crossings and 15 wetland crossings during construction of the new Westside WWTP, sewer lines, and road improvements. The permit required wetland compensatory mitigation due to the permanent alteration of 8.87 acres of wetlands. The wetland mitigation site was deed restricted in perpetuity to guarantee preservation of the wetlands and upland buffers, as required by the COE, and a certified copy of the Notice of Deed Restriction was recorded with the Washington County Registrar of Deeds on January 5, 2007. Consequently, the City of Fayetteville is required to manage and maintain the property as a wetland mitigation site in perpetuity.

As part of the terms and conditions included in the Section 404 permit, seven annual reports on the status of the mitigation site must be submitted to the COE. The first annual wetland monitoring report was due December 31st after the first growing year, and each year thereafter, for a total of seven years. The first monitoring year was 2007 and the seventh annual monitoring report was completed in December 2013. Initially, the COE required intensive monitoring activities at 47 monitoring stations for the first seven years. Since that time, ECO, Inc. has transitioned to an abbreviated methodology strategy that focuses more on where adaptive management activities are needed on a cell-by-cell basis in lieu of the 47 monitoring stations. This serves to assure that the City of Fayetteville continues to meet COE Section 404 permit required ecological performance standards and maintains eligibility to use surplus wetland credits for city infrastructure improvements that permanently alter wetlands.

1.2 – Mitigation Site Concept & Team

The 43.65-acre wetland mitigation site shown in Figure 1 below, is located immediately to the north of the Westside WWTP that became operational on June 1, 2008. McGoodwin, Williams, and Yates Consulting Engineers, Inc. (MWY) of Fayetteville designed hydrological features and Environmental Consulting Operations, Inc. (ECO, Inc.) of Benton provided ecological feature design, site management, and monitoring. Brasfield and Gorrie General Contractors completed construction of the earthen berms and the water level control structures. Operation of hydrological controls, herbicide application, fire line installation, mowing, staff gauge and monitoring well data, are managed through

CH2M Hill Companies, Ltd. that also manages and maintains the City's wastewater utility system. Prescribed burns are contracted by the City of Fayetteville through an informal bidding process. ECO, Inc. oversees environmental regulatory Section 404 permit compliance, develops prescribed burn specifications, identifies problem areas where invasive plant species need to be controlled, and conducts annual monitoring and site adaptive management strategy development at Woolsey Wet Prairie.

Modifications to the existing hydrology at the mitigation site were achieved via the construction of low elevation perimeter earthen berms designed to provide a mechanism for water retention. Water level control structures with stop logs were constructed within the berms in order to provide the ability to hold and release water, as needed. Construction of the earthen berms resulted in two cells (W-1 and W-2) within the West Mitigation Site, and five cells (E-1 through E-5) within the East Mitigation Site. The west and east mitigation sites are separated by a gas pipeline easement that is 80 feet in width. The easement has undergone the same adaptive management as the remaining acreage on the deed restricted property. The mitigation site has been named "Woolsey Wet Prairie Sanctuary" in honor of Samuel Gilbert Woolsey, whose family settled the property in 1830.

The Woolsey Wet Prairie Sanctuary is part of the original prairie of Prairie Township, Fayetteville, Arkansas that extended all the way to the Prairie Grove and Lincoln areas in Washington County. Conversion of an estimated 100,000 acres of prairie habitat to production of wheat in northwest Arkansas in the late 1800's and early 1900's was the beginning of the decimation of prairie habitat, America's most endangered ecosystem. Fire suppression and the introduction of non-native plant species have also contributed greatly to the decimation of prairie habitat.

2.0 – MITIGATION SITE MONITORING ACTIVITIES & RESULTS

During the 2002 through 2006 mitigation site design and construction periods, ECO, Inc. conducted vegetation-monitoring activities to characterize pre-mitigation site baseline conditions. Subsequent to completion of hydrological modifications and other wetland mitigation activities, vegetation-monitoring events commenced in 2007, and have henceforth been conducted twice annually, once in the early to mid portion of the growing season (typically late June to early July) and again during the late portion of the growing season (typically late October to early November).

During these biannual monitoring events, ECO, Inc. documents total plant species richness (including native and non-native species) for each of the seven wetland cells, makes field notes regarding the presence and location of stands of invasive plant species, and denotes the locations of rare plant species tracked as elements of conservation concern by the Arkansas Natural Heritage Commission (ANHC). Drone generated aerial photographs are marked in the field to show locations of invasive plant species that need to be treated with herbicides.

ECO, Inc. conducts periodic site visits throughout the growing season to observe and evaluate the effectiveness of herbicide applications for control of invasive plant species, to evaluate plant succession, and to observe the status of site hydrology.

The results of the 2016 field observations and monitoring data are complied herein for the purpose of evaluating success and failures in controlling invasive plant species that threaten the rare prairie ecosystem at Woolsey Wet Prairie and to develop and prioritize an action item list for adaptive management activities and goals for the 2017 growing season.

Figure 1. Woolsey Wet Prairie Aerial Photograph

2.1 – Rare Plant Species at Woolsey Wet Prairie Sanctuary

Ten plant species tracked as elements of conservation concern (rare species) by the Arkansas Natural Heritage Commission (ANHC), have been found to naturally occur at the wetland mitigation site. The rare plants include sedges (family *Cyperaceae*), milkwort (family *Polygalaceae*), and Hawthorn (genus *Crataegus*), and are characteristic of unplowed tall grass wet prairie remnants, as discussed in the monitoring results descriptions for each wetland cell.

Carex aggregata **(cluster sedge) – G5S1 –** This sedge is known in Arkansas only from a few sites in Benton, Carroll, Fulton, Newton, Sharp, and Washington counties. It typically grows in low open woodlands or seasonally wet grasslands. At Woolsey Wet Prairie it is scattered in seasonally wet areas that are not inundated for long periods. It is found in all seven wetland cells at Woolsey Wet Prairie.

Polygala incarnata **(pink milkwort) – G5S1S2 –** This rare species of wildflower is known in Arkansas from remnant prairies and other historically open grassland habitat like glades and savannas. A single plant was found on a pimple mound in Cell E-4 in 2012 and was not observed at all in 2013. In 2014, this population increased to 6 plants, but none were observed in 2015 or 2016. It is known from scattered counties in Arkansas, but most of the records are historical and many of the sites where it was historically found have since been destroyed. It has only been observed within Wetland Cell E-4.

Carex scoparia **var.** ***scoparia*** **(pointed sedge) – G5S1S2 –** This species is very rare in Arkansas and is known only from prairie-associated wetlands in Washington and Benton counties and from a wet depression on top of Rich Mountain in Polk County. It is known from just a single clump in Cell W-1 at Woolsey Wet Prairie.

Carex arkansana **(Arkansas sedge) – G4S2 –** This uncommon sedge is known in Arkansas from wet prairie remnants, open hydric oak flatwoods, and similar open wetland habitats (ANHC, 2014). While it has no wetland indicator status code in the USDA Plants Database, it is listed by Yatskievych (1999) as occurring primarily in bottomland prairies and moist depressions of upland prairies. At Woolsey Wet Prairie it is scattered in seasonally wet areas that are not inundated for long periods. It is found in all seven wetland cells at Woolsey Wet Prairie.

Carex opaca **(opaque prairie sedge) – G4S2S3 –** This rare sedge is primarily associated with unplowed, wet tall grass prairie remnants in Arkansas (ANHC, 2014). While it has no wetland indicator status code in the USDA Plants Database, it is listed by Yatskievych (1999) as primarily occurring in bottomland prairies, moist depressions of upland prairies, and margins of fens. At Woolsey Wet Prairie it is scattered in seasonally wet areas that are not inundated for long periods. It is found in all seven wetland cells at Woolsey Wet Prairie.

Carex fissa **var.** ***fissa*** **(hammock sedge) – G4S1 –** Prior to its discovery at Woolsey Wet Prairie, this rare sedge was known in Arkansas from only two sites in Franklin and Lonoke Counties where it occurs in prairie-associated wetlands (ANHC, 2014). At Woolsey Wet Prairie it has historically been found in three naturally occurring prairie swales in Cells E-2, W-1 and W-2.

Carex pellita **(woolly sedge) – G5S1S2 –** Prior to its collection at Woolsey Wet Prairie, this species was known to be extant at a single Arkansas locality, in a fen in Marion County. It has since been found at three other sites in Benton, Washington, and Marion counties. At Woolsey Wet Prairie it is now found in several cells where it grows in seasonally wet areas. It has increased at the site based on

observations from 2007 to 2016. It has been observed in Wetland Cells E-4, E-5, W-1, and W-2.

***Eleocharis wolfii* (Wolf's spikerush) – G3G4S3 –** This wetland sedge occurs in Arkansas primarily in wet areas in unplowed tall grass prairie remnants, but can persist in wet, open areas in landscapes that were formerly dominated by prairie vegetation (ANHC, 2014). At Woolsey Wet Prairie, it is locally common in several naturally occurring swales within Wetland Cells E-2, E-3, E-4, E-5, W-1, and W-2 and has been found at the margins of two of the constructed marshes.

***Rhynchospora macrostachya* (tall horned beaksedge) – G4S2 –** Prior to its collection at Woolsey Wet Prairie, this species was known in Arkansas only from a few scattered historical collections from remnant prairies. It has since also been found in several prairie-associated wetlands in Franklin County. At Woolsey Wet Prairie it was known from two natural prairie swales prior to construction of the berms. In the fall of 2006, ECO, Inc. gathered seeds and successfully propagated over 50 specimens during the 2007 growing season that were transplanted into marsh areas at the mitigation site during 2008. A 90 percent survival rate was observed and transplanted specimens produced large seed heads by the end of the 2008 growing. The species has now increased in density in several of the wetland cells and has been found in Wetland Cells E-4, E-5, W-1, and W-2.

***Crataegus reverchonii* (Reverchon's hawthorn) – G4S1 –** This small tree has been confirmed to occur in Arkansas only in Benton and Washington counties. All sites where it grows are low prairies or woodlands. It is primarily a western species. Specimens at Woolsey Wet Prairie appear to be *Crataegus reverchonii* subsp. *palmeri*, but both that subspecies and subspecies *reverchonii* have been reported for northwestern Arkansas. Additional study is needed to determine if both subspecies are present in the state. It has been observed within Wetland Cells E-4, E-5, W-1, and W-2.

In addition to these ten species, which occur within the boundary marked by wetland mitigation signs, an 11th species of state concern was located on City of Fayetteville property just north of Woolsey Wet Prairie:

***Artemisia ludoviciana* var. *mexicana* (Mexican white sage) – G5T5S1S2 –** Two distinct patches of this species were found in a fencerow and field margin along the south side of Persimmon Street, just west of Owl Creek. This species is known to occur in Arkansas in dry grasslands and glades in a few counties in the northwestern part of the state. It was last documented from the Fayetteville area in 1954, when it was collected from "West Mountain" (a site believed to be about two miles east of Woolsey Wet Prairie).

Key to ANHC Species Category Rankings:

G3 – Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (ex. A single physiographic region) or because of other factors making it vulnerable to extension throughout its range (21 to 100 known extant populations)

G4 – Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery (100 to 1000 known extant populations)

G5 – Demonstrably secure globally, although it may be quite rare in parts of its range, especially at the periphery (1000 + known extant populations)

T – Subspecies or variety rank (ex. G5T4 applies to a subspecies with a global species rank of G5, but with a subspecies rank of G4)

S1 – Critically imperiled because of extreme rarity (5 or fewer known extant populations) or because of some factor(s) making it especially vulnerable to extirpation

S2 – Imperiled because of rarity (6 to 20 known extant populations) or because of some factor(s) making it especially vulnerable to extirpation

S3 – Rare and local throughout the state or found locally (even abundantly at some of its locations) in a restricted region of the state, or because of other factors making it vulnerable to extirpation (21 to 100 known extant populations)

The following sections describe observations for each wetland cell during the 2016 growing season. The 2016 field observations are indicated on a cell-by-cell basis in Figures 2-8.

2.2 – Wetland Cell E-1

Rare Species

Three rare plants (as discussed in Section 2.1) including cluster sedge, Arkansas sedge, and opaque prairie sedge occur in Cell E-1. All three are uncommon in this cell and are scattered in low areas that are not inundated for long durations.

Invasive Species

Ten invasive species were observed in this cell in 2016 that need management controls. In particular, the invasive species that pose the greatest potential problem include sericea lespedeza (*Lespedeza cuneata*), white sweet clover (*Melilotus albus*), and Johnsongrass (*Sorghum halepense*). It is noted that the densities of stands of sericea lespedeza have been significantly reduced compared to the 2015 growing season. However, continued control of the sericea is imperative and the white sweet clover persists and needs a continued focus on control. The locations of the non-native/invasive plant species are marked on the E-1 Aerial Photograph shown in Figure 2.

Species Richness

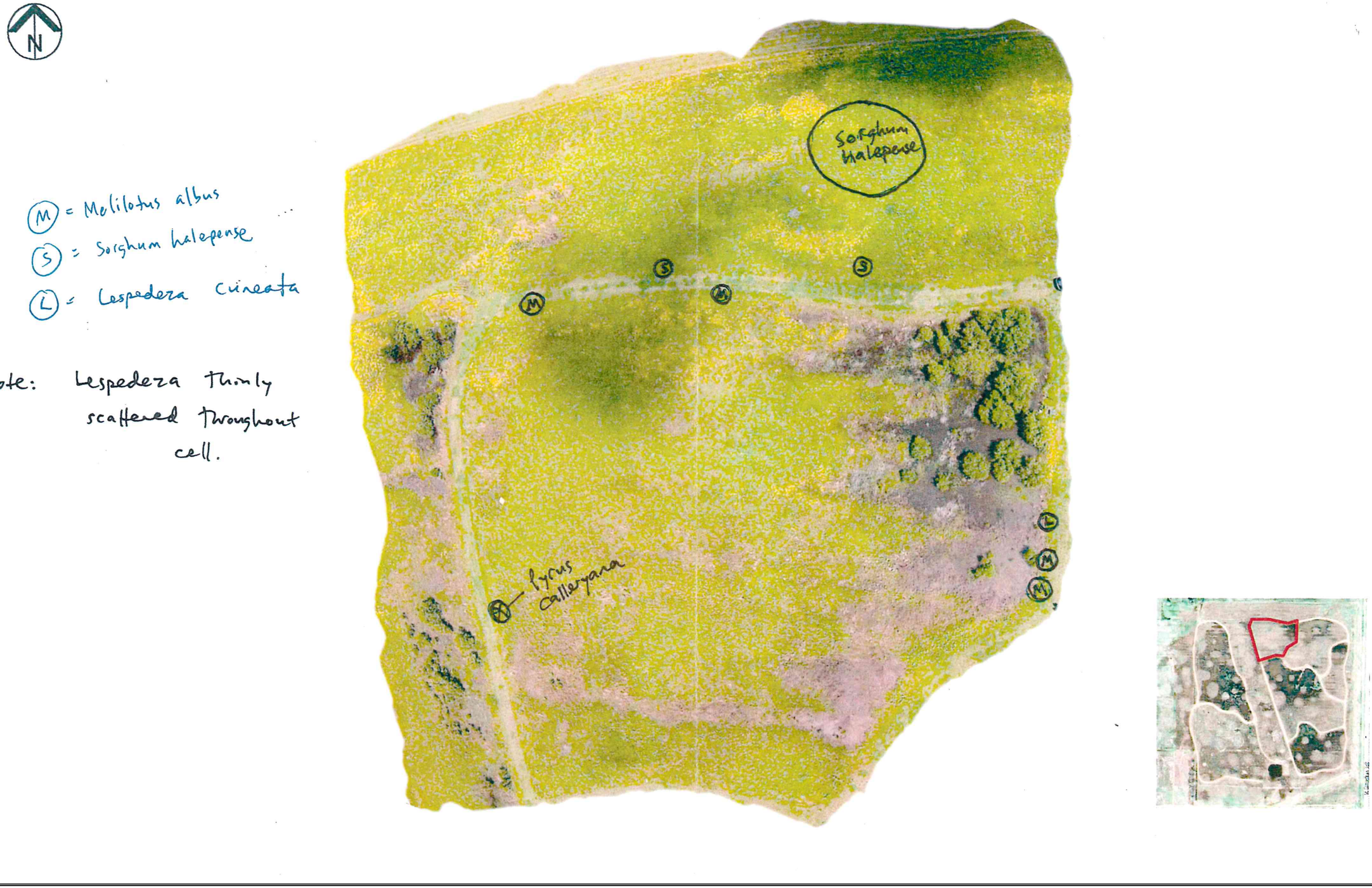
As shown by Table 1, a five-year trend indicates a 15.8% decrease in native plant species richness from the 2015 peak species richness year to 2016 with a corresponding 150% increase in the number of invasive plant species from 2014 to 2016. Species richness does not indicate the relative densities of native plant species versus invasive plant species. It is simply the number of species observed within a wetland cell that serve as an indicator of plant community diversity.

Table 1 – Wetland Cell E-1 Species Richness Trend

Monitoring Year	Desirable Native Plant Species	Invasive Plant Species*
2012	108	4
2013	111	3
2014	103	4
2015	114	10
2016	96	10

*** Invasive Plant Species: For management purposes, these species include both native and non-native plants that have the potential to outcompete native prairie plant species in a manner and degree that poses an ecological threat to sustaining the prairie ecosystem.**

Figure 2. Wetland Cell E-1 2016 Vegetation Monitoring Map



2.3 – Wetland Cell E-2

Rare Species

Five rare plants, (as discussed in Section 2.1) including cluster sedge, Arkansas sedge, opaque prairie sedge, Wolf's spikerush, and tall horned beaksedge occur in Cell E-2. The *Carex* species are uncommon in this cell and are scattered in low areas that are not inundated for long durations. The Wolf's spikerush is rare at the edge of a marsh near the south end and in a swale near the center of the cell. Hammock sedge, found within this cell for several consecutive years was not observed in 2016.

Invasive Species

Fourteen invasive species were observed in this cell in 2016 that need management. In particular, sericea lespedeza, white sweet clover, and Johnsongrass are all persisting and need continued management, although it is noted that the densities of stands of sericea lespedeza have been significantly reduced as compared to the 2015 growing season.

In 2016, an individual Tree of Heaven (*Ailanthus altissima*) was observed just outside the earthen berm in the northwest corner of the cell. This species, native to Taiwan and central China, has been introduced to North America and is very highly invasive. It is allelopathic and produces toxins in the leaves, bark, roots, and seeds that inhibit germination and growth of other plant species. It is among the highest seed producers of tree species and produces winged schizocarps that are easily and widely dispersed. In Arkansas it flowers in April-May and bears fruit by September that remain over the winter and disperse in the spring. This tree and any fruits/seeds should be completely removed and the immediate area should be closely monitored to determine if any seedlings or sprouts from the root crown emerge during the 2017 growing season that need to be promptly sprayed with herbicide.

The locations of the non-native/invasive plant species are marked on the E-2 Aerial Photograph shown in Figure 3.

Species Richness

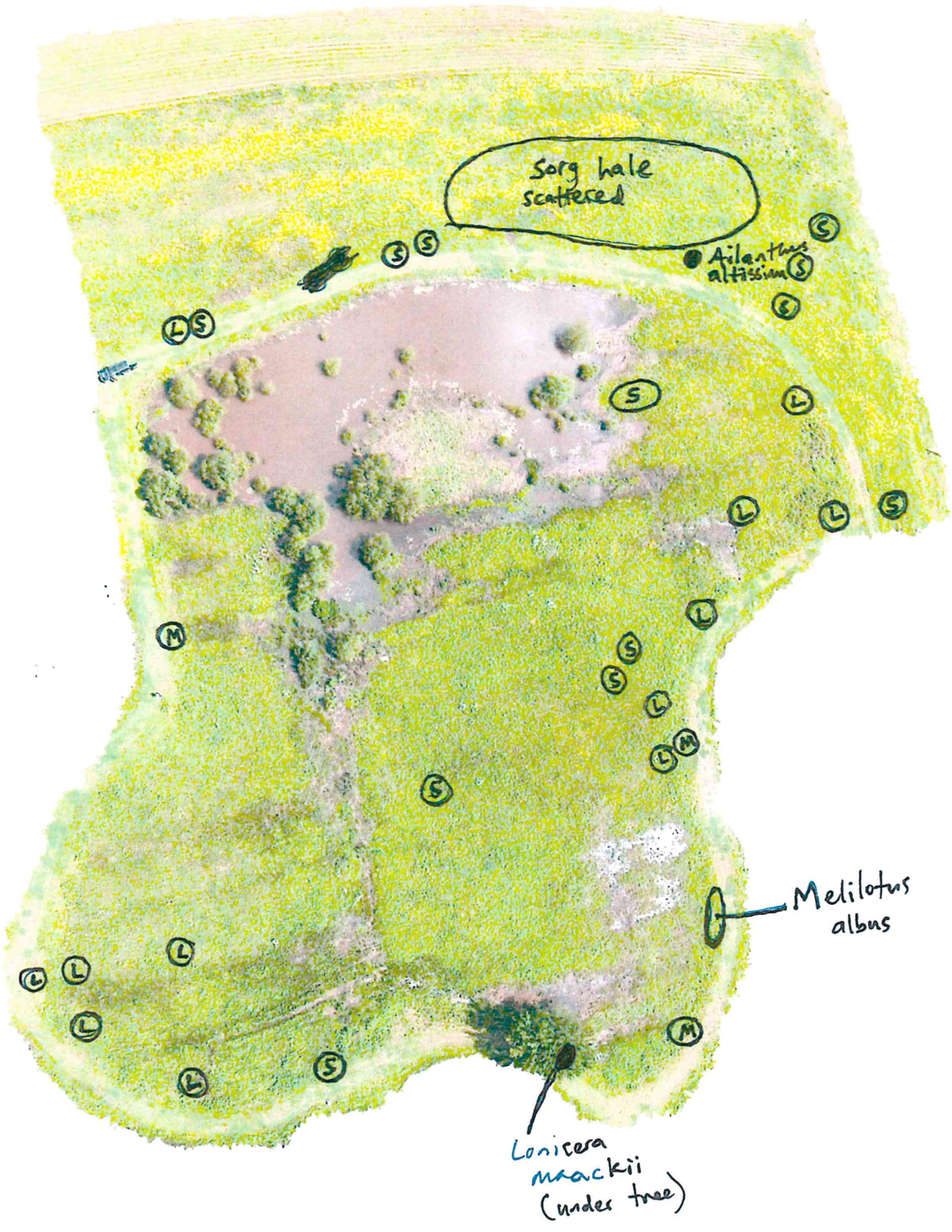
As shown by Table 2, a five-year trend indicates a 17% decrease in native plant species richness from the 2015 peak species richness year to 2016 with a corresponding 100% increase in the number of invasive plant species from 2015 to 2016. Species richness does not indicate the relative densities of native plant species versus invasive plant species. It is simply the number of species observed within a wetland cell that serve as an indicator of plant community diversity.

Table 2– Wetland Cell E-2 Species Richness Trend

Monitoring Year	Desirable Native Plant Species	Invasive Plant Species*
2012	103	5
2013	112	7
2014	129	7
2015	159	7
2016	132	14

*** Invasive Plant Species: For management purposes, these species include both native and non-native plants that have the potential to outcompete native prairie plant species in a manner and degree that poses an ecological threat to sustaining the prairie ecosystem.**

Figure 3. Wetland Cell E-2 2016 Vegetation Monitoring Map

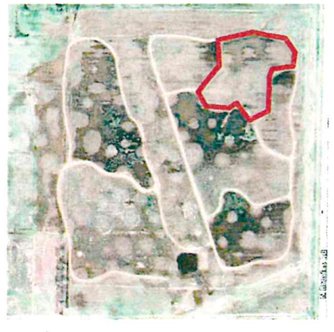


(S) = Sorghum halepense

(M) = Melilotus albus

(L) = Lespedeza cuneata

Note: Lespedeza thinly scattered throughout cell



2.4 – Wetland Cell E-3

Rare Species

Four rare plants (as discussed in Section 2.1) including cluster sedge, Arkansas sedge, opaque prairie sedge, and Wolf's spikerush occur in Cell E-3. All four are uncommon or rare in this cell and are scattered in low areas that are not inundated for long durations.

Invasive Species

Nine invasive species were observed in this cell in 2016 that need management. Specifically, the invasive species that pose the greatest potential problem include Callery pear, sericea lespedeza, white sweet clover, and Johnsongrass are all persisting and need continued management. It is noted that the densities of stands of sericea lespedeza have been significantly reduced compared to the 2015 growing season. However, continued control of the sericea is imperative and the white sweet clover persists and needs a continued focus on control. The locations of the non-native/invasive plant species are marked on the E-3 Aerial Photograph shown in Figure 4.

Species Richness

As shown by Table 3, a five-year trend indicates a 17% decrease in native plant species richness from the 2015 peak species richness year to 2016 with a corresponding 200% increase in the number of invasive plant species from 2015 to 2016. Species richness does not indicate the relative densities of native plant species versus invasive plant species. It is simply the number of species observed within a wetland cell that serve as an indicator of plant community diversity.

Table 3– Wetland Cell E-3 Species Richness Trend

Monitoring Year	Desirable Native Plant Species	Invasive Plant Species*
2012	100	5
2013	89	6
2014	109	4
2015	129	3
2016	107	9

*** Invasive Plant Species: For management purposes, these species include both native and non-native plants that have the potential to outcompete native prairie plant species in a manner and degree that poses an ecological threat to sustaining the prairie ecosystem.**

Figure 4. Wetland Cell E-3 2016 Vegetation Monitoring Map

2.5 – Wetland Cell E-4

Rare Species

Seven rare plants (as discussed in Section 2.1) occur in Cell E-4. Cluster sedge, Arkansas sedge, and opaque prairie sedge are uncommon in this cell and are scattered in low areas that are not inundated for long durations. A single colony of woolly sedge observed in this cell in 2013 has persisted and expanded. Tall horned beaksedge and Wolf's spikerush occur scattered at the edge of open marshes. Pink milkwort was observed on a pimple mound in 2012 and 2014, but was not observed in 2013, 2015, or 2016. However, this type of population fluctuation is not uncommon in annual species. A single plant of Reverchon's hawthorn was found near the west side of the cell in 2014 and is still persisting.

Invasive Species

Eleven invasive species were observed in this cell in 2016 that need management. The non-native Himalayan blackberry (*Rubus serissimus*) occurs in several large patches and was flagged by ECO, Inc. during the November vegetation-monitoring event. The density of this species was somewhat reduced as compared to 2015. One large patch of Japanese honeysuckle (*Lonicera japonica*) occurs in clumps of woody vegetation along the east side of the pond near the berm that has increased in density since 2015. Patches of sericea lespedeza and Johnsongrass are scattered throughout the cell, although sericea densities have been greatly reduced since 2015. Small patches of sweet white clover observed in 2015 were not observed in 2016.

In 2015 the highly invasive small carpetgrass (*Arthraxon hispidus*) was found for the first time at Woolsey Wet Prairie west of the western berm of Cell E-4. In 2016, it was found to have persisted and expanded and is in need of immediate management attention. ECO, Inc. flagged the location of the small carpetgrass during the November monitoring event. It was introduced into the United States from Japan and eastern Asia and is a facultative wetland plant that inhabits low, open areas. With the abundance of wetland areas at Woolsey Wet Prairie, there is cause for concern because it has the ability to rapidly spread and take over areas currently inhabited by sensitive sedges and rushes. The locations of the non-native/invasive plant species are marked on the E-4 Aerial Photograph shown in Figure 5.

Species Richness

As shown by Table 4, a five-year trend indicates a 6% decrease in native plant species richness from the 2015 peak species richness year to 2016 with a corresponding 37.5% increase in the number of invasive plant species from 2015 to 2016. Species richness does not indicate the relative densities of native plant species versus invasive plant species. It is simply the number of species observed within a wetland cell that serve as an indicator of plant community diversity.

Table 4– Wetland Cell E-4 Species Richness Trend

Monitoring Year	Desirable Native Plant Species	Invasive Plant Species*
2012	144	10
2013	154	8
2014	155	8
2015	171	8
2016	160	11

*** Invasive Plant Species: For management purposes, these species include both native and non-native plants that have the potential to outcompete native prairie plant species in a manner and degree that poses an ecological threat to sustaining the prairie ecosystem.**

Figure 5. Wetland Cell E-4 2016 Vegetation Monitoring Map

2.6 – Wetland Cell E-5

Rare Species

Six rare plant species (as discussed in Section 2.1) occur in Cell E-5. Cluster sedge is rare and scattered on the east side of the cell. Arkansas sedge and opaque prairie sedge are uncommon and are scattered in low areas that are not inundated for long durations. A single colony of woolly sedge observed in 2013 has persisted and expanded. Tall horned beaksedge and Wolf's spikerush occur scattered at the edge of open marshes on the south end of the cell.

Invasive Species

Eleven invasive species were observed in 2016 that need management. Sericea lespedeza is scattered in upland areas around the edges of the cell. Callery pear remains as scattered individuals at several sites and were all flagged by ECO, Inc. during the November monitoring event. Tall fescue (*Schedonorus arundinaceus*) exists as small areas scattered throughout moist areas within the cell. A patch of Himalayan blackberry has persisted outside the berm on the south side of the path leading to Cell W-2. White sweet clover is thinly scattered around the berm. The locations of the non-native/invasive plant species are marked on the E-5 Aerial Photograph shown in Figure 6.

Species Richness

As shown by Table 5, a five-year trend indicates a 16.5% decrease in native plant species richness from the 2015 peak species richness year to 2016 with a corresponding 175% increase in the number of invasive plant species from 2015 to 2016. Species richness does not indicate the relative densities of native plant species versus invasive plant species. It is simply the number of species observed within a wetland cell that serve as an indicator of plant community diversity.

Of particular interest is the first time observation of false nettle *(Boehmeria cylindrical)* at Woolsey Wet Prairie that occurred at the edge of an upland mound in Wetland Cell E-5, an area that was home to some of the best quality upland prairie at Woolsey Wet Prairie. False nettle, while native, is a plant of forested wetlands, an indicator of moist, shaded conditions. Its appearance at Woolsey is an indicator that the habitat is shifting from prairie to forest.

Table 5– Wetland Cell E-5 Species Richness Trend

Monitoring Year	Desirable Native Plant Species	Invasive Plant Species*
2012	124	5
2013	133	5
2014	131	4
2015	158	4
2016	132	11

*** Invasive Plant Species: For management purposes, these species include both native and non-native plants that have the potential to outcompete native prairie plant species in a manner and degree that poses an ecological threat to sustaining the prairie ecosystem.**

Figure 6. Wetland Cell E-5 2016 Vegetation Monitoring Map

2.7 – Wetland Cell W-1

Rare Species

Eight rare plants (as discussed in Section 2.1) occur in Cell W-1. The single clump of pointed sedge observed in this cell in 2012 is still persisting. Cluster sedge, Arkansas sedge, and opaque prairie sedge are uncommon in this cell and are scattered in low areas that are not flooded for long durations. A single colony of woolly sedge was found outside the berm. Tall horned beaksedge and Wolf's spikerush occur scattered at the edge of open marshes. Two small plants of Reverchon's hawthorn were found outside the berm on the west side of this cell. In addition, a few individuals of hammock sedge were observed in a swale in this cell in previous years, but appear to have been shaded out by willows and were not observed.

Invasive Species

Eleven invasive species were observed in this cell in 2016 that need management. Himalayan blackberry was observed at the north and south end of this cell in 2015 and 2016 and Callery pear, observed in many locations in 2015, have been reduced and occur as scattered individuals. Both species were flagged by ECO, Inc. during the November monitoring event. Sericea lespedeza and white sweet clover are scattered around the perimeter of the cell, although densities were reduced compared to 2015. Johnsongrass continues to persist just outside the berm near the northwest corner of the cell.

Small carpetgrass, not observed in this cell in 2015, has become established on the east side of W-1 and is in need of immediate attention. ECO, Inc. flagged the location of the small carpetgrass during the November monitoring event. The locations of the non-native/invasive plant species are marked on the W-1 Aerial Photograph shown in Figure 7.

Species Richness

As shown by Table 6, a five-year trend indicates a 3% decrease in native plant species richness from the 2015 peak species richness year to 2016 with a corresponding 37.5% increase in the number of invasive plant species from 2015 to 2016. Species richness does not indicate the relative densities of native plant species versus invasive plant species. It is simply the number of species observed within a wetland cell that serve as an indicator of plant community diversity.

Table 6– Wetland Cell W-1 Species Richness Trend

Monitoring Year	Desirable Native Plant Species	Invasive Plant Species*
2012	114	11
2013	145	8
2014	150	7
2015	168	8
2016	163	11

*** Invasive Plant Species: For management purposes, these species include both native and non-native plants that have the potential to outcompete native prairie plant species in a manner and degree that poses an ecological threat to sustaining the prairie ecosystem.**

Figure 7. Wetland Cell W-1 2016 Vegetation Monitoring Map

2.8 – Wetland Cell W-2

Rare Species

Eight rare plants (as discussed in Section 2.1) occur in Cell W-2. Several clumps of cluster sedge were found in the wooded area outside the berm on the western edge of this cell, along with a few scattered plants elsewhere. Arkansas sedge and opaque prairie sedge are fairly common in this cell and are scattered in low areas that are not inundated for long durations, especially in the southern half of the cell. A large population of hammock sedge occurs in the southern half of this cell and several colonies of woolly sedge occur in the eastern half of this cell. Tall horned beaksedge and Wolf's spikerush occur scattered at the edge of open marshes. A single large, fruiting tree of Reverchon's hawthorn was found on the west side of the wooded area outside the berm on the west edge of this cell.

Invasive Species

Fifteen invasive species were observed in this cell in 2016 that need management controls. Tall fescue has persisted as small, but dense patches in several areas of this cell, especially in the southern half. A dense patch of Himalayan blackberry that was observed in 2015 persists in the northwest corner of the cell and was flagged by ECO, Inc. Sericea lespedeza occurs as scattered individuals, particularly along the berm on the east side and one dense stand south of the berm on the southern end of the cell, although greatly reduced from 2015. Johnsongrass is scattered along the edge of the berm around this cell, concentrated along the southern edge. The wooded area outside the berm on the west edge of this cell is has historically been very thick with invasive plants including multiflora rose (*Rosa multiflora*), Chinese privet (*Ligustrum sinense*), bush honeysuckle (*Lonicera maackii*), Himalayan blackberry, Japanese honeysuckle and winter-creeper (*Euonymus fortunei*). These species are still persistent, but the density has been greatly reduced. Small carpetgrass was observed and flagged by ECO, Inc. immediately outside the berm in the southeast corner of the cell and is in need of immediate management attention. The locations of the non-native/invasive plant species are marked on the W-2 Aerial Photograph shown in Figure 8.

Species Richness

As shown by Table 7, a five-year trend indicates a 4% decrease in native plant species richness from the 2015 peak species richness year to 2016 with a corresponding 50% increase in the number of invasive plant species from 2014 to 2016. Species richness does not indicate the relative densities of native plant species versus invasive plant species. It is simply the number of species observed within a wetland cell that serve as an indicator of plant community diversity.

Table 7– Wetland Cell W-2 Species Richness Trend

Monitoring Year	Desirable Native Plant Species	Invasive Plant Species*
2012	148	5
2013	170	11
2014	176	10
2015	195	15
2016	187	15

*** Invasive Plant Species: For management purposes, these species include both native and non-native plants that have the potential to outcompete native prairie plant species in a manner and degree that poses an ecological threat to sustaining the prairie ecosystem.**

Figure 8. Wetland Cell W-2 2016 Vegetation Monitoring Map

2.9 Overall Plant Species Richness Trends at Woolsey Wet Prairie

Inventory and monitoring work findings in 2016 resulted in the addition of nine new native plant species not previously observed at the site. Among the 2016 additions were several native prairie species, presumably recruited from a dormant seed bank following prescribed burns, or introduced naturally by waterfowl. These include inflated narrow-leaf sedge (*Carex grisea*), frightful sedge (*Carex molestiformis*), spreading sandmat (*Chamaesyce humistrata*), fleabane (*Erigeron tenuis*), yellow wood sorrel (*Oxalis stricta*), stinkweed (*Pluchea camphorata*), and glade skullcap (*Scutellaria parvula var. missouriensis*).

Prairie gayfeather (*Liatris pycnostachya*) seeds were collected by ECO, Inc. from Cherokee Prairie and Presson-Oglesby Prairie in the Arkansas River Valley during the fall of 2012, then cold moist stratified at approximately 35 degrees Fahrenheit for approximately 90 days. The prairie gayfeather seeds were planted at various locations within the West Wetland Cells on March 12, 2013 and in the East Wetland Cells on April 4, 2013. This period was selected due to the recentness of the March 3, 2013 prescribed burn. The ground was still blackened at the time of seeding. After three years, the prairie gayfeather seeds emerged to reach maturity and form flowers.

As discussed in the description of Wetland Cell E-5, false nettle was a new species to be observed at Woolsey Wet Prairie in 2016.

To date, a total of 477 plant species have been observed at Woolsey Wet Prairie since 2001. Of these, 96 (20.2%) species are considered to be non-native and/or invasive species, and 381 (79.8%) are considered to be native plant species. Due to the fact that different species emerge at different times of the year, and the fact that some plant species may not emerge every year, this does not mean that 477 plant species can be observed at any one moment in time. However, new plant species are added each year and a ten-fold increase in plant species has been observed since 2005 when only 47 plant species were observed at the site. The 2016 Woolsey Wet Prairie Master Plant Species List is contained within Appendix I.

On an individual wetland cell basis, there has been a trend whereby desirable native plant species have increased and non-native/invasive plant species have decreased up until 2015. However, this trend abruptly changed (reversed) from 2015 to 2016, as shown in Table 8. For purposes of prairie ecosystem management, "invasive" species are those that most threaten the existence of the prairie plant community, and may include both native and non-native plants, especially woody plants.

Table 8 – 2015 to 2016 Summary of Plant Species Composition

Wetland Cell	% Change Native Plant Species	% Change Invasive Plant Species
E-1	2015-2016 (15.8% decrease)	2014-2016 (150% increase)
E-2	2015-2016 (17% decrease)	2015-2016 (100% increase)
E-3	2015-2016 (17% decrease)	2015-2016 (200% increase)
E-4	2015-2016 (6% decrease)	2015-2016 (37.5% increase)
E-5	2015-2016 (16.5% decrease)	2015-2016 (175% increase)
W-1	2015-2016 (3% decrease)	2015-2016 (37.5% increase)
W-2	2015-2016 (4% decrease)	2014-2016 (50% increase)

Plant species richness does not necessarily coincide with the density of growth for any given plant species, but is an indicator of community diversity dynamics that is helpful in establishing prairie ecosystem management goals and objectives.

2.9.1 Prairie Plant Community Succession

It is apparent that the dramatic changes shown in Table 8 are the result of plant community succession, whereby an increase in woody plant density has outcompeted the native prairie forbs and grasses, resulting in a reduction in both species diversity and density of the desirable native plants in all seven wetland cells.

Prairie Ecosystems are level or slightly undulating, mostly treeless tracts of land, dominated by coarse grasses, forbs, and shrubs, rather than trees, as the dominant vegetation type.
Succession is the observed change in a species structure of an ecological community over time. An example of succession is the progressive change that occurs in a fallow field when it is rested for a long period of time. Initially, bare tilled soil becomes dominated by annual forbs and grasses. With time, perennial grasses and forbs begin to dominate the site. With more time, especially in areas with more than 30 inches of rainfall, shrubs and small trees become common or abundant on the site. With additional time, many sites continue to change and ultimately become forests.

Disturbances generally move succession backward toward structurally simpler, earlier stages dominated by herbaceous (non-woody) plants. Lack of disturbance generally moves succession toward structurally more complex conditions dominated by woody species. Historically, prairies remained in an open condition (the condition of their optimal biological diversity), due to disturbances that arrested woody plant encroachment and prevented the prairie from becoming a forest. Historically, prairies remain in the early stages of succession, due to disturbance that prevents the prairie from becoming a forest. Prior to modern times, fires set by Native Americans and grazing by large herbivores, such as elk and bison maintained the prairie habitat by holding the woody plants in check to prevent them from outcompeting the sun-loving prairie plants. Cultural land management practices in more modern times viewed fire as a bad thing, and the resulting fire suppression caused many prairies to become encroached by woody vegetation.

Since Woolsey Wet Prairie is a wetland prairie designed to be a wetland mitigation site, it is difficult to control woody vegetation strictly through prescribed burning. Therefore, additional adaptive management tools must be used such as mechanical clearing and/or herbicide applications. In its current state, much of the woody vegetation has grown too large to control with herbicides alone. Consequently, the use of both mechanical treatments and herbicides will be necessary and needs to be implemented as soon as possible or the woody growth will only become more difficult to control.

2.9.2 Purpose of Controlling Plant Community Succession

Table 9 shows a comparison of habitat types observed in 2013 versus 2016. The invasive black willows have increased from 2.1 acres to 8.76 acres of surface coverage, thereby displacing 6.66 acres of Wet Meadow/Marsh Habitat. Black willow coverage now covers 21.3% of the Woolsey Wet Prairie acreage, which is significantly greater than the 2.26 acres/5.1% forested coverage for compliance with mitigation requirements.

Table 9 - 2013 Versus 2016 Observed Habitat Type Acreage

Habitat Type	2013 Acreage/% of site	2016 Acreage/% of site
Upland Prairie Mounds/Berms	14.79 acres/36%	14.79 acres/36%
Herbaceous Wet Meadow/Marsh	24.17 acres/58.9%	17.51 acres/42.7%
Black Willow Stands	2.1 acres/5.1%	8.76 acres/21.3%
Totals	41.06 acres	41.06 acres

In mid 2013, the COE agreed to allow the use of the 20.90 surplus wetland credits generated at Woolsey Wet Prairie for city infrastructure improvement projects that required wetland mitigation. To date, the City has used 6.08 of the surplus credits leaving a balance of 14.82 surplus credits.

Table 10 shows the basis of required habitat types that are required for maintaining the surplus credits. Surplus credits are determined by completing worksheets via the COE Charleston Method for each habitat type. In general, more credits are generated via restoration and creation of herbaceous wetlands as compared to forested wetland creation. **The significant increase of willow stands to 8.76 acres has displaced herbaceous wetlands, thereby resulting in a loss of approximately 5.0 of the 14.82 surplus wetland credits.** Therefore, deforestation of the rapidly expanding black willow stands to reduce forested acreages to the level shown in Table 10 is necessary to maintain the surplus credits.

Table 10 - Targeted Habitat Type Acreage for Maximum Surplus Wetland Credits

Habitat Type	Acreage/% of site
Upland Prairie Mounds/Berms	14.79 acres/36%
Herbaceous Wet Meadow/Marsh	24.01 acres/58.5%
Black Willow Stands (forested)	2.26 acres/5.5%
Total	41.06 acres

Furthermore, eight of the ten ANHC Species of concern are wetland sedge/rush species that require open wet meadow habitat exposed to sunlight. Specifically, hammock sedge was known in Arkansas from only two sites in Franklin and Lonoke Counties, prior to its discovery at Woolsey Wet Prairie. Historically, it has been observed within Wetland Cells E-2, W-1, and W-2 for multiple consecutive years. As noted in 2015 and 2016, hammock sedge is no longer present in Wetland Cell W-1, due to being shaded out by black willows. Likewise, hammock sedge was not observed in Wetland Cell E-2 in 2016. Should the over-story shading effect of the willows not be substantially reduced, ECO, Inc. expects a trend whereby densities of rare sedge species will be further reduced, and/or they will be lost from the site altogether.

3.0 – RECOMMENDED ADAPTIVE MANAGEMENT ACTIVITIES FOR 2017

3.1 – Tree Removal To Control Woody Plant Succession

Aerial photographs of each of the seven wetland cells contained in Appendix II show marked locations where trees need to be completely removed and show a **Designated Tree Preservation Area**, where no trees are to be cut in order to maintain compliance with the Section 404 permit requirement for maintaining a minimum of 2.26 acres of forested wetlands. All black willow, honey locust, green ash, elm (*Ulmus spp.)* and persimmon observed within **Designated Tree Clearing Areas** should be cut and sprayed with herbicide. Any new saplings that emerge throughout the growing season outside of the **Designated Tree Preservation Area** should be basal bark sprayed with the appropriate herbicide that is approved for aquatic sites.

Correspondence received from Tommy Inebnit` of the U.S. Fish & Wildlife Service (USFWS) Conway, AR Field Office on July 13, 2016 indicated that both the federally listed endangered Indiana bat (*Myotis sodalis*) and the threatened Northern Long-eared Bat (NLEB) (*Myotis septentrionalis)* have the potential to occur at Woolsey Wet Prairie. These bats use forested areas during the summer and hibernate in caves and mines during the winter. Hibernation in nearby caves is an adaptation for survival during the cold winter months when no insects are available for bats to eat. After hibernation, bats migrate to their summer habitat in wooded areas.

The USFWS specifies that trees (including live trees and snags) ≥ 4" Diameter at Breast Height (DBH) that have exfoliating bark, cracks, crevices, and/or hollows are potential bat roosting habitat. The USFWS recommends that trees meeting the specified criteria of ≥ 4" DBH not be removed during the bat active period, which typically occurs between March 16th and October 15th, because Indiana bats roost in trees throughout the karst region in Northwest Arkansas during these dates.

In order to prevent/mitigate potential adverse effects to bats, any tree removal activities that involve cutting trees ≥ 4" DBH (but not herbicide applications) should be scheduled to occur during the bat non-active period of October 16th through March 15th. However, the removal of trees and saplings < 4" DBH via any methodology is unrestricted and can take place at Woolsey Wet Prairie at any point in time throughout the year. The USFWS considers that any herbicide and/or "lance injection" methodologies on trees ≥ 4" DBH will have "discountable, if any," effect on Indiana bats, and as long as these types of activities are conducted outside of the bat pup season, which is May 15th through July 31st, they would also be allowed to occur at any other point in time throughout the year.

A summary of recommendations is as follows:

- **Currently, the vast majority of the areas where trees are to be cleared are present in areas surrounded by dry ground due to dry summer and fall conditions. Due to the fact that most herbicide labels prohibit spraying the chemical over standing water, it is imperative that herbicide applications to target saplings/trees/cut stumps are made as soon as possible in order to remove canopy that inhibits growth of rare sedges.**
- **Cutting of any tree ≥ 4" Diameter at Breast Height (DBH) shall be restricted to the listed bat non-active period of October 16th through March 15th. Cut stumps should have herbicide applied immediately.**
- **Removal of trees and saplings < 4" DBH via any methodology is unrestricted and can take place at any time of the year.**
- **Small tree/sapling control can be achieved via basal bark/foliar herbicide applications that contains a penetrant oil, such as MSO**
- **Due to the density and number of trees that need to be removed, another option is lance injection of an herbicide. This method is approved for use in wetland and aquatic sites. Use of this method is restricted to August 1 through May 14.**

3.2 - General Invasive Plant Species Observations

A summary of the 2016 invasive species observations is contained in Table 11.

Table 11– 2016 Wetland Cell Invasive Plants Observations Summary

Wetland Cell	Forbs	Grasses	Saplings/Shrubs
E-1	Curly Dock Japanese Bush Clover Queen Anne's Lace Sericea Lespedeza White Sweet Clover Tall Goldenrod	Bermudagrass Johnsongrass Southern Crabgrass Tall Fescue	Black Willow Callery Pear Elm Green Ash Honey Locust Persimmon
E-2	Curly Dock Japanese Honeysuckle Korean Bush Clover Queen Anne's Lace Sericea Lespedeza White Sweet Clover Yellow Rocket Tall Goldenrod	Bermudagrass Johnsongrass Southern Crabgrass Tall Fescue	Bush Honeysuckle Black Willow Callery Pear Elm Green Ash Honey Locust Persimmon Tree of Heaven
E-3	Curly Dock Korean Bush Clover Queen Anne's Lace Sericea Lespedeza White Sweet Clover Tall Goldenrod	Bermudagrass Johnsongrass Tall Fescue	Black Willow Callery Pear Elm Green Ash Honey Locust Persimmon
E-4	Curly Dock Japanese Bush Clover Japanese Honeysuckle Queen Anne's Lace Sericea Lespedeza Tall Goldenrod	Bermudagrass Johnsongrass Small Carpetgrass Tall Fescue	Black Willow Callery Pear Elm Green Ash Himalayan Blackberry Honey Locust Persimmon
E-5	Curly Dock Japanese Bush Clover Japanese Honeysuckle Korean Bush Clover Queen Anne's Lace Sericea Lespedeza Tall Goldenrod White Sweet Clover	Bermudagrass Johnsongrass Tall Fescue	Black Willow Callery Pear Elm Green Ash Himalayan Blackberry Honey Locust Persimmon
W-1	Curly Dock Japanese Bush Clover Queen Anne's Lace Sericea Lespedeza Tall Goldenrod White Sweet Clover	Bermudagrass Johnsongrass Small Carpetgrass Tall Fescue	Black Willow Callery Pear Elm Green Ash Himalayan Blackberry Honey Locust Persimmon
W-2	Curly Dock Japanese Bush Clover Japanese Honeysuckle Korean Bush Clover Queen Anne's Lace Sericea Lespedeza Tall Goldenrod White Sweet Clover Winter Creeper Yellow Rocket	Bermudagrass Johnsongrass Small Carpetgrass Smooth Crabgrass Southern Crabgrass Tall Fescue	Bush Honeysuckle Elm Green Ash Himalayan Blackberry Multiflora Rose

In addition to tree removal activities discussed in Section 3.1, invasive plant management will be ongoing at Woolsey Wet Prairie to continue to control the invasive species listed in Table 11 that have been persistent. The largest densities of these invasive species are shown on the aerial photographs for each wetland cell in Figures 2-8.

3.3 Site Adaptive Management Activities To Date

The "adaptive management" approach has been utilized to manage site vegetation and hydrology. Adaptive management is a structured, iterative process of optimal decision making in the face of uncertainty, with the objective to reduce uncertainty over time via system monitoring. Adaptive management is often characterized as "learning by doing" in a decision-making process whereby any given selection of a vegetation management tools is done after observing the results of the previous vegetation management tool.

Adaptive management tools used for vegetation management at Woolsey Wet Prairie include the following:

- **Hand cutting/cut stump herbicide application of woody plants**
- **Mowing to prevent undesirable plant species from forming seed heads**
- **Hand pulling of undesirable plant species**
- **Herbicide applications**
- **Prescribed burning**
- **Water level control**

A historical list of 2006-2016 adaptive management activities at Woolsey Wet Prairie is contained within Appendix III.

3.4 – Mowing and Hand Cutting/Pulling

The mowing at the site is aimed toward invasive species such as tall fescue, Johnsongrass, Dallis grass (*Paspalum dilatatum*), Queen Anne's lace (*Daucus carota*), ragweed (*Ambrosia spp.),* and sericea lespedeza. When necessary, stands of these species are mowed to a height of 10-12 inches as they begin to mature, but before they form seed heads. This is intended to prevent the dispersal of additional seeds from invasive species. Currently, most areas at the mitigation site remain too wet to mow. However, periodic mowing will be continued in a 50-foot perimeter around the mitigation site and on the earthen berms, as necessary.

3.5 – Prescribed Burning

To date, prescribed burns have been conducted at Woolsey Wet Prairie on February 29, 2008, February 19, 2009, December 16, 2009, March 18, 2011, March 13, 2012, March 3, 2013, March 13, 2014, March 23, 2015, and March 5, 2016. ECO, Inc. develops prescribed burn specifications and a prescribed burn contractor is selected through an informal bid process.

For ecological restoration, fire has become recognized as a valuable vegetation management tool that can be used to enhance community diversity. Fire removes much of the surface layer of decaying vegetation "thatch" that covers the ground. Many native plant species require sunlight to germinate, while others actually require fire to germinate. Prescribed burns aide in preventing woody encroachment and maintains the wet prairie habitat, depending upon the time of year of the burn, and the site hydrology at the time of the burn. The volunteer woody plant growth has primarily occurred in the wetter areas where inundation protects woody plants from fire.

With the objective of increasing encouraging native warm season grasses (NWSG) and suppressing hardwood sprouts, the most effective burn period at Woolsey Wet Prairie has been found to be during the February to March time period. Ideally, this will occur during the transition from the Late Dormant to Dormancy Break periods. At that time, most of the warm season species will still be dormant and there will be adequate fuel from the vegetation killed by winter cold weather.

3.6 – Hydrological Controls

All wetland cells (with the exception of Cell W-2) have water level control structures. The structures have stop logs consisting of two dimensions; five-inch and seven-inch heights. This allows for control of water levels within the wetland cells within two-inch increments, depending upon the configuration of the stop logs and the amount of rainfall. In general, the stop log configurations are set to: 1) maintain surface water within portions of each wetland cell; 2) maintain non-inundated areas that have saturated surface soils; and 3) preclude overflows over the berms that would result in berm erosion. Maximum water retention within the wetland cells is not desirable, as it may create conditions not suitable for maintaining rare wetland sedge and rush species that cannot survive in periods of prolonged inundation.

Management of hydrology is an important tool in vegetation community diversity optimization because plant zonation occurs along water depth and soil saturation gradients. Consequently, variations in water depth and degree of soil saturation lead to variations in species composition. In summary, for management of hydrology, the major emphasis will be to recreate natural hydrological regimes in a manner to limit productivity of any single species from becoming excessively high, while at the same time, enriching biodiversity. The strategy for management of hydrology has not only included considerations for the volume of water retained, but also the time of the year water is retained. It is vital to retain water during the growing season in order to maintain areas of soil saturation and/or inundation to support desirable wetland vegetation.

Table 12 shows target stop log setting for 2017. Stop logs should be set to lower water levels in December 2016 in preparation for the February to March prescribed burn. Water levels will need to be kept at an atypically lower level through May 2017 in order to facilitate access by equipment and personnel for tree removal activities. Upon completion of tree removal activities, the stop logs should be reset to maintain higher water levels through the remainder of the growing season.

Table 12 – Target 2017 Seasonal Stop Log Settings

Wetland Cell	December 2016 –May 2017	June-November 2017
E-1	7	7:5
E-2	7:5	7:7
E-3	7:5	7:7
E-4	7	7:5
E-5	7	7:5
W-1	7	7:7
W-2	NA	NA

3.7 – Herbicide Applications

ECO, Inc. develops specifications for which type of herbicide and adjuvant are to be used for each targeted invasive plant species group. Broad-spectrum herbicides are avoided when practicable. Herbicide applications are made following label recommendations and are not directly applied to standing surface water except when an EPA-approved Aquatic Site herbicide is used. Typically, graminicides are applied for control of invasive grass species and broadleaf herbicides are applied for invasive broadleaf and woody plants. The majority of herbicide applications are made via backpack sprayers and/or ATV mounted spray equipment.

3.8 – 2017 Adaptive Management Tentative Scheduling

A general schedule for 2017 is shown in Table 13. Site conditions will be observed and changes will be made to scheduling, as necessary.

Table 13 – 2017 Woolsey Wet Prairie Adaptive Management Tentative Schedule

General Timeframe	Activity
January	Prescribed burn informal bid process; complete establishment of fire line
	Adjust stop logs to reduce water retention in all wetland cells
	Commence tree removal activities for trees ≥ 4" Diameter at Breast Height (DBH)/apply Remedy Ultra (60.45% Triclopyr) to cut stumps
February-March	Prescribed burn
	Continue tree removal activities for trees ≥ 4" Diameter at Breast Height (DBH) until March 15/ apply Remedy Ultra (60.45% Triclopyr) to cut stumps
	After March 15, continue tree removal activities for trees /saplings < 4" DBH
	Cut Tree of Heaven and apply Remedy Ultra (60.45% Triclopyr) to cut stump/reapply as necessary
March through April	Spray tall fescue with Clethodim 2 weeks after prescribed burn before native plants come out of dormancy
Late-March through September	Continue tree removal activities for trees /saplings < 4" DBH via cut and spray or basal bark/foliar spray using Remedy Ultra (60.45% Triclopyr) for terrestrial areas, or Renovate 3 (44.4% Triclopyr) for areas of standing water.
May	Evaluate site for presence of yellow rocket; control via top-cutting/hand pulling/spray with Remedy Ultra (60.45% Triclopyr)
	Evaluate site for presence of carpet grass and spray with Section 2EC
	Reset stop logs to retain more water in wetland cells
June	Adjacent (west and north) fescue fields to be hayed before tall fescue goes to seed
	Hand pull curly dock & Queen Anne's lace
May through September	Evaluate site for presence of carpet grass and spray with Section 2EC
	Spot spray woody plants (callery pear, persimmon, black willow, green ash, honey locust, , bush honeysuckle) with Remedy Ultra (60.45% Triclopyr)
	Spot spray sericea lespedeza with PastureGard HL
	Spot spray Japanese honeysuckle, Bush Honeysuckle, burdock, thistle, curly dock, Himalayan blackberry, multiflora rose, tall goldenrod, Queen Anne's lace, White sweet clover, privet with Remedy Ultra or Pasturegard HL
	Spot spray Johnsongrass, orchard grass, tall fescue, Dallisgrass, Bermuda with Section 2 EC

4.0 – 2016 EXISTING SURPLUS WETLAND MITIGATION CREDITS

4.1 – Background and Overview

Subsequent to construction and initial adaptive management of Woolsey Wet Prairie, ECO, Inc. determined that 94.47 mitigation credits had been generated, producing a surplus of 20.90 credits above the required 73.57 wetland mitigation credits required by the Corps Section 404 permit. ECO, Inc. and the City of Fayetteville met with the Corps in mid-2013 to discuss the use of surplus wetland credits for city infrastructure projects that required wetland compensatory mitigation. On September 30, 2013, the City of Fayetteville received approval from the Corps to use the 20.90 surplus wetland credits for impacts to wetlands caused by municipal projects within the Illinois River Watershed 8-digit Hydrologic Unit Code (HUC) watershed (11110103), but the City would not be allowed to sell the surplus credits.

Consequently, the City of Fayetteville's surplus wetland credits in essence serve as a mitigation bank where improvements to wetland ecological function and value provide an ecological gain, and are available to be used to meet compensatory mitigation requirements for city projects that permanently alter wetlands. More specifically, these surplus credits serve as what is known as a Single-Client Mitigation Bank, or a bank for which the sponsor is also the principal credit user or client.

4.2 – Service Area

The Woolsey Wet Prairie Bank service area primarily includes impact projects within the watersheds of Clear Creek, Goose Creek, and headwaters of the Illinois River within HUC 11110103 that are under the authority and control of the City of Fayetteville. This service area may change as the city's area expands into other portions of HUC 11110103.

4.3 – Credit Release Process

ECO, Inc. provided wetland credit guidance to the City of Fayetteville for the purpose of clarifying the terms, uses, and measures of credits as they apply to wetland mitigation banking. This guide is intended for use by the City of Fayetteville as the bank sponsor of the surplus wetland credits to satisfy mitigation requirements, for regulated impacts to aquatic resources. This process may change, as wetland mitigation regulations and policies are modified. The WSIP was funded by and through the City of Fayetteville Utilities Department. Therefore, the Utilities Department is considered to be the bank sponsor for releasing credits to other City of Fayetteville entities.

4.4 – Accounting Procedures For Tracking Credits

The number of available credits and all credit releases must be tracked throughout the life of a mitigation bank and credit use must be monitored to ensure that bank credits aren't overdrawn. Tracking credits on a ledger ensures that the same credit is not used to meet compensatory mitigation requirements for multiple projects. The **ledger** documents the credit releases and withdrawals for a mitigation bank, similar to keeping track of money in a checking account.

The Sponsor shall be responsible for keeping an up-to-date ledger of all transactions within the Bank. The bank sponsor must compile an annual ledger report showing the beginning and ending balances of available credits and permitted impacts (i.e., debits) for each resource type, all credit additions and subtractions, and other changes in credit availability, such as the release of additional credits or the suspension of credit sales. The ledger report is to be submitted to the Corps as part of the

administrative record for the mitigation bank and will be made available to the public by the Corps upon request.

During 2014, the Corps authorized the use of a portion of the Woolsey Wet Prairie surplus wetland credits to offset 0.31 acres of permanent alterations to wetlands from the construction of an extension to Van Ashe Drive (COE Project No. 2012-00525). Consequently, the City of Fayetteville Transportation Division Van Asche Drive project deducted 2.94 credits from the Woolsey Wet Prairie 20.90 surplus wetland credits, leaving a balance of 17.96 surplus credits.

In 2015, the Corps authorized the use of a portion of the Woolsey Wet Prairie surplus wetland credits to offset 0.192 acres of permanent alterations to wetlands from the construction of the Clabber Creek Recreational Trail. Consequently, the City of Fayetteville Clabber Creek Recreational Trail project deducted 3.14 credits from the remaining 17.96 Woolsey Wet Prairie surplus wetland credits, leaving a balance of 14.82 surplus credits.

The City of Fayetteville did not use any surplus wetland credits in 2016, therefore, a balance of 14.82 surplus credits remains.

The current surplus wetland credit ledger report for Woolsey Wet Prairie through 2016 is contained in Appendix IV.

5.0 – Appendices

Appendix I
Woolsey Wet Prairie
2016 Master Plant Species List

MASTER PLANT LIST FOR WOOLSEY WET PRAIRIE - updated November 2016 - 477 taxa

SCIENTIFIC NAME	WETLAND INDICATOR STATUS	CODE	COMMON NAME	FAMILY	STRATA	SOURCE CODE
Abutilon theophrastii *	FACU-	ABUT THEO	pie-maker	MALVACEAE	herb	5
Acalypha gracilens	no data	ACAL GRAC	copperleaf	EUPHORBIACEAE	herb	5
Acalypha virginica	FACU-	ACAL VIRG	Virginia copperleaf	EUPHORBIACEAE	herb	3
Acer negundo	FACW	ACER NEGU	boxelder	ACERACEAE	tree/sapling	5
Acer saccharinum	FACW	ACER SACC	silver maple	ACERACEAE	tree/sapling	9
Achillea millefolium	FACU	ACHI MILL	yarrow	ASTERACEAE	herb	12
Agalinis fasciculata	FAC	AGAL FASC	gerardia	SCROPHULARIACEAE	herb	6
Agrimonia parviflora +	FACW	AGRI PARV	swamp agrimony	ROSACEAE	herb	21
Agrostis gigantea *	FACW	AGRO GIGA	redtop	POACEAE	herb	3
Agrostis hyemalis	FAC	AGRO HYEM	ticklegrass	POACEAE	herb	5
Ailanthus altissima **	NI	AILA ALTI	tree-of-heaven	SIMAROUBACEAE	tree/sapling	10
Allium canadense var. canadense	FACU	ALLI CANA CANA	wild onion	ALLIACEAE	herb	19
Allium vineale *	FACU-	ALLI VINE	field garlic	ALLIACEAE	herb	3
Amaranthus cf. viridis *	NO	AMAR VIRI	pigweed	AMARANTHACEAE	herb	4
Amaranthus spinosus	FACU	AMAR SPIN	spiny pigweed	AMARANTHACEAE	herb	3
Ambrosia artemisiifolia	FACU	AMBR ARTE	common ragweed	ASTERACEAE	herb	3
Ambrosia bidentata	no data	AMBR BIDE	lanceleaf ragweed	ASTERACEAE	herb	3
Ambrosia trifida	FAC	AMBR TRIF	giant ragweed	ASTERACEAE	herb	3
Ammannia X coccinea	FACW+	AMMA COCC	toothcup	LYTHRACEAE	herb	3
Amorpha fruticosa +	FACW	AMOR FRUT	false indigo bush	FABACEAE	shrub	21
Ampelopsis cordata	FAC+	AMPE CORD	heartleaf ampelopsis	VITACEAE	woody vine	10
Anagallis minima	FACW	ANAG MINI	chaffweed	PRIMULACEAE	herb	23
Andropogon gerardii	FAC	ANDR GERA	big bluestem	POACEAE	herb	3
Andropogon glomeratus	FACW+	ANDR GLOM	bushy bluestem	POACEAE	herb	11
Andropogon hirsutior	FACW	ANDR HIRS	hirsute bushy bluestem	POACEAE	herb	24
Andropogon virginicus	FAC-	ANDR VIRG	broomsedge bluestem	POACEAE	herb	3
Apios americana	FACW	APIO AMER	groundnut	FABACEAE	herb	3
Apocynum cannabinum	FAC-	APOC CANN	Indian hemp	APOCYNACEAE	herb	3
Arctium minus *	FACU	ARCT MINU	burdock	ASTERACEAE	herb	19
Arenaria serpyllifolia var. tenuior *	FAC	AREN SERP TENU	thyme-leaved sandwort	CARYOPHYLLACEAE	herb	19
Aristida dichotoma	FACU	ARIS DICH	churchmouse three-awn	POACEAE	herb	8
Aristida longespica var. longespica	UPL	ARIS LONG	slimspike three-awn	POACEAE	herb	22
Aristida oligantha	no data	ARIS OLIG	three-awn	POACEAE	herb	8
Arthraxon hispidus **	FAC	ARTH HISP	small carpetgrass	POACEAE	herb	23
Asclepias amplexicaulis	no data	ASCL AMPL	curly milkweed	ASCLEPIADACEAE	herb	3
Asclepias longifolia ssp. hirtella	UPL	ASCL HIRT	longleaf milkweed	ASCLEPIADACEAE	herb	3
Asclepias viridis	no data	ASCL VIRI	spider milkweed	ASCLEPIADACEAE	herb	3
Baptisia alba var. macrophylla	no data	BAPT ALBA	white false indigo	FABACEAE	herb	3
Baptisia bracteata var. leucophaea	no data	BAPT BRAC	cream false indigo	FABACEAE	herb	1
Barbarea vulgaris **	FAC	BARB VULG	yellow rocket	BRASSICACEAE	herb	5
Bidens aristosa	FACW	BIDE ARIS	tickseed sunflower	ASTERACEAE	herb	8
Bidens frondosa	FACW	BIDE FRON	tickseed sunflower	ASTERACEAE	herb	13
Boehmeria cylindrica	FACW	BOEH CYLI	false nettle	URTICACEAE	herb	27
Boltonia asteroides	FACW	BOLT ASTE	false aster	ASTERACEAE	herb	3
Boltonia diffusa	FAC	BOLT DIFF	doll's daisy	ASTERACEAE	herb	8
Brassica rapa *	no data	BRAS RAPA	turnip	BRASSICACEAE	herb	5

Bromus catharticus *	*no data*	BROM CATH	rescue grass	POACEAE	herb	5
Bromus hordeaceus *	*no data*	BROM HORD	soft chess	POACEAE	herb	5
Bromus inermis *	*no data*	BROM INER	smooth broome	POACEAE	herb	5
Bromus racemosus **	*no data*	BROM RACE	bald brome	POACEAE	herb	5
Bromus sterilis **	*no data*	BROM STER	poverty brome	POACEAE	herb	19
Bromus tectorum *	*no data*	BROM TECT	cheatgrass	POACEAE	herb	5
Callitriche heterophylla	*OBL*	CALL HETE	water starwort	CALLITRICHACEAE	herb	5
Callitriche terrestris	*FACW*	CALL TERR	terrestrial water starwort	CALLITRICHACEAE	herb	19
Campsis radicans	*FAC*	CAMP RADI	trumpet creeper	BIGNONIACEAE	herb	10
Capsella bursa-pastoris *	*FACU+*	CAPS BURS	shepherd's purse	BRASSICACEAE	herb	5
Cardamine parviflora var. arenicola	*FACU*	CARD PARV AREN	small-flowered bittercress	BRASSICACEAE	herb	5
Carduus nutans **	*no data*	CARD NUTA	nodding thistle	ASTERACEAE	herb	4
Carex aggregata	***no data***	**CARX AGGR**	**cluster sedge**	**CYPERACEAE**	**herb**	**19**
Carex amphibola	*FAC*	CARX AMPH	a sedge	CYPERACEAE	herb	19
Carex annectens	*FACW*	CARX ANNE	a sedge	CYPERACEAE	herb	5
Carex arkansana	***no data***	**CARX ARKA**	**Arkansas sedge**	**CYPERACEAE**	**herb**	**5**
Carex aureolensis	*no data*	CARX AURE	a sedge	CYPERACEAE	herb	19
Carex austrina	*no data*	CARX AUST	a sedge	CYPERACEAE	herb	5
Carex blanda	*FAC*	CARX BLAN	a sedge	CYPERACEAE	herb	19
Carex brevior	*OBL*	CARX BREV	a sedge	CYPERACEAE	herb	5
Carex bushii	*FACW*	CARX BUSH	Bush's sedge	CYPERACEAE	herb	5
Carex complanata	*FAC+*	CARX COMP	a sedge	CYPERACEAE	herb	5
Carex festucacea	*FACW*	CARX FEST	a sedge	CYPERACEAE	herb	5
Carex fissa	***FACW+***	**CARX FISS**	**hammock sedge**	**CYPERACEAE**	**herb**	**5**
Carex flaccosperma	*FAC+*	CARX FLAC	a sedge	CYPERACEAE	herb	9
Carex frankii	*OBL*	CARX FRAN	Frank's sedge	CYPERACEAE	herb	5
Carex glaucodea	*no data*	CARX GLAU	blue sedge	CYPERACEAE	herb	15
Carex granularis	*FACW*	CARX GRAN	granular sedge	CYPERACEAE	herb	5
Carex grisea	*FACU*	CARX GRIS	inflated narrow-leaf sedge	CYPERACEAE	herb	26
Carex hirsutella	*no data*	CARX HIRS	a sedge	CYPERACEAE	herb	5
Carex leavenworthii	*no data*	CARX LEAV	Leavenworth's sedge	CYPERACEAE	herb	5
Carex meadii	*FAC*	CARX MEAD	Mead's sedge	CYPERACEAE	herb	7
Carex molestiformis	*no data*	CARX MOLE	frightful sedge	CYPERACEAE	herb	26
Carex oklahomensis	*OBL*	CARX OKLA	Oklahoma sedge	CYPERACEAE	herb	3
Carex opaca	***no data***	**CARX OPAC**	**opaque prairie sedge**	**CYPERACEAE**	**herb**	**5**
Carex pellita	***OBL***	**CARX PELL**	**woolly sedge**	**CYPERACEAE**	**herb**	**5**
Carex retroflexa	*no data*	CARX RETR	a sedge	CYPERACEAE	herb	5
Carex scoparia	***FACW***	**CARX SCOP**	**pointed sedge**	**CYPERACEAE**	**herb**	**16**
Carex shortiana	*FACW*	CARX SHOR	Short's sedge	CYPERACEAE	herb	14
Carex vulpinoidea	*OBL*	CARX VULP	foxtail sedge	CYPERACEAE	herb	3
Carya illinoinensis	*FACU*	CARY ILLI	pecan	JUGLANDACEAE	tree/sapling	20
Catalpa bignonioides	*FAC-*	CATA BIGN	catalpa	BIGNONIACEAE	tree/sapling	3
Celtis laevigata	*FACW*	CELT LAEV	sugarberry	CELTIDACEAE	tree/sapling	20
Celtis occidentalis	*FACU*	CELT OCCI	hackberry	CELTIDACEAE	tree/sapling	8
Cephalanthus occidentalis	*OBL*	CEPH OCCI	buttonbush	RUBIACEAE	shrub	3
Cerastium fontanum ssp. vulgare *	*no data*	CERA FONT VULG	chickweed	CARYOPHYLLACEAE	herb	19
Cerastium pumilum *	*no data*	CERA PUMI	chickweed	CARYOPHYLLACEAE	herb	4
Ceratophyllum demersum	*OBL*	CERA DEME	coontail	CERATOPHYLLACEAE	herb	10
Chamaesyce humistrata	*FAC*	CHAM HUMI	spreading sandmat	EUPHORBIACEAE	herb	27
Chamaesyce maculata	*no data*	CHAM MACU	spotted spurge	EUPHORBIACEAE	herb	3
Chamaesyce nutans	*FACU*	CHAM NUTA	spurge	EUPHORBIACEAE	herb	8
Chasmanthium latifolium	*FACU*	CHAS LATI	river oats	POACEAE	herb	23

Chenopodium album	*FAC-*	CHEN ALBU	lamb's quarters	CHENOPODIACEAE	herb	3
Cicuta maculata	*OBL*	CICU MACU	water hemlock	APIACEAE	herb	5
Cirsium altissimum	*no data*	CIRS ALTI	tall thistle	ASTERACEAE	herb	19
Cirsium vulgare **	*FAC*	CIRS VULG	common thistle	ASTERACEAE	herb	8
Claytonia virginica	*FAC*	CLAY VIRG	spring beauty	PORTULACACEAE	herb	18
Cocculus carolinus	*FAC*	COCC CARO	Carolina snailseed	MENISPERMACEAE	herb	20
Conium maculatum *	*FACW*	CONI MACU	poison hemlock	APIACEAE	herb	7
Conyza canadensis	*FACU*	CONY CANA	horseweed	ASTERACEAE	herb	3
Coreopsis grandiflora	*no data*	CORE GRAN	tickseed	ASTERACEAE	herb	5
Cornus drummondii	*FAC*	CORN DRUM	rough-leaved dogwood	CORNACEAE	shrub	3
Corydalis crystallina	*no data*	CORY CRYS	mealy fumewort	FUMARIACEAE	herb	5
Crataegus mollis	*FAC*	CRAT MOLL	hairy hawthorn	ROSACEAE	herb	8
Crataegus reverchonii	***no data***	**CRAT CRUS**	**Reverchon's hawthorn**	**ROSACEAE**	**shrub**	**21**
Crotalaria sagittalis	*no data*	CROT SAGI	rattlebox	FABACEAE	herb	12
Croton capitatus	*no data*	CROT CAPI	goatweed	EUPHORBIACEAE	herb	3
Croton glandulosus var. septentrionalis	*no data*	CROT GLAN SEPT	tropic croton	EUPHORBIACEAE	herb	3
Croton monanthogynus	*no data*	CROT MONA	prairie tea	EUPHORBIACEAE	herb	8
Croton willdenowii	*no data*	CROT WILD	rushfoil	EUPHORBIACEAE	herb	3
Cruciata pedemontana *	*no data*	CRUC PEDE	yellow-flowered bedstraw	RUBIACEAE	herb	5
Cuscuta campestris	*no data*	CUSC CAMP	field dodder	CONVOLVULACEAE	herb	12
Cynodon dactylon **	*FACU*	CYNO DACT	Bermuda grass	POACEAE	herb	3
Cyperus acuminatus	*OBL*	CYPE ACUM	tapertip flatsedge	CYPERACEAE	herb	6
Cyperus echinatus	*FAC*	CYPE ECHI	globe flatsedge	CYPERACEAE	herb	3
Cyperus erythrorhizos	*OBL*	CYPE ERYT	redroot flatsedge	CYPERACEAE	herb	11
Cyperus esculentus	*FAC*	CYPE ESCU	yellow nutsedge	CYPERACEAE	herb	3
Cyperus flavescens	*OBL*	CYPE FLAV	yellow flatsedge	CYPERACEAE	herb	3
Cyperus lancastriensis	*FAC*	CYPE LANC	manyflower flatsedge	CYPERACEAE	herb	21
Cyperus lupulinus	*no data*	CYPE LUPU	flatsedge	CYPERACEAE	herb	4
Cyperus odoratus	*FACW*	CYPE ODOR	rusty flatsedge	CYPERACEAE	herb	6
Cyperus pseudovegetus	*FACW*	CYPE PSEU	marsh flatsedge	CYPERACEAE	herb	3
Cyperus strigosus	*FACW*	CYPE STRI	false nutsedge	CYPERACEAE	herb	1
Dactylis glomerata **	*FACU*	DACT GLOM	orchard grass	POACEAE	herb	3
Datura stramonium *	*no data*	DATU STRA	Jimson weed	SOLANACEAE	herb	5
Daucus carota **	*no data*	DAUC CARO	Queen Anne's lace	APIACEAE	herb	3
Desmanthus illinoensis	*FAC*	DESM ILLI	Illinois bundleflower	FABACEAE	herb	21
Desmodium canescens	*no data*	DESM CANE	tick-trefoil	FABACEAE	herb	19
Desmodium nuttallii	*no data*	DESM NUTT	tick-trefoil	FABACEAE	herb	8
Desmodium obtusum	*no data*	DESM OBTU	tick-trefoil	FABACEAE	herb	8
Desmodium paniculatum	*FACU*	DESM PANI	tick-trefoil	FABACEAE	herb	3
Desmodium sessilifolium	*no data*	DESM SESS	sessile-leaf tick-trefoil	FABACEAE	herb	16
Dichanthelium aciculare	*FACU*	DICH ACIC	slimleaf rosettegrass	POACEAE	herb	3
Dichanthelium acuminatum	*FAC*	DICH ACUM	pointed rosettegrass	POACEAE	herb	3
Dichanthelium clandestinum	*FACW*	DICH CLAN	deer-tongue rosettegrass	POACEAE	herb	8
Dichanthelium commutatum	*FAC*	DICH COMM	variable rosettegrass	POACEAE	herb	11
Dichanthelium dichotomum	*FAC*	DICH DICH	rosettegrass	POACEAE	herb	3
Dichanthelium malacophyllum	*no data*	DICH MALA	soft-leaved rosettegrass	POACEAE	herb	19
Dichanthelium oligosanthes var. scribnerianum	*FACU*	DICH OLIG SCRI	Scribner's rosettegrass	POACEAE	herb	5
Dichanthelium scoparium	*FACW*	DICH SCOP	velvet rosettegrass	POACEAE	herb	3
Dichanthelium sphaerocarpon	*FACU*	DICH SPHA	rosettegrass	POACEAE	herb	5
Digitaria ciliaris **	*FAC*	DIGI CILI	southern crabgrass	POACEAE	herb	4

Digitaria ischaemum **	*UPL*	DIGI ISCH	smooth crabgrass	POACEAE	herb	3
Diodia teres	*FACU-*	DIOD TERE	poorjoe	RUBIACEAE	herb	3
Diodia virginiana	*FACW*	DIOD VIRG	Virginia buttonweed	RUBIACEAE	herb	3
Diospyros virginiana	*FAC*	DIOS VIRG	persimmon	EBENACEAE	tree/sapling	3
Dysphania ambrosioides *	*FACU*	DYSP AMBR	wormseed	CHENOPODIACEAE	herb	3
Echinochloa colona *	*FACW*	ECHI COLO	jungle rice	POACEAE	herb	3
Echinochloa crus-galli *	*FACW-*	ECHI CRUS	barnyard grass	POACEAE	herb	1
Echinochloa muricata	*FAC*	ECHI MURI	barnyard grass	POACEAE	herb	3
Eclipta prostrata	*FACW-*	ECLI PROS	yerba de tajo	ASTERACEAE	herb	1
Eleocharis acicularis	*OBL*	ELEO ACIC	least spikerush	CYPERACEAE	herb	5
Eleocharis lanceolata	*FACW*	ELEO LANC	spikerush	CYPERACEAE	herb	3
Eleocharis macrostachya	*OBL*	ELEO MACR	pale spikerush	CYPERACEAE	herb	16
Eleocharis obtusa	*OBL*	ELEO OBTU	blunt spikerush	CYPERACEAE	herb	3
Eleocharis palustris	*OBL*	ELEO PALU	common spikerush	CYPERACEAE	herb	3
Eleocharis quadrangulata	*OBL*	ELEO QUAD	squarestem spikerush	CYPERACEAE	herb	9
Eleocharis tenuis var. verrucosa	*FACW*	ELEO TENU VERR	slender spikerush	CYPERACEAE	herb	5
Eleocharis wolfii	***OBL***	**ELEO WOLF**	**Wolf's spikerush**	**CYPERACEAE**	**herb**	**5**
Eleusine indica *	*FACU*	ELEU INDI	India goosegrass	POACEAE	herb	3
Elymus glabrifloris	*no data*	ELYM GLAB	wild rye	POACEAE	herb	3
Eragrostis hirsuta	*UPL*	ERAG HIRS	bigtop lovegrass	POACEAE	herb	22
Eragrostis spectabilis	*FACU*	ERAG SPEC	purple lovegrass	POACEAE	herb	3
Eragrostis intermedia	*no data*	ERAG INTE	lovegrass	POACEAE	herb	8
Erechtites hieraciifolia	*FAC-*	EREC HIER	fireweed	ASTERACEAE	herb	8
Erigeron annuus	*FACU*	ERIG ANNU	fleabane	ASTERACEAE	herb	3
Erigeron strigosus	*FAC*	ERIG STRI	daisy fleabane	ASTERACEAE	herb	5
Erigeron tenuis	*no data*	ERIG TENU	fleabane	ASTERACEAE	herb	25
Eryngium yuccifolium +	*FAC*	ERYN YUCC	rattlensnake master	APIACEAE	herb	10
Euonymus fortunei **	*no data*	EUON FORT	winter-creeper	CELASTRACEAE	woody vine	19
Eupatorium perfoliatum	*FACW+*	EUPA PERF	clasping boneset	ASTERACEAE	herb	3
Eupatorium serotinum	*FAC*	EUPA SERO	late boneset	ASTERACEAE	herb	1
Euphorbia spathulata	*FACU*	EUPH SPAT	warty spurge	EUPHORBIACEAE	herb	21
Euthamia gymnospermoides	*FAC*	EUTH GYMN	Texas goldentop	ASTERACEAE	herb	21
Festuca rubra	*FACU+*	FEST RUBR	red fescue	POACEAE	herb	2
Fimbristylis annua	*FACW*	FIMB ANNU	annual fimbry	CYPERACEAE	herb	9
Fimbristylis puberula	*OBL*	FIMB PUBE	hairy fimbry	CYPERACEAE	herb	5
Fraxinus pennsylvanica	*FACW*	FRAX PENN	green ash	OLEACEAE	tree/sapling	3
Galactia regularis	*no data*	GALA REGU	milk pea	FABACEAE	herb	3
Galium aparine	*FACU*	GALI APAR	cleavers	RUBIACEAE	herb	19
Galium obtusum	*FACW-*	GALI OBTU	bluntleaf bedstraw	RUBIACEAE	herb	7
Galium pilosum	*no data*	GALI PILO	hairy bedstraw	RUBIACEAE	herb	4
Gamochaeta antillana	*no data*	GAMO ANTI	cudweed	ASTERACEAE	herb	19
Gamochaeta purpurea	*UPL*	GAMO PURP	purple cudweed	ASTERACEAE	herb	5
Gaura longiflora	*no data*	GAUR LONG	gaura	ONAGRACEAE	herb	8
Geranium carolinianum	*no data*	GERA CARO	Carolina cranesbill	GERANIACEAE	herb	5
Geranium dissectum *	*no data*	GERA DISS	cutleaf cranesbill	GERANIACEAE	herb	5
Geranium molle *	*no data*	GERA MOLL	dovesfoot cranesbill	GERANIACEAE	herb	4
Geum canadense	*FACU*	GEUM CANA	white avens	ROSACEAE	herb	19
Glandularia canadensis	*no data*	GLAN CANA	rose vervain	VERBENACEAE	herb	3
Gleditsia triacanthos	*FAC-*	GLED TRIA	honey locust	FABACEAE	tree/sapling	3
Glyceria septentrionalis	*OBL*	GLYC SEPT	mannagrass	POACEAE	herb	3
Gratiola neglecta	*OBL*	GRAT NEGL	hedge-hyssop	SCROPHULARIACEAE	herb	9
Gratiola virginiana	*OBL*	GRAT VIRG	hedge-hyssop	SCROPHULARIACEAE	herb	3

Helenium amarum	*FACU-*	HELE AMAR	bitterweed	ASTERACEAE	herb	3
Helenium flexuosum	*FACW*	HELE FLEX	purple-headed sneezeweed	ASTERACEAE	herb	1
Helenium autumnale	*FACW*	HELE AUTU	fall sneezeweed	ASTERACEAE	herb	8
Helianthus grosseserratus	*FAC+*	HELI GROS	sawtooth sunflower	ASTERACEAE	herb	3
Helianthus mollis	*no data*	HELI MOLL	ashy sunflower	ASTERACEAE	herb	3
*Heliotropium indicum **	*FAC*	HELI INDI	Indian heliotrope	BORAGINACEAE	herb	21
Hibiscus moscheutos ssp. lasiocarpos	*OBL*	HIBI MOSC LASI	rose mallow	MALVACEAE	herb	3
Hieracium gronovii	*UPL*	HIER GRON	hawkweed	ASTERACEAE	herb	2
*Hordeum pusillum **	*FACU*	HORD PUSI	little barley	POACEAE	herb	5
Hypericum drummondii	*FACU*	HYPE DRUM	nits-and-lice	CLUSIACEAE	herb	8
Hypericum gymnanthum	*FACW*	HYPE GYMN	clasping St. John's wort	CLUSIACEAE	herb	10
Hypericum hypericoides var. multicaule	*FAC*	HYPE HYPE MULT	creeping St. Andrew's cross	CLUSIACEAE	shrub	3
Hypericum mutilum	*FACW*	HYPE MUTI	dwarf St. John's wort	CLUSIACEAE	herb	9
Hypericum punctatum	*FAC*	HYPE PUNC	dotted St. John's wort	CLUSIACEAE	herb	8
Ilex decidua	*FACW*	ILEX DECI	deciduous holly	AQUIFOLIACEAE	shrub	22
Ipomoea lacunosa	*FAC+*	IPOM LACU	whitestar morning glory	CONVOLVULACEAE	herb	10
Ipomoea pandurata	*FACU*	IPOM PAND	wild potato vine	CONVOLVULACEAE	herb	5
Isoetes melanopoda	*OBL*	ISOE MELA	black-footed quillwort	ISOETACEAE	herb	19
Isolepis carinata	*FACW+*	ISOL CARI	bulrush	CYPERACEAE	herb	5
Juncus anthelatus	*no data*	JUNC ANTH	rush	JUNCACEAE	herb	3
Juncus biflorus	*FACW*	JUNC BIFL	rush	JUNCACEAE	herb	3
Juncus brachycarpus	*FACW*	JUNC BRAC	rush	JUNCACEAE	herb	9
Juncus diffusissimus	*FACW*	JUNC DIFF	spreading rush	JUNCACEAE	herb	10
Juncus effusus	*FACW+*	JUNC EFFU	soft rush	JUNCACEAE	herb	3
Juncus interior	*FACU*	JUNC INTE	inland rush	JUNCACEAE	herb	5
Juncus marginatus	*FACW*	JUNC MARG	rush	JUNCACEAE	herb	8
Juncus secundus	*FAC*	JUNC SECU	rush	JUNCACEAE	herb	4
Juncus tenuis	*FAC*	JUNC TENU	path rush	JUNCACEAE	herb	24
Juncus torreyi	*FACW*	JUNC TORR	Torrey's rush	JUNCACEAE	herb	23
Juncus validus	*FACW+*	JUNC VALI	rush	JUNCACEAE	herb	5
Juniperus virginiana	*FACU-*	JUNI VIRG	eastern redcedar	CUPRESSACEAE	tree/sapling	8
Krigia dandelion	*FACU*	KRIG DAND	potato dandelion	ASTERACEAE	herb	7
*Kummerowia stipulacea ***	*FACU-*	KUMM STIP	Korean bushclover	FABACEAE	herb	3
*Kummerowia striata ***	*FACU*	KUMM STRI	Japanese bushclover	FABACEAE	herb	3
Lactuca canadensis	*FACU-*	LACT CANA	Canada wild lettuce	ASTERACEAE	herb	16
*Lactuca saligna **	*UPL*	LACT SALI	willowleaf lettuce	ASTERACEAE	herb	21
*Lactuca serriola **	*FAC*	LACT SERR	prickly wild lettuce	ASTERACEAE	herb	3
Leersia oryzoides	*OBL*	LEER ORYZ	rice cutgrass	POACEAE	herb	2
Leersia virginica	*FACW*	LEER VIRG	Virginia cutgrass	POACEAE	herb	8
Lemna minuta	*OBL*	LEMN MINU	duckweed	LEMNACEAE	herb	5
Lepidium virginicum	*FACU*	LEPI VIRG	Virginia peppergrass	BRASSICACEAE	herb	3
*Lespedeza cuneata ***	*NI*	LESP CUNE	sericea lespedeza	FABACEAE	herb	3
Lespedeza repens	*no data*	LESP REPE	creeping lespedeza	FABACEAE	herb	21
Leucospora multifida	*OBL*	LEUC MULT	leucospora	SCROPHULARIACEAE	herb	5
Liatris pycnostachya +	*FACU*	LIAT PYCN	prairie gayfeather	ASTERACEAE	herb	27
*Ligustrum sinense ***	*FAC*	LIGU SINE	Chinese privet	OLEACEAE	shrub	17
Lindernia dubia var. anagallidea	*OBL*	LIND ANAG	false pimpernel	SCROPHULARIACEAE	herb	10
Lindernia dubia var. dubia	*OBL*	LIND DUBI	false pimpernel	SCROPHULARIACEAE	herb	23
Linum medium var. texanum	*FACU*	LINU MEDI TEXA	stiff yellow flax	LINACEAE	herb	23
Lobelia siphilitica	*OBL*	LOBE SIPH	big blue lobelia	CAMPANULACEAE	herb	8

Lobelia spicata	*FAC*	LOBE SPIC	spike lobelia	CAMPANULACEAE	herb	5
Lolium perenne *	*FACU*	LOLI PERE	ryegrass	POACEAE	herb	5
Lonicera japonica **	*FAC-*	LONI JAPO	Japanese honeysuckle	CAPRIFOLIACEAE	woody vine	3
Lonicera maackii **	*no data*	LONI MAAC	bush honeysuckle	CAPRIFOLIACEAE	shrub	17
Lonicera sempervirens	*FAC*	LONI SEMP	trumpet honeysuckle	CAPRIFOLIACEAE	woody vine	5
Ludwigia alternifolia	*OBL*	LUDW ALTE	seedbox	ONAGRACEAE	herb	8
Ludwigia glandulosa	*OBL*	LUDW GLAN	primrose-willow	ONAGRACEAE	herb	23
Ludwigia palustris	*OBL*	LUDW PALU	creeping seedbox	ONAGRACEAE	herb	3
Ludwigia peploides ssp. glabrescens	*OBL*	LUDW PEPL GLAB	floating primrose-willow	ONAGRACEAE	herb	3
Luzula echinata	*FAC*	LUZU ECHI	wood rush	JUNCACEAE	herb	10
Lycopus americanus	*OBL*	LYCO AMER	American water horehound	LAMIACEAE	herb	8
Lythrum alatum	*FACW+*	LYTH ALAT	winged loosestrife	LYTHRACEAE	herb	5
Maclura pomifera *	*FACU*	MACL POMI	bois d'arc	MORACEAE	tree/sapling	3
Mecardonia acuminata	*FACW*	MECA ACUM	purple axilflower	SCROPHULARIACEAE	herb	3
Medicago lupulina	*no data*	MEDI SP.	black medic	FABACEAE	herb	16
Melilotus albus **	*FACU-*	MELI ALBU	white sweetclover	FABACEAE	herb	3
Melilotus officinalis *	*FACU-*	MELI OFFI	yellow sweetclover	FABACEAE	herb	16
Melothria pendula	*FACW-*	MELO PEND	dwarf cucumber vine	CUCURBITACEAE	herb	10
Mimosa quadrivalvis var. nuttallii	*no data*	MIMO QUAD NUTT	sensitive brier	FABACEAE	herb	3
Mollugo verticillata	*FAC*	MOLL VERT	green carpetweed	MOLLUGINACEAE	herb	10
Morus alba *	*UPL*	MORU ALBA	white mulberry	MORACEAE	tree/sapling	20
Morus rubra	*FAC*	MORU RUBR	red mulberry	MORACEAE	tree/sapling	8
Muhlenbergia schreberi	*FAC*	MUHL SCHR	nimblewill	POACEAE	herb	8
Muhlenbergia sp.	*no data*	MUHL SP.	muhly grass	POACEAE	herb	19
Myosotis macrosperma	*FAC*	MYOS MACR	large-seeded forget-me-not	BORAGINACEAE	herb	19
Myriophyllum sp.	*OBL*	MYRI SP	water milfoil	HALORAGACEAE	herb	9
Nothoscordum bivalve	*FAC*	NOTH BIVA	crow poison	ALLIACEAE	herb	7
Nuttallanthus texanus	*no data*	NUTT TEXA	blue toadflax	SCROPHULARIACEAE	herb	5
Oenothera biennis	*FACU*	OENO BIEN	evening-primrose	ONAGRACEAE	herb	7
Oenothera laciniata	*FACU*	OENO LACI	cutleaf evening-primrose	ONAGRACEAE	herb	5
Orbexilum pedunculatum var. pedunculatum	*FACU*	ORBE PEDU	Sampson's snakeroot	FABACEAE	herb	5
Oxalis dillenii	*no data*	OXAL DILL	yellow wood sorrel	OXALIDACEAE	herb	3
Oxalis stricta	*FACU*	OXAL STRI	yellow wood sorrel	OXALIDACEAE	herb	27
Oxalis violacea	*no data*	OXAL VIOL	violet woodsorrel	OXALIDACEAE	herb	5
Panicum anceps	*FAC-*	PANI ANCE	beaked panicgrass	POACEAE	herb	3
Panicum capillare	*FAC*	PANI CAPI	witchgrass	POACEAE	herb	8
Panicum dichotomiflorum	*FACW*	PANI DICH	fall panicgrass	POACEAE	herb	3
Panicum rigidulum	*FACW*	PANI RIGI	rigid panicgrass	POACEAE	herb	5
Panicum virgatum	*FAC+*	PANI VIRG	switchgrass	POACEAE	herb	3
Parthenocissus quinquefolia	*FACU*	PART QUIN	Virginia creeper	VITACEAE	woody vine	19
Paspalum dilatatum *	*FAC+*	PASP DILA	Dallisgrass	POACEAE	herb	3
Paspalum floridanum	*FACW-*	PASP FLOR	Florida crowngrass	POACEAE	herb	3
Paspalum laeve	*FACW-*	PASP LAEV	field paspalum	POACEAE	herb	3
Paspalum notatum *	*FACU+*	PASP NOTA	Bahia grass	POACEAE	herb	10
Paspalum pubiflorum	*FACW*	PASP PUBI	hairyseed crowngrass	POACEAE	herb	10
Paspalum setaceum	*FAC*	PASP SETA	thin crowngrass	POACEAE	herb	4
Passiflora incarnata	*no data*	PASS INCA	passion flower	PASSIFLORACEAE	herb	3
Passiflora lutea	*no data*	PASS LUTE	yellow passion flower	PASSIFLORACEAE	herb	19
Penstemon digitalis	*FAC*	PENS DIGI	foxglove beard-tongue	SCROPHULARIACEAE	herb	5
Penstemon tubaeflorus	*no data*	PENS TUBA	whitewand beard-tongue	SCROPHULARIACEAE	herb	3

*Persicaria hydropiper **	*OBL*	PERS HYDROPIPER	water pepper	POLYGONACEAE	herb	6
Persicaria hydropiperoides	*OBL*	ERS HYDROPIPEROIDE	wild water pepper	POLYGONACEAE	herb	3
Persicaria lapathifolia	*FACW*	PERS LAPA	pale smartweed	POLYGONACEAE	herb	3
*Persicaria longiseta **	*no data*	PERS LONG	pink smartweed	POLYGONACEAE	herb	8
*Persicaria maculosa **	*FACW*	PERS MACU	lady's-thumb	POLYGONACEAE	herb	6
Persicaria pensylvanica	*FACW*	PERS PENS	Pennsylvania smartweed	POLYGONACEAE	herb	3
Persicaria punctata	*FACW+*	PERS PUNC	dotted smartweed	POLYGONACEAE	herb	2
*Phleum pratense **	*FACU*	PHLE PRAT	timothy	POACEAE	herb	21
Phyla lanceolata	*OBL*	PHYL LANC	lanceleaf fogfruit	VERBENACEAE	herb	24
Physalis angulata	*FAC*	PHYS ANGU	smooth groundcherry	SOLANACEAE	herb	8
Physalis heterophylla	*no data*	PHYS HETE	clammy groundcherry	SOLANACEAE	herb	10
Physalis longifolia	*no data*	PHYS LONG	longleaf groundcherry	SOLANACEAE	herb	10
Physalis pubescens	*FACU*	PHYS PUBE	hairy groundcherry	SOLANACEAE	herb	3
Physostegia angustifolia	*FACW*	PHYS ANGU	false dragonhead	LAMIACEAE	herb	3
Phytolacca americana	*FACU+*	PHYT AMER	pokeweed	PHYTOLACACEAE	herb	3
Plantago aristata	*no data*	PLAN ARIS	bracted plantain	PLANTAGINACEAE	herb	3
*Plantago lanceolata **	*FAC*	PLAN LANC	English plantain	PLANTAGINACEAE	herb	3
Plantago rugelii	*FAC*	PLAN RUGE	blackseed plantain	PLANTAGINACEAE	herb	2
Plantago virginica	*FACU-*	PLAN VIRG	Virginia plantain	PLANTAGINACEAE	herb	5
Platanus occidentalis	*FACW-*	PLAT OCCI	American sycamore	PLATANACEAE	tree/sapling	12
Pluchea camphorata	*FACW*	PLUC CAMP	stinkweed	ASTERACEAE	herb	27
*Poa annua **	*FAC*	POA ANNU	annual bluegrass	POACEAE	herb	5
*Poa compressa **	*FACU-*	POA COMP	Canada bluegrass	POACEAE	herb	3
*Poa pratensis **	*FACU+*	POA PRAT	Kentucky bluegrass	POACEAE	herb	5
Polygala incarnata	***FAC-***	**POLY INCA**	**pink milkwort**	**POLYGALACEAE**	**herb**	**16**
Polygala sanguinea	*FAC-*	POLY SANG	purple milkwort	POLYGALACEAE	herb	10
Polygala verticillata	*UPL*	POLY VERT	whorled milkwort	POLYGALACEAE	herb	23
*Polygonum aviculare **	*FAC-*	POLY AVIC	knotweed	POLYGONACEAE	herb	3
Polygonum erectum	*FACU*	POLY EREC	erect knotweed	POLYGONACEAE	herb	10
Populus deltoides	*FAC+*	POPU DELT	eastern cottonwood	SALICACEAE	tree/sapling	10
Potamogeton diversifolius	*OBL*	POTA DIVE	pondweed	POTAMOGETONACEAE	herb	5
Potamogeton nodosus	*OBL*	POTA NODO	pondweed	POTAMOGETONACEAE	herb	1
Potamogeton pusillus	*OBL*	POTA PUSI	narrowleaf pondweed	POTAMOGETONACEAE	herb	11
*Potentilla recta **	*no data*	POTE RECT	rough-fruited cinquefoil	ROSACEAE	herb	5
Potentilla simplex	*FACU*	POTE SIMP	cinquefoil	ROSACEAE	herb	5
Proserpinaca palustris	*OBL*	PROS PALU	mermaid weed	HALORAGACEAE	herb	1
Prunella vulgaris ssp. lanceolata	*FAC-*	PRUN VULG	heal-all	LAMIACEAE	herb	4
Prunus munsoniana	*no data*	PRUN MUNS	wild goose plum	ROSACEAE	shrub	19
Prunus serotina	*FACU*	PRUN SERO	black cherry	ROSACEAE	tree/sapling	3
Pseudognaphalium obtusifolium	*no data*	PSEU OBTU	rabbit-tobacco	ASTERACEAE	herb	22
Pycnanthemum pilosum	*UPL*	PYCN PILO	hairy mountain mint	LAMIACEAE	herb	7
Pycnanthemum tenuifolium	*FAC-*	PYCN TENU	slender mountain mint	LAMIACEAE	herb	3
Pycnanthemum pilosum X P. tenuifolium	*no data*	PYCN PILO X TENU	hybrid mountain mint	LAMIACEAE	herb	13
Pyrrhopappus carolinianus	*no data*	PYRR CARO	false dandelion	ASTERACEAE	herb	12
*Pyrus calleryana ***	*no data*	PYRU CALL	callery pear	ROSACEAE	tree/sapling	3
Quercus +	-	QUER SP.	oak	FAGACEAE	tree/sapling	10
*Ranunculus bulbosus**	*FAC+*	RANU BULB	bulbous buttercup	RANUNCULACEAE	herb	1
Ranunculus laxicaulis	*OBL*	RANU LAXI	water plantain spearwort	RANUNCULACEAE	herb	5
Ranunculus micranthus	*FACU*	RANU MICR	rock buttercup	RANUNCULACEAE	herb	19
*Ranunculus parviflorus **	*FAC*	RANU PARV	smallflower crowfoot	RANUNCULACEAE	herb	5
*Ranunculus sardous **	*FAC+*	RANU SARD	hairy buttercup	RANUNCULACEAE	herb	3

Rhexia mariana	*FACW+*	RHEX MARI	meadow beauty	MELASTOMATACEAE	herb	10
Rhus copallinum	*NI*	RHUS COPA	winged sumac	ANACARDIACEAE	shrub	10
Rhus glabra	*no data*	RHUS GLAB	smooth sumac	ANACARDIACEAE	shrub	10
Rhynchospora harveyi	*OBL*	RHYN HARV	Harvey's beaksedge	CYPERACEAE	herb	5
Rhynchospora macrostachya	***OBL***	**RHYN MACR**	**tall horned beaksedge**	**CYPERACEAE**	**herb**	**1**
Rhynchospora recognita	*FACW*	RHYN RECO	beaksedge	CYPERACEAE	herb	14
Rorippa palustris ssp. fernaldiana	*OBL*	RORI PALU FERN	Fernald's yellowcress	BRASSICACEAE	herb	12
Rosa carolina	*FACU*	ROSA CARO	Carolina rose	ROSACEAE	shrub	3
Rosa multiflora **	*UPL*	ROSA MULT	multiflora rose	ROSACEAE	shrub	3
Rosa setigera	*FACU*	ROSA SETI	prairie rose	ROSACEAE	shrub	3
Rotala ramosior	*OBL*	ROTA RAMO	toothcup	LYTHRACEAE	herb	3
Rubus aboriginum	*no data*	RUBU ABOR	dewberry	ROSACEAE	shrub	21
Rubus laudatus	*no data*	RUBU LAUD	plains blackberry	ROSACEAE	shrub	21
Rubus satis	*no data*	RUBU SATI	dewberry	ROSACEAE	shrub	21
Rubus serissimus **	*UPL*	RUBU SERI	Himalayan blackberry	ROSACEAE	shrub	5
Rubus flagellaris	*UPL*	RUBU FLAG	northern dewberry	ROSACEAE	herb	3
Rudbeckia hirta	*FACU*	RUDB HIRT	black-eyed Susan	ASTERACEAE	herb	3
Rudbeckia subtomentosa	*FAC+*	RUDB SUBT	sweet coneflower	ASTERACEAE	herb	3
Ruellia humilis var. humilis	*FACU*	RUEL HUMI	hairy wild petunia	ACANTHACEAE	herb	3
Rumex acetosella *	*FACU+*	RUME ACET	red sorrel	POLYGONACEAE	herb	5
Rumex altissimus	*FACW*	RUME ALTI	pale dock	POLYGONACEAE	herb	4
Rumex crispus **	*FAC*	RUME CRIS	curly dock	POLYGONACEAE	herb	3
Rumex obtusifolius **	*FACU*	RUME OBTU	bitter dock	POLYGONACEAE	herb	23
Sabatia angularis	*FAC*	SABA ANGU	winged rosepink	GENTIANACEAE	herb	5
Sabatia campestris	*FACU*	SABA CAMP	prairie rosepink	GENTIANACEAE	herb	7
Sagittaria montevidensis	*OBL*	SAGI MONT	duck potato	ALISMATACEAE	herb	3
Sagittaria platyphylla	*OBL*	SAGI PLAT	delta arrowhead	ALISMATACEAE	herb	23
Salix nigra	*OBL*	SALI NIGR	black willow	SALICACEAE	tree/sapling	3
Salsola tragus *	*FACU*	SALS TRAG	Russian thistle	CHENOPODIACEAE	herb	11
Salvia lyrata	*FAC-*	SALV LYRA	cancerweed	LAMIACEAE	herb	3
Sambucus nigra ssp. canadensis	*FAC*	SAMB NIGR CANA	elderberry	CAPRIFOLIACEAE	shrub	24
Sanicula canadensis	*UPL*	SANI CANA	Canada black snakeroot	APIACEAE	herb	19
Sassafras albidum	*FACU*	SASS ALBI	sassafras	LAURACEAE	tree/sapling	3
Schedonorus arundinaceus **	*FAC-*	SCHE ARUN	tall fescue	POACEAE	herb	3
Schizachyrium scoparium	*FACU*	SCHI SCOP	little bluestem	POACEAE	herb	3
Schoenoplectus tabernaemontani	*OBL*	SCHO TABE	softstem bulrush	CYPERACEAE	herb	9
Scirpus cyperinus	*FACW*	SCIR CYPE	woolgrass bulbrush	CYPERACEAE	herb	20
Scirpus georgianus	*OBL*	SCIR GEOR	Georgia bulrush	CYPERACEAE	herb	3
Scirpus pendulus	*OBL*	SCIR PEND	drooping bulrush	CYPERACEAE	herb	5
Scleria ciliata	*FAC*	SCLE CILI	fringed nutrush	CYPERACEAE	herb	12
Scleria pauciflora var. caroliniana	*FAC+*	SCLE PAUC	fewflower nutrush	CYPERACEAE	herb	5
Scutellaria parvula var. missouriensis	*no data*	SCUT PARV MISS	glade skullcap	LAMIACEAE	herb	27
Setaria faberi *	*UPL*	SETA FABE	Chinese foxtail	POACEAE	herb	3
Setaria italica *	*FACU*	SETA ITAL	Italian foxtail	POACEAE	herb	14
Setaria parviflora	*FAC*	SETA PARV	knotroot bristlegrass	POACEAE	herb	3
Setaria pumila ssp. pumila *	*FAC*	SETA PUMI	yellow foxtail	POACEAE	herb	3
Setaria viridis *	*no data*	SETA VIRI	green bristlegrass	POACEAE	herb	23
Sherardia arvensis *	*no data*	SHER ARVE	field madder	RUBIACEAE	herb	5
Sida spinosa *	*FACU*	SIDA SPIN	prickly sida	MALVACEAE	herb	3
Sideroxylon lanuginosum	*FACU*	SIDE LANU	chittum wood	SAPOTACEAE	tree/sapling	3
Silene antirrhina	*no data*	SILE ANTI	sleepy catchfly	CARYOPHYLLACEAE	herb	19

Silphium laciniatum	*no data*	SILP LACI	compass plant	ASTERACEAE	herb	7
Sisymbrium officinale *	*no data*	SISY OFFI	hedge mustard	BRASSICACEAE	herb	5
Sisyrinchium angustifolium	*FAC*	SISY ANGU	blue-eyed grass	IRIDACEAE	herb	7
Sisyrinchium atlanticum	*FACW-*	SISY ATLA	blue-eyed grass	IRIDACEAE	herb	5
Smilax bona-nox	*FAC*	SMIL BONA	bull greenbrier	SMILACACEAE	woody vine	3
Smilax rotundifolia	*FAC*	SMIL ROTU	common greenbrier	SMILACACEAE	woody vine	19
Solanum carolinense	*FACU*	SOLA CARO	Carolina horsenettle	SOLANACEAE	herb	3
Solanum sarrachoides *	*no data*	SOLA PHYS	hairy nightshade	SOLANACEAE	herb	6
Solidago altissima	*FACU*	SOLI ALTI	tall goldenrod	ASTERACEAE	herb	3
Solidago gigantea	*FACW*	SOLI GIGA	giant goldenrod	ASTERACEAE	herb	16
Solidago rugosa	*FAC*	SOLI RUGO	wrinkleleaf goldenrod	ASTERACEAE	herb	13
Sonchus asper **	*FAC+*	SONC ASPE	spiny sowthistle	ASTERACEAE	herb	10
Sorghastrum nutans	*FACU*	SORG NUTA	Indiangrass	POACEAE	herb	3
Sorghum bicolor *	*FACU*	SORG BICO	sorghum	POACEAE	herb	15
Sorghum halepense **	*FACU*	SORG HALE	Johnsongrass	POACEAE	herb	3
Sphenopholis obtusata	*FAC+*	SPHE OBTU	prairie wedgescale	POACEAE	herb	3
Spiranthes cernua	*FACW*	SPIR CERN	nodding ladies'-tresses	ORCHIDACEAE	herb	4
Spiranthes vernalis	*FACW-*	SPIR VERN	spring ladies'-tresses	ORCHIDACEAE	herb	10
Spirodella polyrhiza	*OBL*	SPIR POLY	giant duckweed	LEMNACEAE	herb	5
Sporobolus compositus var. compositus	*UPL*	SPOR COMP COMP	rough dropseed	POACEAE	herb	4
Sporobolus compositus var. macer	*no data*	SPOR COMP MACE	creeping dropseed	POACEAE	herb	22
Sporobolus vaginiflorus var. vaginiflorus	*UPL*	SPOR VAGI	dropseed	POACEAE	herb	8
Steinchisma hians	*OBL*	STEI HIAN	gaping panicgrass	POACEAE	herb	1
Stellaria media *	*FACU*	STEL MEDI	common chickweed	CARYOPHYLLACEAE	herb	5
Strophostyles leiosperma	*no data*	STRO LEIO	wild bean	FABACEAE	herb	8
Strophostyles helvola	*FAC*	STRO HELV	amberique-bean	FABACEAE	herb	3
Stylosanthes biflora	*no data*	STYL BIFL	pencil flower	FABACEAE	herb	7
Symphoricarpos orbiculatus	*FAC-*	SYMP ORBI	coralberry	CAPRIFOLIACEAE	shrub	3
Symphyotrichum divaricatum	*OBL*	SYMP DIVA	annual aster	ASTERACEAE	herb	24
Symphyotrichum dumosum	*FAC*	SYMP DUMO	aster	ASTERACEAE	herb	1
Symphyotrichum ericoides	*UPL*	SYMP ERIC	heath aster	ASTERACEAE	herb	3
Symphyotrichum lanceolatum	*NI*	SYMP LANC	tall white ater	ASTERACEAE	herb	5
Symphyotrichum patens	*no data*	SYMP PATE	spreading aster	ASTERACEAE	herb	4
Symphyotrichum pilosum	*FAC-*	SYMP PILO	white heath aster	ASTERACEAE	herb	3
Taraxacum officinale	*FACU*	TARA OFFI	common dandelion	ASTERACEAE	herb	3
Teucrium canadense	*FACW-*	TEUC CANA	germander	LAMIACEAE	herb	10
Torilis arvensis *	*no data*	TORI ARVE	hedge parsley	APIACEAE	herb	3
Toxicodendron radicans	*FAC*	TOXI RADI	poison ivy	ANACARDIACEAE	woody vine	3
Trachelospermum difforme	*FACW*	TRAC DIFF	climbing dogbane	APOCYNACEAE	woody vine	5
Tragia ramosa	*no data*	TRAG RAMO	noseburn	EUPHORBIACEAE	herb	5
Tridens flavus var. flavus	*FACU*	TRID FLAV	purpletop tridens	POACEAE	herb	1
Tridens strictus	*FACW*	TRID STRI	longspike tridens	POACEAE	herb	1
Tridens X oklahomensis	*no data*	TRID OKLA	Oklahoma purpletop	POACEAE	herb	11
Trifolium campestre *	*no data*	TRIF CAMP	hop clover	FABACEAE	herb	5
Trifolium dubium *	*FACU-*	TRIF DUBI	low hop clover	FABACEAE	herb	5
Trifolium pratense *	*FACU-*	TRIF PRAT	red clover	FABACEAE	herb	3
Trifolium repens *	*FACU*	TRIF REPE	white clover	FABACEAE	herb	2
Triodanis perfoliata var. biflora	*no data*	TRIO PERF BIFL	round-leaved Venus' looking glass	CAMPANULACEAE	herb	19
Triodanis perfoliata var. perfoliata	*FAC*	TRIO PERF PERF	twinflower Venus' looking glass	CAMPANULACEAE	herb	5

Tripsacum dactyloides +	*FACW*	TRIP DACT	eastern gamagrass	POACEAE	herb	19
*Typha angustifolia ** *	*OBL*	TYPH ANGU	narrowleaf cattail	TYPHACEAE	herb	7
Typha domingiensis	*OBL*	TYPH DOMI	southern cattail	TYPHACEAE	herb	3
Typha latifolia	*OBL*	TYPH LATI	broadleaf cattail	TYPHACEAE	herb	14
Ulmus alata	*FACU+*	ULMU ALAT	winged elm	ULMACEAE	tree/sapling	3
Ulmus americana	*FACW*	ULMU AMER	American elm	ULMACEAE	tree/sapling	3
Valerianella radiata	*FAC*	VALE RADI	cornsalad	VALERIANACEAE	herb	5
*Verbascum thapsus **	*no data*	VERB THAP	woolly mullein	SCROPHULARIACEAE	herb	11
Verbena bracteata	*FACU-*	VERB BRAC	bigbract vervain	VERBENACEAE	herb	16
Verbena hastata	*FAC*	VERB HAST	blue vervain	VERBENACEAE	herb	3
Verbena simplex	*OBL*	VERB SIMP	vervain	VERBENACEAE	herb	5
Verbena stricta	*no data*	VERB STRI	hoary vervain	VERBENACEAE	herb	21
Verbena urticifolia	*FAC+*	VERB URTI	white vervain	VERBENACEAE	herb	5
Vernonia arkansana	*FAC*	VERN ARKA	Arkansas ironweed	ASTERACEAE	herb	10
Vernonia baldwinii	*UPL*	VERN BALD	Baldwin's ironweed	ASTERACEAE	herb	8
Vernonia missurica	*FAC+*	VERN MISS	Missouri ironweed	ASTERACEAE	herb	3
*Veronica arvensis **	*NI*	VERO ARVE	corn speedwell	SCROPHULARIACEAE	herb	5
Veronica peregrina	*FAC+*	VERO PERS	necklace weed	SCROPHULARIACEAE	herb	5
*Vicia sativa **	*FACU*	VICI SATI	common vetch	FABACEAE	herb	5
*Vicia villosa **	*no data*	VICI VILL	vetch	FABACEAE	herb	19
Viola sagittata	*FAC*	VIOL SAGI	arrowleaf violet	VIOLACEAE	herb	24
Vitis cinerea	*FACW*	VITI CINE	grayback grape	VITACEAE	herb	23
Vitis vulpina	*FAC+*	VITI VULP	fox grape	VITACEAE	woody vine	3
Vulpia octoflora	*FACU*	VULP OCTO	sixweeks fescue	POACEAE	herb	21
Wolffia brasiliensis	*OBL*	WOLF BRAS	wolffia	LEMNACEAE	herb	11
Xanthium strumarium	*FAC*	XANT STRU	cocklebur	ASTERACEAE	herb	6

Species in bold type are tracked by the ANHC. (n = 10)

Species in red font are new additions to the master list for 2016. (n=9)

***/** = nonnative/invasive species (96/477 = 20.2% of total)**

+ = native species intentionally introduced to site (n = 6)

STRATA:

tree = ≥ 5 in dbh and ≥ 20 ft tall

sapling = 0.4 to < 5 in dbh and ≥ 20 ft. tall

shrub = usually 3 to 20 ft tall; multi-stemmed brushy shrubs, small trees, and saplings

woody vine = vines that are woody

herb = graminoids, forbs, ferns, fern allies, herbaceous vines, tree seedlings

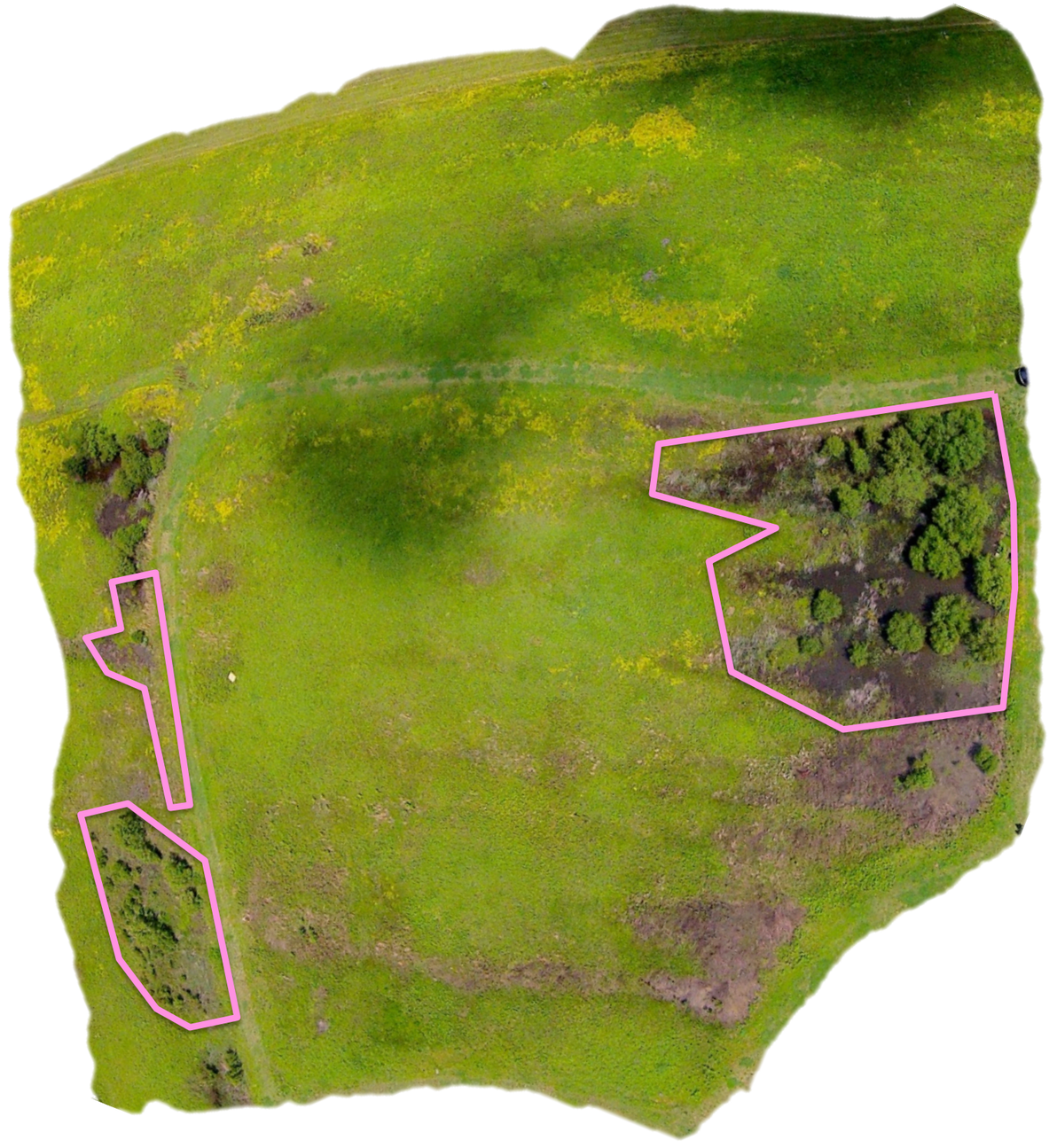
SOURCE CODES:
1 = Chris Reid, site inventory, 17 August 2001 (west side)
2 = Bruce Shackleford, plot data
3 = Theo Witsell, site inventory, 1 August 2006
4 = Theo Witsell, Fall 2006 monitoring & inventory
5 = Theo Witsell, June 2007 monitoring & inventory
6 = Theo Witsell, October 2007 monitoring & inventory
7 = Theo Witsell, May/June 2008 monitoring & inventory
8 = Theo Witsell, September 2008 inventory
9 = Theo Witsell, November 2008 monitoring & inventory
10 = Theo Witsell, July 2009 monitoring & inventory
11 = Theo Witsell, October/November 2009 monitoring & inventory
12 = Theo Witsell, July 2010 monitoring & inventory
13 = Theo Witsell, October/November 2010 monitoring & inventory
14 = Theo Witsell, July 2011 monitoring & inventory
15 = Theo Witsell, November 2011 monitoring & inventory
16 = Theo Witsell, June 2012 monitoring & inventory
17 = Theo Witsell, November 2012 monitoring & inventory
18 = Bruce Shackleford & Seth Pickens, Spring 2013 inventory
19 = Theo Witsell, June 10 & 11 2013 monitoring & inventory
20 = Theo Witsell, November 2013 monitoring & inventory
21 = Theo Witsell, July 2014 monitoring & inventory (with Rubus identified by Dr. Johnnie Gentry, U of A)
22 = Theo Witsell, November 2014 monitoring & inventory
23 = Theo Witsell, June 2015 monitoring & inventory
24 = Theo Witsell, November 2015 monitoring & inventory
25 = Theo Witsell, 13 May 2016 site visit
26 = Theo Witsell, 19 May 2016 site visit
27 = Theo Witsell, 3 & 4 July 2016 monitoring & inventory
28 = Theo Witsell, 5 & 6 November 2016 monitoring & inventory
Scientific Nomenclature according to Checklist of the Vascular Plants of Arkansas
Arkansas Vascular Flora Committee. 2006.

Appendix II
Designated Tree Removal Aerial Photographs

Wetland Cell E-1

= Clear Cut (+/- 0.36 acres)

****Note: Cut all willows in close proximity (25' or less) from berm.**



Wetland Cell E-2

= Clear Cut (+/- .30 acres)

**Note: Cut all willows in close proximity (25’ or less) from berm.

Wetland Cell E-3

= Clear Cut (+/- 0.16 acres)

**Note: Cut all willows in close proximity (25’ or less) from berm.

Wetland Cell E-4

= Designated Tree Preservation Area (+/- 0.54 acres)

= Clear Cut (+/- 1.13 acres)

**Note: Cut all willows in close proximity (25' or less) from berm.

Wetland Cell E-5

= Designated Tree Preservation Area (+/- 0.75 acres)

= Clear Cut (+/- 1.26 acres)

**Note: Cut all willows in close proximity (25' or less) from berm.

Wetland Cell W-1

= Designated Tree Perseveration Area (+/- 1.20 acres)

= Clear Cut (+/- 1.95 acres)

**Note: Cut all willows in close proximity (25’ or less) from berm.

Wetland Cell W-2

= Clear Cut (+/- .95 acres)

= Thin (cut 1 out of every 3 trees) Target smaller saplings and leave larger trees. (+/- 0.16 acres)

**Note: Cut all willows in close proximity (25’ or less) from berm.

Appendix III
Historical List Of 2006-2016 Adaptive Management Activities At Woolsey Wet Prairie

Woolsey Wet Prairie Adaptive Management Activities 2006-2016

Date	Activity
May 2006	Discontinuation of decades of cattle grazing and haying operations
May - July 2006	Construction on of earthen berms for hydrological modification
Oct. 4-11, 2006	Spot spray Bermuda, Johnson grass with Glyphosate (Roundup) - PWC, Inc.
Oct. 11-20, 2006	Basal bark spot spray honey locust, sericea lespedeza, elm with Triclopyr (Remedy) - PWC, Inc.
Mar. 2007	Installation of water level control structures/ Wetland cells drained
Apr. 27, 2007	Mow to height of 10-12 " to prevent tall fescue seed head development (OMI)
Feb. 29, 2008	Prescribed burn – Wildland, Inc.
Mar. 27, 2008	Plant tree saplings in forested wetland cells and at outfall structure
Mar. 27-Apr. 5, 2008	60 ft. Boom spray fescue with Sulfosulfuron (Outrider) - OERI
June 13, 2008	Plant approx. 10 Rattlesnake Master (*Eryngium yuccifolium)* plants from Saline County – ECO, Inc.
June 25, 2008	Plant approx. 50 tallhorned beaksedge (*Rhynchospora macrostachya*) from WWP seeds/cultured in Saline Co. – ECO, Inc.
Nov. 14, 2008	60 ft. Boom spray fescue with Sulfosulfuron (Outrider) - OERI
Feb. 19, 2009	Prescribed burn – Wildland, Inc.
Mar. 25, 2009	60 ft. Boom spray fescue with Glyphosate (Roundup) - OERI
Mar. 29, 2009	Spot spray Johnson grass with Sethoxydim (Poast) - ECO, Inc. found that Poast is not effective for Johnson grass
June – Oct. 2009	Weekly spot spraying of invasive woody vegetation (callery pear, persimmon, honey locust, elm, honeysuckle, and sericea lespedeza) with Triclopyr (Remedy); and weekly spot spraying of Bermuda and Johnson grass with Sulfosulfuron (Maverick) - OERI
Nov. 19-24, 2009	Wetland cell drawdown in preparation for prescribed burn.
Dec. 16, 2009	Prescribed burn – Wildland, Inc.
Dec. 17, 2009	Reset stop logs in water level control structures to restore water levels in wetland cells
Mar. 23, 2010	Wetland cell drawdown in preparation for herbicide application.
Apr. 9-12, 2010	60 ft. Boom spray with Clethodim (CropSmart) and spot spray with ATV - OERI
March 18, 2011	Prescribed Burn – Chloeta Fire, LLC
June 15-18, 2011	Mow tall fescue and Queen Anne's Lace around perimeter of mitigation site prior to formation of seed heads - OMI
June 16-17, 2011	Hand pull Queen Anne's Lace and curly dock on entire mitigation site - OERI
June-Sept. 2011	Monthly spot spraying of selected woody vegetation with Triclopyr (Remedy) - OERI
June-Nov. 2011	Hand cut selected black willow, honey locust, persimmon and green ash/spray cut stems with Triclopyr (Remedy) - OERI
Dec. 2011	Spot spray tall fescue with Clethodim (CropSmart) OERI
Mar. 13, 2012	Prescribed burn – Chloeta Fire, LLC
June-Sept. 2012	Monthly spot spraying of selected woody vegetation with Triclopyr (Remedy) - OERI
June-Nov. 2012	Hand cut selected black willow, honey locust, persimmon and green ash/sprayed cut stems with Triclopyr (Remedy) - OERI
Dec. 2012	Spot spray tall fescue with Clethodim (CropSmart) OERI
Feb. 13-14, 2013	Hand cut selected black willow/sprayed cut stems with Triclopyr (Remedy) - OERI
Mar. 3, 2013	Prescribed burn – Chloeta Fire, LLC
Mar. 12, 2013	Native plant seeding in all West Wetland Cells - ECO, Inc.
Apr. 4, 2013	Native plant seeding in all East Wetland Cells - ECO, Inc.
Apr. 4-5, 2013	Spray tall fescue with Clethodim (Section2EC) - ECO, Inc.
Apr. 30, 2013	Plant sprigs of Eastern gamagrass (*Tripsacum dactyloides*) within all wetland cells. – ECO, Inc.
June 14, 16-18, 2013	Spot spray curly dock, nodding thistle, and Himalayan blackberry using Triclopyr and Glyphosate and hand pulling of Queen Anne's lace – IOL
June 18, 2013	Mow tall fescue and Queen Anne's Lace around perimeter of mitigation site prior to formation of seed heads - IOL
June 28, 2013	Mow northern boundary of WWP to remove seed heads of Queen Anne's lace, nodding thistle, dallis grass, curly dock, and fescue – IOL
July 3, 2013	Hand pulling of Queen Anne's lace and thistle – IOL
July 11, 2013	Spot spray Himalayan blackberry and Johnson grass using Glyphosate and mow northern boundary of WWP to remove seed heads of Queen Anne's lace, nodding thistle, dallis grass, curly dock, and fescue – IOL
July 22, 2013	Spot spray Himalayan blackberry and Johnson grass using Glyphosate and hand pulling of Queen Anne's lace and thistle – IOL
July 25-26, 2013	Hand pulling of sericea lespedeza, and spot treatment of Himalayan blackberry using Glyphosate and Triclopyr – IOL
Aug. 8-9, 2013	Hand pulling of sericea lespedeza, and spot treatment of Himalayan blackberry using Glyphosate and Triclopyr – IOL
Aug. 14-15, 2013	Hand pulling of sericea lespedeza – IOL
Aug. 21, 2013	Spot treatment of Himalayan blackberry using Triclopyr – IOL
Sept. 5, 2013	Spot treatment of sericea lespedeza and Himalayan blackberry using Glyphosate and Triclopyr – IOL
Sept. 13, 2013	Spot treatment of sericea lespedeza and Himalayan blackberry using Glyphosate and Triclopyr – IOL
Sept. 21, 2013	Spot treatment of sericea lespedeza and Himalayan blackberry using Glyphosate and Triclopyr – IOL
Oct. 5, 2013	Spot treatment of Himalayan blackberry using Triclopyr and hand pulling of Queen Anne's lace – IOL
Oct. 23, 2013	Hand pulling of sericea lespedeza and top mowing of cocklebur to remove seed heads – IOL
Mar. 13, 2014	Prescribed burn – Wildland, LLC
March 30, 2014	Post burn treatment of fescue with Clethodim IOL
April 9, 2014	Spot treatment of curly dock with Glyphosate - IOL
April 17, 2014	Hand cutting and spot treatment of curly dock with Glyphosate - IOL
May 7, 14, & 21, 2014	Hand cutting and spot treatment of curly dock, Himalayan blackberry, Queen Anne's lace, nodding thistle, and callery pear with Glyphosate - IOL
June 3, 13, & 21, 2014	Hand cutting and spot treatment of Himalayan blackberry, Queen Anne's lace, nodding thistle, sericea lespedeza, and fescue with Glyphosate. Flail mowing of the northern and southwest buffer to control Queen Anne's lace, nodding thistle, and fescue- IOL
July 1, 18, & 25, 2014	Hand cutting and spot treatment of Himalayan blackberry, Johnson grass, and sericea lespedeza with Glyphosate. Flail mowing of the northern and southwest buffer to control sericea lespedeza, fescue, and Johnson grass - IOL
August 8, 9, 20, & 28, 2014	Spot treatment and hand pulling of sericea lespedeza and Himalayan blackberry with Glyphosate. - IOL
September 4, 12, & 19, 2014	Hand cutting/pulling and spot treatment of Queen Anne's lace, sericea lespedeza, and Himalayan blackberry with Glyphosate - IOL
March 23, 2015	Prescribed burn – Wildland, LLC
April 11, 2015	Post-burn application of Clethodim to control tall fescue on 11.2 acres - CBS
April 24 & 29, 2015	Spot treatment of Callery pear and tall fescue with Glyphosate; hand pulling of yellow-rocket - CBS
May 1, 8, 29, & 30, 2015	Spot treatment of Callery pear, tall fescue, curly dock, multiflora rose and bush honeysuckle with Glyphosate; hand pulling of curly dock- CBS
June 12, 13, 22, 26, & 27, 2015	Spot treatment of curly dock, common burdock, and small carpetgrass with Glyphosate, and Himalayan blackberry with Triclopyr; hand pulling of curly dock and Queen Anne's-lace - CBS
July 17, 24, 28, 30, & 31, 2015	Spot treatment of Johnson grass, nodding thistle, and white sweet-clover with Glyphosate; spot treatment of sericea lespedeza and Himalayan blackberry with Triclopyr; flail mowing of southwestern and northern buffers for control of sericea lespedeza and Johnson grass - CBS
August 7, 17, 28, & 29, 2015	Spot treatment of sericea lespedeza and Himalayan blackberry with Triclopyr; spot treatment of Johnson grass with Glyphosate - CBS
September 4, 10, 11, & 25, 2015	Spot treatment of sericea lespedeza with Triclopyr; spot treatment of Johnson grass with Glyphosate; hand pulling of Queen Anne's-lace - CBS
October 2 & 12, 2015	Spot treatment of sericea lespedeza with Triclopyr - CBS
March 1, & 26, 2016	Spot spray Japanese honeysuckle, bush honeysuckle, and yellow rocket with PastureGard HL –CH2MHill
March 5, 2016	Prescribed burn – Wildland, LLC
April 3, 13, 19, 22, 29, 2016	Spot spray yellow rocket, burdock, Japanese honeysuckle, bush honeysuckle, thistle, privet, curly dock, Himalayan blackberry, multiflora rose with PastureGard HL –CH2MHill
April 22 & 29, 2016	Spot spray Callery pear, multiflora rose with Remedy Ultra –CH2MHill
April 18, 2016	Post-burn application of Section 2EC to control tall fescue on 3.2 acres- CBS

May 6, 7, 12, 20, 27, 2016	Spot treatment of Callery pear with Remedy Ultra and tall fescue with Section 2EC; hand pulling of yellow-rocket - CBS
May 6, 11, 18, 2016	Spot spray curly dock, burdock, Queen Anne's lace, hedge parsley with Roundup Pro – CH2MHill
May 6, 11, 18, 26, 2016	Spot spray Callery pear, multiflora rose, Himalayan blackberry with Remedy Ultra –CH2MHill
May 6, 11, 18, 26, 2016	Spot-spray isolated patches of Johnson Grass, tall fescue, foxtail, orchard grass with Section 2EC– CH2MHill
June 15, 24, 29, 2016	Spot treatment of Callery pear, curly dock, multiflora rose and bush honeysuckle with Remedy Ultra; spot treatment of tall fescue with Section 2EC, hand pulling of curly dock - CBS
June 6, 10, 15, 20, 29, 2016	Spot-spray isolated patches of Johnsongrass & tall fescue with Section 2EC– CH2MHill
June 15, 24, 29, 2016	Spot spray curly dock, burdock, Queen Anne's lace, hedge parsley, Johnsongrass with Roundup Pro – CH2MHill
June 6, 15, 24, 29, 2016	Spot spray Callery pear, multiflora rose, Himalayan blackberry, sericea lespedeza, green ash, persimmon, locust, elm with Remedy Ultra –CH2MHill
June 10, 2016	Spot spray thistle, callery pear, Himalayan blackberry with PastureGard HL –CH2MHill
July 1, 9, 22, 23, 29, 2016	Spot treatment of curly dock, common burdock, and small carp grass with Remedy Ultra, and Himalayan blackberry and sericea lespedeza with PastureGard; hand pulling of curly dock and Queen Anne's-lace; flail mowing (2) to control above invasives in the North and West buffers - CBS
July 2, 19, 27, 2016	Boom-spray & spot spray areas of Johnsongrass & Bermuda with Section 2EC– CH2MHill
July 2, 19, 2016	Boom spray Queen Anne's lace, white sweet clover, sericea lespedeza, green ash, locust, persimmon, bush honeysuckle with PastureGard HL –CH2MHill
July 19, 2016	Boom spray south-west Buffer Area for Queen Anne's Lace; Sericea lespedeza with Roundup Pro – CH2MHill
July 27, 2016	Spot spray Himalayan blackberry, persimmon, locust, willow, green ash, sericea lespedeza with Remedy Ultra –CH2MHill
August 5, 6, 11, 26, 27, 2016	Spot treatment of Johnsongrass, nodding thistle with Roundup Pro, and white sweet-clover with Remedy Ultra; spot treatment of sericea lespedeza and Himalayan blackberry with Remedy Ultra- CBS
August 5, 11, 17 24, 2016	Boom-spray & spray gun patches of Johnsongrass with Section 2EC– CH2MHill
August 11, 2016	Boom spray NE Buffer & NE Utility Easement for Queen Anne's Lace; sericea lespedeza; sweet white clover with Roundup Pro – CH2MHill
August 4 & 17, 2016	Boom spray sericea lespedeza; spot spray sericea lespedeza; green ash, locust, persimmon, willow with PastureGard HL –CH2MHill
August 4 & 24, 2016	Spot spray Himalayan blackberry; Persimmon-Locust-Willow-Green Ash Saplings; Sericea lespedeza with Remedy Ultra – CH2MHill
September 2, 3, 14, 24, 2016	Spot treatment of sericea lespedeza and Himalayan blackberry with Remedy Ultra; spot treatment of Johnson grass with Roundup Pro; hand pulling of Queen Anne's-lace - CBS
September 9, 2016	Boom spray sericea lespedeza with PastureGard HL –CH2MHill
October 4 & 24, 2016	Spot spray sericea lespedeza; Himalayan blackberry; persimmon-locust-willow-green ash, multiflora rose with Remedy Ultra – CH2MHill
October 30, 2016	Boom spray NE Utility Easement for Bermuda & Fireline Perimeter as Non-Selective with Roundup Pro – CH2MHill
October 30, 2016	Boom-spray areas of Johnsongrass and Bermuda in SW Corner + Buffer Area with Section 2EC– CH2MHill

Appendix IV
2016 Woolsey Wet Prairie Surplus Wetland Credit Ledger Report

CITY OF FAYETTEVILLE WOOLSEY WET PRAIRIE SURPLUS WETLAND CREDITS LEDGER
SERVICE AREA: City Jurisdictional Property Within Illinois River Watershed 8-digit Hydrologic Unit Code (HUC) watershed (11110103)

Contact: Don Marr, Chief of Staff City of Fayetteville
113 West Mountain Street
Fayetteville, Arkansas 72701
479-575-8330

Entry #	Entry Date	Available Credits	Withdrawn Credits for Impact Site	Debit (Impact) Site	Date of Credit Withdrawal	Debit Site Impacts	Debit Site COE Project/Permit No.	New Credit Balance
1	06/30/13	20.90[1]	3.09[2]	Van Asche Drive Extension Terry Gulley, City of Fayetteville Transportation Services Director 479-444-3491	June 30, 2013	0.31 acres Palustrine Emergent Wetland	2012-00525	17.81
2	01/05/15	20.90	2.94[3]	Van Asche Drive Extension Terry Gulley, City of Fayetteville Transportation Services Director 479-444-3491	October 10, 2013	0.31 acres Palustrine Emergent Wetland	2012-00525-1	17.96
3	04/16/15	NA	NA	Correcting entry to change Van Asche Drive Extension contact to be Chris Brown City of Fayetteville City Engineer 479-575-8207	NA	NA	NA	NA
4	04/16/15	17.96	3.14	Clabber Creek Recreational Trail Chris Brown City of Fayetteville City Engineer 479-575-8207	April 10, 2015	0.192 acres Emergent Wetlands	2013-00322-1	14.82

[1] As per September 30, 2013 Corps Correspondence approving use of Woolsey Wet Prairie 20.90 surplus wetland credits for impacts to wetlands caused by municipal projects within the Illinois River Watershed 8-digit Hydrologic Unit Code (HUC) watershed 11110103 (Standard Permit Modification No. 1997-14207-3) contained as Attachment #1 in January 5, 2015 City of Fayetteville, AR Woolsey Wet Prairie Surplus Wetland Credit Guidance.

[2] As per February 14, 2013 initial mitigation credit work sheets submitted to Corps contained as Attachment #2 in January 5, 2015 City of Fayetteville, AR Woolsey Wet Prairie Surplus Wetland Credit Guidance.

[3] Correcting entry for final required credits for mitigation as per October 10, 2013 Van Asche Drive Project Corps of Engineers Section 404 Permit No. 2012-00525-1 contained as Attachment #3 in January 5, 2015 City of Fayetteville, AR Woolsey Wet Prairie Surplus Wetland Credit Guidance.

Entry #	Date Updated Ledger Submitted to Little Rock District Corps of Engineers	Submitted By
1	December 31, 2014	Bruce Shackleford, ECO, Inc. 501-765-9009
2	January 5, 2015	Bruce Shackleford, ECO, Inc. 501-765-9009
3		
4		

DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
POST OFFICE BOX 867
LITTLE ROCK, ARKANSAS 72203-0867
www.swl.usace.army.mil/

REPLY TO
ATTENTION OF

Regulatory Division

STANDARD PERMIT MODIFICATION NO. **1997-14207-3**

The Honorable Lioneld Jordan
Mayor of Fayetteville
113 West Mountain Street
Fayetteville, Arkansas 72701

Dear Mayor Jordan:

This letter is in response to the request by Environmental Consulting Operations, Inc. (ECO) to recalculate impacts incurred and mitigation required for Department of the Army (DA) Permit No. **1997-14207**. The project site is located in the E ½ of section 14, T. 16 N., R. 31 W., in Fayetteville, Washington County, Arkansas.

Regulatory personnel have evaluated the original authorizations, existing site conditions, and current proposal. The impacts and mitigation credits were reviewed and recalculated based off of the original 2005 mitigation proposal, with these changes/additions:

1. On the Adverse Impacts calculation, corrected Duration value for Wastewater Treatment Plant and North Broyles Road from 0.2 to 2.0.
2. On the Adverse Impacts calculation, adjusted impact acreages based on information from ECO in June 2013.
3. On the Adverse Impacts calculation, adjusted Cumulative Impact value to account for lesser impact acreage.
4. On the Restoration and Enhancement calculation, removed Eastside Line Work as there were no impacts to restore.
5. On the Restoration and Enhancement calculation, changed the Net Improvement value for the buffer areas to 0.1, per ECO.
6. On the Restoration, Enhancement, and Creation calculations, separated herbaceous and forested as well as inside berm and outside berm to maintain consistency with original proposal.
7. On the Restoration, Enhancement, and Creation calculations, adjusted the Control value to "Covenant POA," except for Westside Line Work, which cannot be deed restricted.
8. On the Creation calculation, adjusted wetland created acreage to account for additional wetlands created.
9. On the Creation calculation, adjusted Vegetation values within the berms to 0.25, and used a value of 0.1 for areas outside the berms, per ECO.

As identified on the attached 2002 Charleston Method calculation sheets, 73.57 credits are

required to mitigate for impacts to aquatic resources for the City of Fayetteville's Wastewater Treatment Plant. We have calculated that the mitigation areas have generated 94.47 wetland credits. Therefore, the city will be able to use the excess 20.90 wetland credits to mitigate for wetland impacts generated by the City of Fayetteville within the Illinois River watershed, HUC 11110103.

The additional areas (referred to as South, West, and North Buffer) cannot generate buffer credit for this project. If you are interested in expanding the mitigation area into these areas, please submit a mitigation bank prospectus and we will evaluate these areas at that time.

This project and the Woolsey mitigation area present a unique situation in which we are considering new assessments of wetland impacts for a finalized project and recalculation of credits generated from a completed mitigation area. Please note that the Corps Regulatory Division does not intend to use this approach with other permit actions. It would not be feasible to make this a standard practice with the numerous issued permits, mitigation sites, and wetland banks finalized within the Little Rock District. The mitigation assessment credits for this 43-acre site will not be reconsidered in the future.

This letter becomes a part of and should be attached to your original permit.

If you have any questions, please contact Lisa Boyle, Project Manager, at (501) 324-5295 and refer to DA Permit No. **1997-14207-3**.

Sincerely,

M. Elaine Edwards

M. Elaine Edwards
Chief, Regulatory Division

Enclosures

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Copy Furnished:
Environmental Consulting Operations, Inc.
Mr. Bruce Shackleford, w/cy permit
Arkansas Department of Environmental Quality, w/cy dwgs
Proj Mgr, Beaver Lake PO, w/cy permit
Ch, Regulatory Enf, w/cy permit
Mr. Rocky Presley, w/cy permit