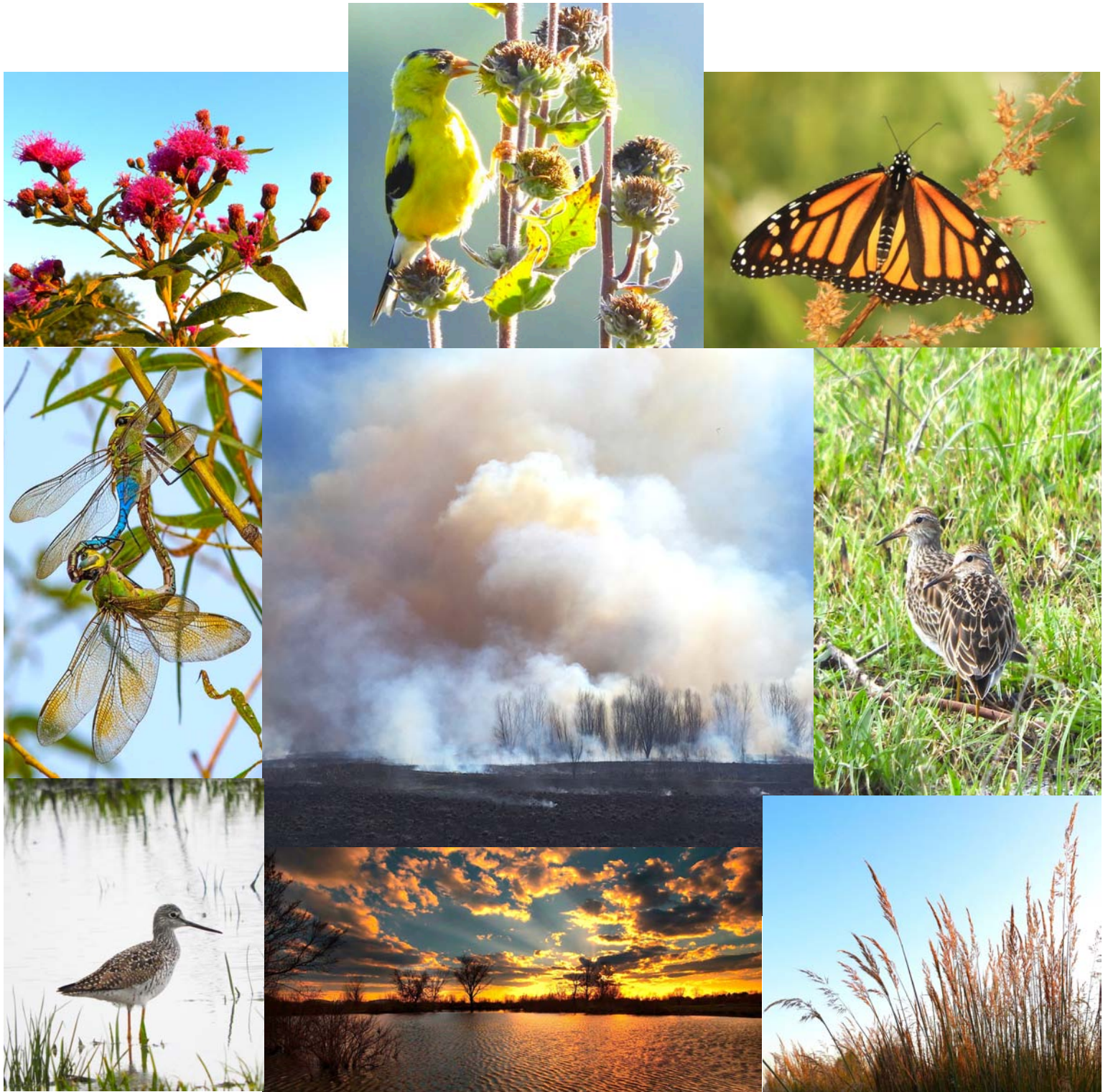
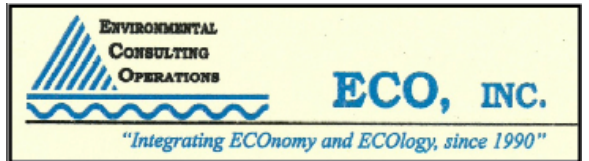


**City Of Fayetteville, Arkansas  
2017 Woolsey Wet Prairie  
Adaptive Management Strategy & Monitoring Report No. 11**



**CITY OF  
FAYETTEVILLE  
ARKANSAS**

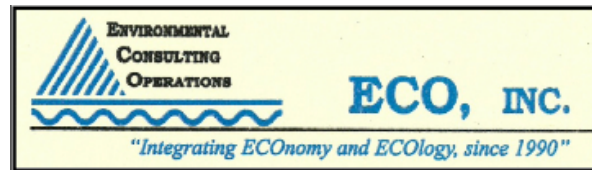


**DECEMBER 2017**

**City of Fayetteville, Arkansas  
2017 Woolsey Wet Prairie  
Adaptive Management Strategy & Monitoring Report No. 11**



**Field Monitoring, Adaptive Management Guidance, & Report Preparation  
Conducted by  
Bruce Shackelford and Seth Pickens  
Environmental Consulting Operations, Inc. Benton, Arkansas.**



**“Special Thanks” to Jeff Hickle of CH2MHill and Isaac Ogle of CBS for their  
"hands on" adaptive management hard work to make things happen!**



**Cover Photograph Credits:**

**Upper Left: Joe Neal - Missouri ironweed**

**Top Center Photo: Joe Neal -American Goldfinch**

**Upper Right Photo: Joe Neal - Monarch Butterfly**

**Center Left Photo: David Oakley - Common Green Darners**

**Center Right Photo: Joe Neal - Pectoral Sandpipers,**

**Lower Left Photo: Joe Neal - Greater Yellowlegs**

**Lower Center: Joe Sparks - Sunset at Woolsey Wet Prairie**

**Lower Right: David Oakley - Indiangrass**

**Center Photo: Bruce Shackelford February 24, 2017 Prescribed Burn -  
*Fire Brings Forth Abundant Life To Woolsey Wet Prairie***

**DECEMBER 2017**

**TABLE OF CONTENTS**

<b>Section</b>	<b>Page</b>
<b>1.0 – Introduction &amp; Project Background</b>	<b>1</b>
1.1 – Individual Section 404 Permit No. 14207	1
1.2 – Mitigation Site Concept & Team	1
1.3 – Historical Rare Plant Species Observed at Woolsey Wet Prairie Sanctuary	3
1.4 – Historical Monitoring Strategies at Woolsey Wet Prairie Sanctuary	5
<b>2.0 – 2017 Adaptive Management Activities</b>	<b>6</b>
2.1 – Mowing and Hand Cutting/Pulling	6
2.2 – Prescribed Burning	6
2.3 – Hydrological Controls	7
2.4 – Historical Herbicide Applications	8
2.5 – 2017 Timber Mulching	10
<b>3.0 – Historical Growing Season Observations</b>	<b>11</b>
3.1 – Historical Invasive Plant Species Observed at Woolsey Wet Prairie Sanctuary	11
3.1.1 – Wetland Cell E-1 Observations	11
3.1.2 – Wetland Cell E-2 Observations	12
3.1.3 – Wetland Cell E-3 Observations	12
3.1.4 – Wetland Cell E-4 Observations	12
3.1.5 – Wetland Cell E-5 Observations	13
3.1.6 – Wetland Cell W-1 Observations	13
3.1.7 – Wetland Cell W-2 Observations	14
3.2 – Overall Plant Species Richness Trends at Woolsey Wet Prairie	15
<b>4.0 – Recommended Adaptive Management Activities for 2018</b>	<b>15</b>
<b>5.0 – 2018 Existing Surplus Wetland Mitigation Credits</b>	<b>16</b>
5.1 – Background and Overview	16
5.2 – Service Area	16
5.3 – Credit Release Process	16
5.4 – Accounting Procedures For Tracking Credits	16
<b>6.0 – Appendices</b>	<b>18</b>
Appendix I – 2017 Stop Log Data for Hydrological Controls in Wetland Cells	
Appendix II – Woolsey Wet Prairie Sanctuary Herbicide Mixing/Application Rates	
Appendix III – 2013 - 2017 Wetland Cell Adaptive Management Aerial Images	
Appendix IV – Woolsey Wet Prairie 2017 Master Plant Species List	
Appendix V – 2017 Woolsey Wet Prairie Surplus Wetland Credit Ledger Report	

<b>List of Figures</b>	<b>Page</b>
Figure 1. Woolsey Wet Prairie Aerial Photograph	2

<b>List of Tables</b>	<b>Page</b>
Table 1 – Typical Seasonal Stop Log Settings	8
Table 2 – 2018 Woolsey Wet Prairie Adaptive Management Tentative Schedule	15

**CITY OF FAYETTEVILLE, ARKANSAS**  
**WOOLSEY WET PRAIRIE SANCTUARY**  
**ADAPTIVE MANAGEMENT STRATEGY & MONITORING REPORT NO. 11**

**1.0 – INTRODUCTION & PROJECT BACKGROUND**

The City of Fayetteville, Arkansas' Wastewater System Improvement Project (WSIP) entailed improvements to the City's sewer collection system, upgrading the Paul Noland Wastewater Treatment Plant (WWTP), and construction of the 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 outside the treatment area while reducing the total hydraulic loading to the system. WSIP activities involved discharges of fill into "Waters of the U.S." within the Illinois River Watershed 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 improvements to Broyles Road. The 404 permit required wetland compensatory mitigation due to the permanent alteration of 8.87 acres of wetlands. As required by the COE, the wetland mitigation site was deed restricted in perpetuity to guarantee preservation of the wetlands and upland buffers 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.

**1.2 – Mitigation Site Concept and Team**

The 43.65-acre wetland mitigation site (Figure 1) 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, AR provided civil engineering design of hydrological features and Environmental Consulting Operations, Inc. (ECO, Inc.) of Benton, AR provided ecological feature design, site management, and monitoring. Brasfield and Gorrie General Contractors completed construction of earthen berms and water level control structures. Operation of hydrological controls, herbicide applications, fire line installations, and mowing are managed through CH2M Hill Companies, Ltd. that 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 Section 404 permit compliance, develops prescribed burn and herbicide application specifications, identifies problem areas where invasive plant species need to be controlled, and conducts annual monitoring and site adaptive management strategy development.

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 within seven wetland cells. The micro-topography within the wetland cells was not disturbed or altered during the construction of the berms. The presence of depressions between prairie mounds provides a diversity of hydrology, which, in turn provides diversity in wetland and upland plant communities.

**Figure 1. Woolsey Wet Prairie Aerial Photograph**



Water level control structures with stop logs were constructed within the berms in order to provide the ability to hold and to release water as needed in order to maintain inundation/saturation within the wetland cells for the purpose of optimizing wetland plant community diversity. 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. In 2006, Bruce Shackelford, ECO, Inc. President, named the mitigation site “Woolsey Wet Prairie Sanctuary” in honor of Samuel Gilbert Woolsey, whose family settled the property in 1830 when prairies were abundant in Northwest Arkansas.

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 both wetland and upland prairie habitat in Northwest Arkansas to production of wheat 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 near complete extirpation of prairie habitat.

### **1.3 – Historical Rare Plant Species Observed 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 has been observed 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 *palmeri* and the subspecies *reverchonii* have been reported for northwestern Arkansas. Additional study is needed to determine if both subspecies are present at the site. 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 11<sup>th</sup> 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 extinction 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)

#### **1.4 – Historical Monitoring Strategies at Woolsey Wet Prairie Sanctuary**

As part of the terms and conditions included in the City of Fayetteville’s Section 404 permit, seven annual reports on the status of the mitigation site were required to be submitted to the COE. The first annual wetland monitoring report was due December 31<sup>st</sup> 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.

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, to evaluate performance standards status, and to observe the status of site hydrology. During these 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.



The results of the 2017 field observations and monitoring data are compiled 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 upcoming 2018 growing season.

In prior years, monitoring activities focused largely on evaluating species richness within each wetland cell and for the overall site. During the 2017 monitoring year, an increased focus was placed upon the evaluation of adverse impacts to the native prairie plants caused by persistent invasive plant species and the woody plant succession that was adversely affecting the prairie character of the site. Observations made during the 2016 monitoring activities were used to develop a more aggressive plan of action for controlling invasive and woody plant species in 2017. Positive results were achieved via this more aggressive adaptive management approach that will be continued throughout the 2018-growing season.

## **2.0 – 2017 ADAPTIVE MANAGEMENT ACTIVITIES**

### **2.1 – Mowing and Hand Cutting/Pulling**

The mowing at the site is aimed toward invasive species such as tall fescue (*Schedonorus arundinaceus*), Johnsongrass (*Sorghum halepense*), Dallis grass (*Paspalum dilatatum*), Queen Anne's lace (*Daucus carota*), ragweed (*Ambrosia spp.*), and sericea lespedeza (*Lespedeza cuneata*). 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. As a precautionary measure, pastures to the north, and west of the mitigation site are mowed to reduce the risk of seed dispersal of undesirable plant species from unrestored areas. The trails on top of the earthen berms are routinely mowed for the purpose of maintaining site access by the public and to control invasive plant species from forming seeds..

### **2.2 – Prescribed Burning**

To date, ten 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, March 5, 2016, and February 24, 2017. ECO, Inc. routinely 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.

Prairies existed for thousands of years, primarily because Native Americans burned the local landscapes. Research has shown that they sometimes chose the most severe weather to ignite fires in order to maintain open grasslands that attracted the large herbivores they hunted. Some fires were done during drought conditions that greatly inhibited the plant succession, killing the majority of the trees in the fires path. What remained were open grassland prairies with scattered post oak (*Quercus stellata*) savannas (very low density tree areas) that had an understory of native prairie grasses and forbs. The post oaks prevailed because they were the most fire-resistant tree species in the Ozarks. Unlike the use of fire by Native Americans during drought conditions, the prescribed burns at Woolsey Wet Prairie must be conducted under safe conditions due to the urban-interface setting, and when there are no burn bans issued by the Arkansas Forestry Commission.

Prescribed burns help maintain a fire dependent prairie ecosystem, but they are likely not as hot and as intense as historical fires of Native American origin and do not kill a large number of trees. Furthermore, due to the fact that Woolsey has an abundance of wetland areas, thorough burning of stands of black willow (*Salix nigra*) and green ash (*Fraxinus pennsylvanica*) are often difficult to achieve due to moisture levels in the ground and vegetation. Therefore, we supplement the prescribed burning with herbicide applications to control the woody vegetation.

### **2.3 – 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 1 below shows the typical seasonal stop log settings. Stop logs are typically set to lower water levels in December in preparation for the February to March prescribed burn, then returned to their original settings after the prescribed burn.

In early 2017 water levels were maintained 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 were re-set to maintain higher water levels through the remainder of the growing season. However, the wetland cells were very dry in the autumn months, due to drought conditions that prevailed until mid-November. Maintaining too much water is to be avoided, as it can make access to herbicide applications to woody vegetation more difficult. The 2017 stop log data are contained in Appendix 1.

**Table 1 – Typical Seasonal Stop Log Settings**

Wetland Cell	June-November	December –May
E-1	7:5	7
E-2	7:7	7:5
E-3	7:7	7:5
E-4	7:5	7
E-5	7:5	7
W-1	7:7	7
W-2	N/A	N/A

#### **2.4 – Historical Herbicide Applications**

ECO, Inc. routinely develops specifications for the types of herbicides and adjuvants to be applied for each targeted invasive plant species group. Use of broad-spectrum herbicides are avoided when practicable, but used on occasion. 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 UTV mounted spray equipment.

Historically, the predominate recurring and persistent non-native and invasive grasses to which herbicides have been applied, include:

- **tall fescue**
- **Johnsongrass**
- **small carpetgrass (*Arthraxon hispidus*)**
- **southern crabgrass (*Digitaria ciliaris*)**
- **smooth crabgrass (*Digitaria ischaemum*)**
- **Bermuda grass (*Cynodon dactylon*)**

During pre-construction and early post-construction periods (pre-2006 through 2010) the very invasive tall fescue was the dominant plant species, due to the fact that the site was previously a hay pasture. Tall fescue has a wetland indicator status of FAC- and is capable of dominating wet meadow areas, significantly reducing native plant species richness. It is a cool season grass and actively begins photosynthesis very early in the growing season. It goes dormant during hot dry weather and actively grows in the fall even after several killing frosts. This provides an advantage in vegetation management since the fescue can have herbicide applied at a time when native plant species are dormant. It has been observed that three to four weeks after the late winter/early spring burns are a critical time to apply herbicides on the fescue.

Recurring and persistent non-native and invasive broadleaf forbs to which herbicides have been applied, include:

- **sericea lespedeza**
- **white sweet clover (*Melilotus albus*)**
- **curly dock (*Rumex crispus*)**
- **bitter dock (*Rumex obtusifolius*)**
- **nodding thistle (*Carduus nutans*)**
- **Japanese honeysuckle (*Lonicera japonica*)**
- **wooly mullein (*Verbascum Thapsus*)**
- **narrowleaf cattail (*Typha angustifolia*)**
- **Queen Anne's lace**
- **common thistle (*Cirsium vulgare*)**
- **yellow rocket (*Barbarea vulgaris*)**

Herbicide applications to woody plant species have primarily focused upon black willow, green ash (*Fraxinus pennsylvanica*), and persimmon (*Diospyros virginiana*). Complete eradication of these woody plants has been part of an ongoing vegetation management objective, but is a difficult task to achieve. In the past, selected stands of black willows have routinely been cut, with cut stumps sprayed with herbicide for the intent of a complete kill of individual trees; while green ash and persimmon saplings have had foliar and basal bark applications of herbicides.

Historically, the predominate recurring and persistent non-native and invasive woody plants to which herbicides have been applied, include:

- **black willow**
- **green ash**
- **persimmon**
- **callery pear (*Pyrus calleryana*)**
- **honey locust (*Gleditsia triacanthos*)**
- **winged elm (*Ulmus alata*)**
- **American elm (*Ulmus americana*)**
- **multiflora rose (*Rosa multiflora*)**
- **Chinese privet (*Ligustrum sinense*)**
- **bush honeysuckle (*Lonicera maackii*)**
- **Himalayan blackberry (*Rubus serissimus*)**

During 2016 monitoring activities, it became more apparent to ECO, Inc. that the rate of black willow, persimmon, and green ash stand expansion exceeded the rate of black willow cutting/spraying/eradication. As a part of developing the 2016 Woolsey Wet Prairie Adaptive Management Strategy & Monitoring Report No. 10, ECO, Inc. reviewed tree density information and recommended a more aggressive tree removal strategy to control woody plant succession. This was further discussed during the annual pre-growing season Woolsey Wet Prairie Adaptive Management Planning and Strategy Meeting with individuals from the City of Fayetteville and CH2MHill on February 8, 2017.

The increase in woody plant density is problematic, because the woody growth outcompetes 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. The expanding stands of woody vegetation posed a threat to the prairie ecosystem character of the site to the point that if allowed to continue, the site would become a forest. As observed during the 2016 monitoring season, 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.

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, alone. Therefore, additional adaptive management tools became necessary, such as mechanical clearing and/or more aggressive herbicide applications. As observed in 2016, much of the woody vegetation had grown too large to be controlled with herbicide applications. Consequently, the use of both mechanical treatments and herbicides became necessary.

The consequences of not controlling tree growth and density on the site include the following:

- The Corps of Engineers Little Rock District has allowed the City of Fayetteville to use surplus credits to offset wetland losses from city infrastructure improvements projects. The existence of surplus wetland mitigation credits is based upon maintaining specific habitat types. In general, more surplus credits are generated via restoration and creation of herbaceous wetlands as compared to forested wetland creation. The significant increase of willow/green ash stands displaces herbaceous wetlands, thereby resulting in a loss of surplus wetland credits.
- 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 was no longer present in Wetland Cell W-1, due to being shaded out by black willows. Should the over-story shading effect of the willows not be substantially contained, 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.

It is imperative to use the appropriate concentrations and application rates of herbicides to effectively control invasive plant species. A general guide for preparing herbicide mixtures is contained in the Appendix II Woolsey Wet Prairie Sanctuary Herbicide Mixing/Application Rates Table. Any personnel who are applying herbicides at Woolsey Wet Prairie shall also be advised to closely read each herbicide label and contact ECO, Inc. should they have any questions.

### **2.5 – 2017 Timber Mulching**

During early 2016, ECO, Inc. developed a revised adaptive management strategy whereby a minimum of 2.26 acres of forested areas are to be maintained in order to comply with COE Section 404 permit requirements for compensatory mitigation of forested wetlands that were permanently altered during the construction of the City's WSIP.

In order to quickly mitigate this issue, Isaac Ogle of Comprehensive Botanical Services based in Fayetteville, Arkansas was contracted by CH2MHill to conduct timber mulching of the black willow, persimmon, and green ash stands at specific areas on the site. “Designated Tree Preservation Areas” were established within Wetland Cells E-4, E-5, and W-1 that totaled 2.5 acres where no controls would be exercised on native trees and saplings. This provides a small buffer for the required 2.26-forested acres. Designated Tree Preservation Areas for each wetland cell are shown in Appendix III.

The timber mulching was conducted during January and February of 2017 prior to the prescribed burn, leaving dense piles of wood chips where the dense stands of trees once stood, greatly opening up and improving the view scape across the site, while restoring the mudflats used by many migratory shorebird species during the spring. Approximately 6.5 acres of trees were removed during the timber mulching activities. Following what was perhaps one of the hottest and most thorough prescribed burns in the history of Woolsey Wet Prairie on February 24, 2017, the dense piles of wood chips left behind by the timber mulching were completely burned leaving open mudflats as preferred shorebird habitat.

### **3.0 – HISTORICAL GROWING SEASON OBSERVATIONS**

#### **3.1 – Historical Invasive Plant Species Observed at Woolsey Wet Prairie Sanctuary**

The following sections describe observations for each wetland cell during the 2017 growing season. For purposes of adaptive management at Woolsey Wet Prairie, invasive plant 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. Field observations of invasive plant species are indicated on a cell-by-cell basis for 2013 through 2017, as shown by the aerial images contained within Appendix III.

##### **3.1.1 – Wetland Cell E-1 Observations**

The Appendix III Wetland Cell E-1 image shows a progression of invasive plant species infestations within Wetland Cell E-1 from 2013 through 2017.

Historically, the invasive species that have posed the greatest problem since 2013 include sericea (lespedeza), white sweet clover, and Johnsongrass. As noted in the aerial image, the densities of these species have been significantly reduced compared to the 2014 and 2015 growing seasons. However, continued control of these species needs to be maintained.

In the last two years, persistent stands of woody plants that have increased in size, shading out desirable native plant species, include persimmon, black willow, and green ash. Isolated individual woody plant species that are targeted for control include callery pear, honey locust, and elm species, in order to keep them from spreading. Approximately 0.36 acres of dense stands of green ash and black willow that previously existed within the northeast corner and along the western berm were removed via timber mulching in January – February 2017 and have exhibited minimal regrowth. However, a small stand of persimmon and honey locust saplings is emerging in the northwest corner of Wetland Cell E-1 that needs to be controlled with herbicides during the 2018 growing season.

### **3.1.2 – Wetland Cell E-2 Observations**

The Appendix III Wetland Cell E-2 image shows a progression of invasive plant species infestations within Wetland Cell E-2 from 2013 through 2017.

Historically, the invasive species that have posed the greatest problem since 2013 include sericea lespedeza, white sweet clover, nodding thistle, Japanese honeysuckle, Himalayan blackberry, and Johnsongrass. As noted in the Wetland Cell E-2 image, the densities of these species have been significantly reduced compared to the 2014 and 2015 growing seasons. However, continued control of these species needs to be continued.

In the last two years, persistent stands of black willow have increased in size, shading out desirable native plant species. Approximately 0.3 acres of dense stands of black willow that previously existed within the northeast corner were removed via timber mulching in January – February 2017 and have exhibited minimal regrowth.

### **3.1.3 – Wetland Cell E-3 Observations**

The Appendix III Wetland Cell E-3 image shows a progression of invasive plant species infestations within Wetland Cell E-3 from 2013 through 2017.

Historically, the invasive species that have posed the greatest problem since 2013 have primarily been sericea lespedeza and white sweet clover, with scattered stems of callery pear saplings.

As noted the Wetland Cell E-3 image, the densities of these species have been significantly reduced in 2017 compared to the 2014 through 2016 growing seasons. However, continued control of these species will need to be maintained.

In the last two years, persistent stands of black willow have increased in size, shading out desirable native plant species. Approximately 0.16 acres of dense stands of black willow that previously existed within the north end of the cell were removed via timber mulching in January – February 2017 and have exhibited minimal regrowth.

### **3.1.4 – Wetland Cell E-4 Observations**

The Appendix III Wetland Cell E-4 image shows a progression of invasive plant species infestations within Wetland Cell E-4 from 2013 through 2017.

Historically, the invasive species that have posed the greatest problem since 2013 have included sericea lespedeza, white sweet clover, Himalayan blackberry, and Japanese honeysuckle with scattered stems of callery pear saplings.

As noted the Wetland Cell E-4 image, the densities of these species have been significantly reduced in 2017 compared to the 2013 through 2016 growing seasons. However, continued control of these species will need to be maintained.

The highly invasive small carpetgrass that was found for the first time to the west of the western berm of Cell E-4 was found to have persisted and expanded in 2016. More aggressive herbicide applications were made in 2017 and it will be important to continue to monitor this species and to

keep it controlled. 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.

In the last two years, persistent stands of black willow and green ash have increased in size, shading out desirable native plant species. Approximately 1.13 acres of dense stands of black willow and green ash that previously existed within the north end of the cell were removed via timber mulching in January – February 2017 and have exhibited minimal regrowth.

This wetland cell has approximately 0.54 acres of designated Tree Preservation Areas where woody vegetation is allowed to grow in order to meet COE compensatory requirements for permanent alterations to forested wetlands during construction of the WSIP.

### **3.1.5 – Wetland Cell E-5 Observations**

The Appendix III Wetland Cell E-5 image shows a progression of invasive plant species infestations within Wetland Cell E-5 from 2013 through 2017.

Historically, the invasive species that have posed the greatest problem since 2013 have included sericea lespedeza and Himalayan blackberry with scattered stems of callery pear saplings.

As noted in the Wetland Cell E-5 image, the densities of these species have been significantly reduced in 2017 compared to the 2013 through 2016 growing seasons. However, continued control of these species will need to be maintained.

In the last two years, persistent stands of black willow and green ash have increased in size, shading out desirable native plant species. Approximately 1.26 acres of dense stands of black willow and green ash that previously existed throughout the cell were removed via timber mulching in January – February 2017 and have exhibited minimal regrowth. However, woody plant saplings are beginning to emerge at other locations within the cell, as shown in the Wetland Cell E-5 image, that will need to be controlled during the 2018-growing season.

This wetland cell has approximately 0.75 acres of designated Tree Preservation Areas where woody vegetation is allowed to grow in order to meet COE compensatory requirements for permanent alterations to forested wetlands during construction of the WSIP.

### **3.1.6 – Wetland Cell W-1 Observations**

The Appendix III Wetland Cell W-1 image shows a progression of invasive plant species infestations within Wetland Cell W-1 from 2013 through 2017.

Historically, the invasive species that have posed the greatest problem since 2013 have included sericea lespedeza, Himalayan blackberry, and white sweet clover with scattered stems of callery pear saplings.



As noted in the Wetland Cell W-1-image, the densities of these species have been significantly reduced in 2017 compared to the 2013 through 2016 growing seasons. However, continued control of these species will need to be maintained.

In the last two years, persistent stands of black willow and green ash have increased in size, shading out desirable native plant species. Approximately 1.95 acres of dense stands of black willow and green ash that previously existed throughout the cell were removed via timber mulching in January – February 2017 and have exhibited minimal regrowth. However, woody plant saplings are beginning to emerge at other locations within the cell, as shown in the Wetland Cell W-1- image, that will need to be controlled during the 2018-growing season.

This wetland cell has approximately 1.2 acres of designated Tree Preservation Areas where woody vegetation is allowed to grow in order to meet COE compensatory requirements for permanent alterations to forested wetlands during construction of the WSIP.

An infestation of small carpetgrass, first observed in this cell in 2016, needs to be closely watched and controlled during the 2018 growing season.

### **3.1.7 – Wetland Cell W-2 Observations**

The Appendix III Wetland Cell W-2 image shows a progression of invasive plant species infestations within Wetland Cell W-2 from 2013 through 2017.

Historically, the invasive species that have posed the greatest problem since 2013 have included sericea lespedeza, Himalayan blackberry, and Johnsongrass with scattered stems of callery pear and honey locust saplings. 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, Chinese privet, bush honeysuckle, Himalayan blackberry, Japanese honeysuckle and winter creeper (*Euonymus fortunei*). These species are still persistent, but the density has been greatly reduced.

Winter creeper was found to be present in the tree line located at the Southwest corner of Wetland Cell W-2 and responded positively to treatments using the herbicide PastureGard HL.

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 during the 2018 growing season.

As noted in the Wetland Cell W-2 image, the densities of these species have been significantly reduced in 2017 compared to the 2013 through 2016 growing seasons. However, continued control of these species will need to be maintained.

In October 2017, the very invasive Chinese Silver Grass (*Miscanthus sinensis*) was found for the first time at the site in the southeast corner of Wetland Cell W-2 just west of the old farm pond. The tall clumps of Chinese Silver Grass were treated using the herbicide Outrider. The GPS location of the clumps were recorded and the area will be observed following the spring 2018 burn to treat any returning individuals as soon as they emerge from dormancy.

In the last two years, persistent stands of black willow and green ash have increased in size, shading out desirable native plant species. Approximately 0.95 acres of dense stands of black willow and green ash that previously existed throughout the cell were removed via timber mulching in January – February 2017 and have exhibited minimal regrowth. However, woody plant saplings are beginning to emerge at other locations within the cell, as shown in the Wetland Cell W-2 image, that will need to be controlled during the 2018-growing season.

**3.2 - Overall Plant Species Richness Trends at Woolsey Wet Prairie**

Inventory and monitoring work findings in 2017 resulted in the addition of two new plant species not previously observed at the site. Among the 2017 additions were Appalachian blazing star (*Liatris squarrulosa*) and Chinese silvergrass.

To date, a total of 479 plant species have been observed at Woolsey Wet Prairie since 2001. Of these, 97 (20.3%) species are considered to be non-native and/or invasive species, and 382 (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 479 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 2018 Woolsey Wet Prairie Master Plant Species List is contained within Appendix IV.

**4.0 – RECOMMENDED ADAPTIVE MANAGEMENT ACTIVITIES FOR 2018**

Based upon observations made during the 2017, and previous growing seasons, the anticipated general adaptive management activities for 2018 are contained in Table 2.

**Table 2 – 2018 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 in preparation for the prescribed burn, as needed.
February through March	Conduct prescribed burn
	Reset stop logs to retain more water in wetland cells after prescribed burn.
	Observe re-emergence of tall fescue in 3-4 weeks after burn and apply Section 2-EC when tall fescue is 4-6 inches tall. Spray tall fescue with after prescribed burn and before native plants come out of dormancy.
March through April	Observe site for the emergence of yellow rocket, bull thistle, burdock, bush honeysuckle, and Japanese honeysuckle. Treat with PastureGard HL.
Late-March through September	Observe site for emergence of woody vegetation, including Himalayan blackberry, black willow saplings, green ash saplings, callery pear saplings, and honey locust saplings, all of which are to be treated using basal bark spray with Remedy Ultra for terrestrial and dry areas, or Renovate 3 for areas of standing water.
	Spray sericea lespedeza with PastureGard HL.
	Evaluate site for presence of yellow rocket; control via top-cutting/hand pulling/spray with Remedy Ultra.
May through September	Observe site for emergence of white sweet clover (previously observed in Wetland Cells E-1, E-2, and E-3 along the inner portions of the berms); treat with PastureGard HL.
	Evaluate site for presence of carpet grass and spray with 1.0% Section 2EC, or 0.25% Outrider.
	Adjacent (west and north) fescue fields to be mowed before tall fescue goes to seed
June through September	Spot spray Johnsongrass with Outrider.
	Hand pull curly dock & Queen Anne’s lace.

\* The appropriate concentrations and application rates of herbicides summarized in the Appendix II Woolsey Wet Prairie Sanctuary Herbicide Mixing/Application Rates should be followed.

## **5.0 – 2018 EXISTING SURPLUS WETLAND MITIGATION CREDITS**

### **5.1 – 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.

### **5.2 – 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.

### **5.3 – 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.

### **5.4 – 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 Ashe 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 or 2017; therefore, a balance of 14.82 surplus credits remains. The current surplus wetland credit ledger report for Woolsey Wet Prairie through 2017 is contained in Appendix V.

## **6.0 – Appendices**

**Appendix I**  
**2017 Stop Log Data For**  
**Hydrological Controls In Wetland Cells**



**Appendix II**  
**Woolsey Wet Prairie Sanctuary**  
**Herbicide Mixing/Application Rates**

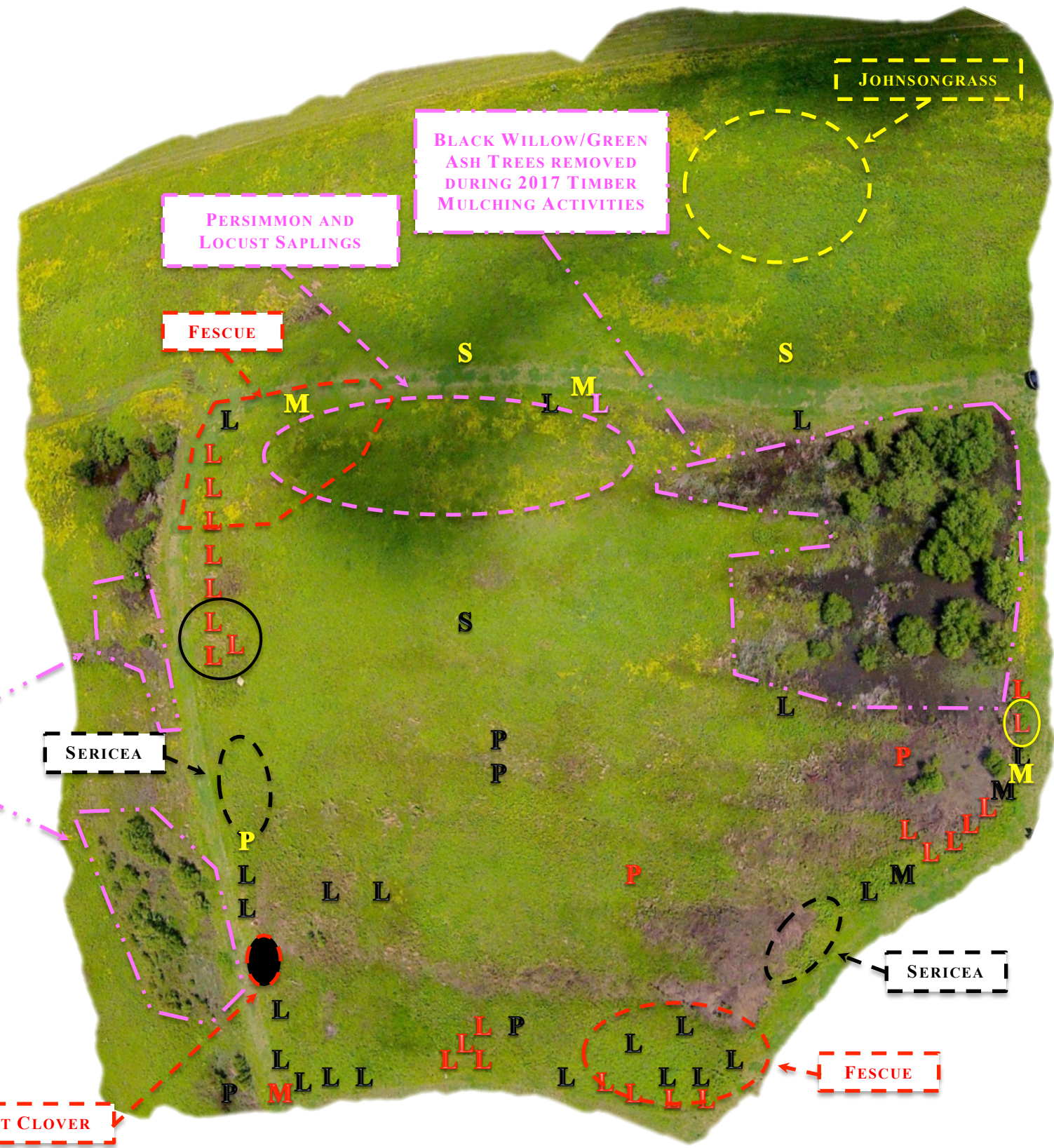


**WOOLSEY WET PRAIRIE SANCTUARY HERBICIDE MIXING/APPLICATION RATES**

<b>Herbicide</b>	<b>Target Species</b>	<b>Label Mixing Rate for Spot Spray Control of Target Plant Species</b>
<b>Remedy Ultra (60.45% triclopyr)</b>	<b>Broadleaf Weeds</b>	<b>3.2 fl. oz. Remedy Ultra + 0.68 fl. oz. surfactant + 124 fl. oz. water of water = 128 fl. oz. = 1 gal. of 2.5% mixture</b>
<b>Remedy Ultra</b>	<b>Woody Plants</b>	<b>32 fl. oz. Remedy Ultra + 96 fl. oz. Oil Carrier (in lieu of water + surfactant) = 1 gal. of 25% mixture.  Can be mixed with a penetrant such as Cide-kick in enough oil to make the desired volume of spray mixture to penetrate the cuticle of the woody plant, allowing more herbicide to translocate to the root system. Oil carrier should be a petroleum-based oil, or a vegetable oil concentrate. DO NOT use diesel or kerosene at Woolsey Wet Prairie. For basil bark spraying (stems &lt; 6 inches in diameter, thoroughly wet the base and root collar of all stems to a height of 12 to 15 inches, but not to the point of runoff.</b>
<b>PastureGard HL (45% triclopyr + 15.56% fluroxypyr)</b>	<b>Broadleaf Weeds; Herbicide of choice for sericea lespedeza and white sweet clover</b>	<b>1.35 fl. oz. PastureGard HL + 0.68 fl. oz. surfactant + 127 fl. oz. water = 128 fl. oz. = 1 gal. = 1.0% mixture.</b>
<b>PastureGard HL</b>	<b>Woody Plants Cut stump/basal bark</b>	<b>32 fl. oz. PastureGard HL + 96 fl. oz. Oil Carrier (in lieu of water + surfactant) = 1 gal. 25% mixture PastureGard HL. Can be mixed with a penetrant such as Cide-kick in enough oil to make the desired volume of spray mixture to penetrate the cuticle of the woody plant, allowing more herbicide to translocate to the root system. Oil carrier should be a petroleum-based oil, or a vegetable oil concentrate. DO NOT use diesel or kerosene at Woolsey Wet Prairie. For basil bark spraying (stems &lt; 6 inches in diameter, thoroughly wet the base and root collar of all stems to a height of 12 to 15 inches, but not to the point of runoff.</b>
<b>Renovate® 3 (44.4% trichlopry)</b>	<b>Woody Plants: Allowable to spray over water basal bark or cut surface treatment</b>	<b>Can be applied either undiluted or diluted in a 1 to 1 ratio with water and sprayed where the mixture will completely surround the tree trunk. Cide-Kick to be mixed with Renovate 3 as a penetrant to increase bark penetration.</b>
<b>Roundup Pro Concentrate (50.2% glyphosate)</b>	<b>Broad-spectrum non-selective chemical used to control both grasses and forbs.</b>	<b>Use a 1.6% solution for harder to control perennials such as Bermuda grass, dock, thistle, sericea, etc. This would be the equivalent of 2.1 fl. oz. Roundup Pro Concentrate in 125.9 fl. oz. of water to make one gallon of spray mix. Roundup Pro Concentrate already contains a 13% surfactant so none should be added.</b>
<b>Section 2EC (26.4% clethodim )</b>	<b>Grasses; best herbicide for tall fescue, especially in moist soils because it will not harm rushes.</b>	<b>Mix 1.2 fl. oz. Section 2 EC + 1.66 fl. oz. Superb HC surfactant + 0.4 fl. oz. Mystic HC dye + 125 fl. oz. water = 1 gal. of 1% mixture.</b>
<b>Outrider (75% clethodim)</b>	<b>Grasses; best herbicide for Johnsongrass In upland habitat.</b>	<b>Mix 0.25 fl. oz. Outrider + 0.1 fl. oz. nonionic surfactant + 127 fl. oz. water = 1 gal. of 0.2% mixture</b>

**Appendix III**  
**2013 - 2017 Wetland Cell**  
**Adaptive Management Aerial Images**

# 2013 – 2017 Invasive Species Monitoring Map Wetland Cell E-1



## LEGEND:

BLUE – 2013

RED – 2014

BLACK – 2015

YELLOW – 2016

PINK – 2017

L – SERICEA LESPEDEZA (*LESPEDEZA CUNEATA*)

M – WHITE SWEET CLOVER (*MELILOTUS ALBUS*)

P – CALLERY PEAR (*PYRUS CALLERYANA*)

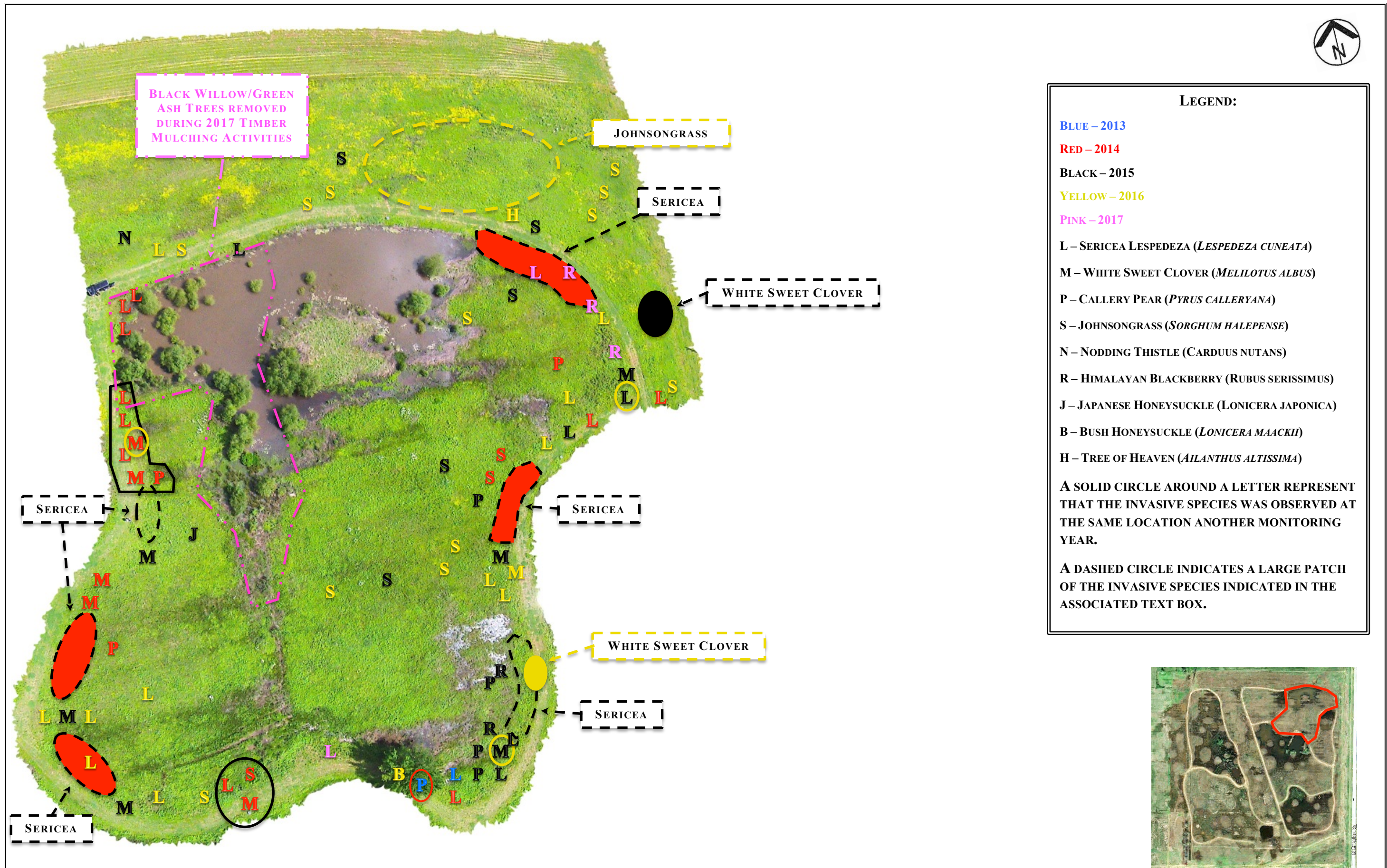
S – JOHNSONGRASS (*SORGHUM HALEPENSE*)

A SOLID CIRCLE AROUND A LETTER REPRESENT THAT THE INVASIVE SPECIES WAS OBSERVED AT THE SAME LOCATION ANOTHER MONITORING YEAR.

A DASHED CIRCLE INDICATES A LARGE PATCH OF THE INVASIVE SPECIES INDICATED IN THE ASSOCIATED TEXT BOX.



2013 – 2017 Invasive Species Monitoring Map Wetland Cell E-2



**LEGEND:**

BLUE – 2013

RED – 2014

BLACK – 2015

YELLOW – 2016

PINK – 2017

L – SERICEA LESPEDEZA (*LESPEDEZA CUNEATA*)

M – WHITE SWEET CLOVER (*MELILOTUS ALBUS*)

P – CALLERY PEAR (*PYRUS CALLERYANA*)

S – JOHNSONGRASS (*SORGHUM HALEPENSE*)

N – NODDING THISTLE (*CARDUS NUTANS*)

R – HIMALAYAN BLACKBERRY (*RUBUS SERISSIMUS*)

J – JAPANESE HONEYSUCKLE (*LONICERA JAPONICA*)

B – BUSH HONEYSUCKLE (*LONICERA MAACKII*)

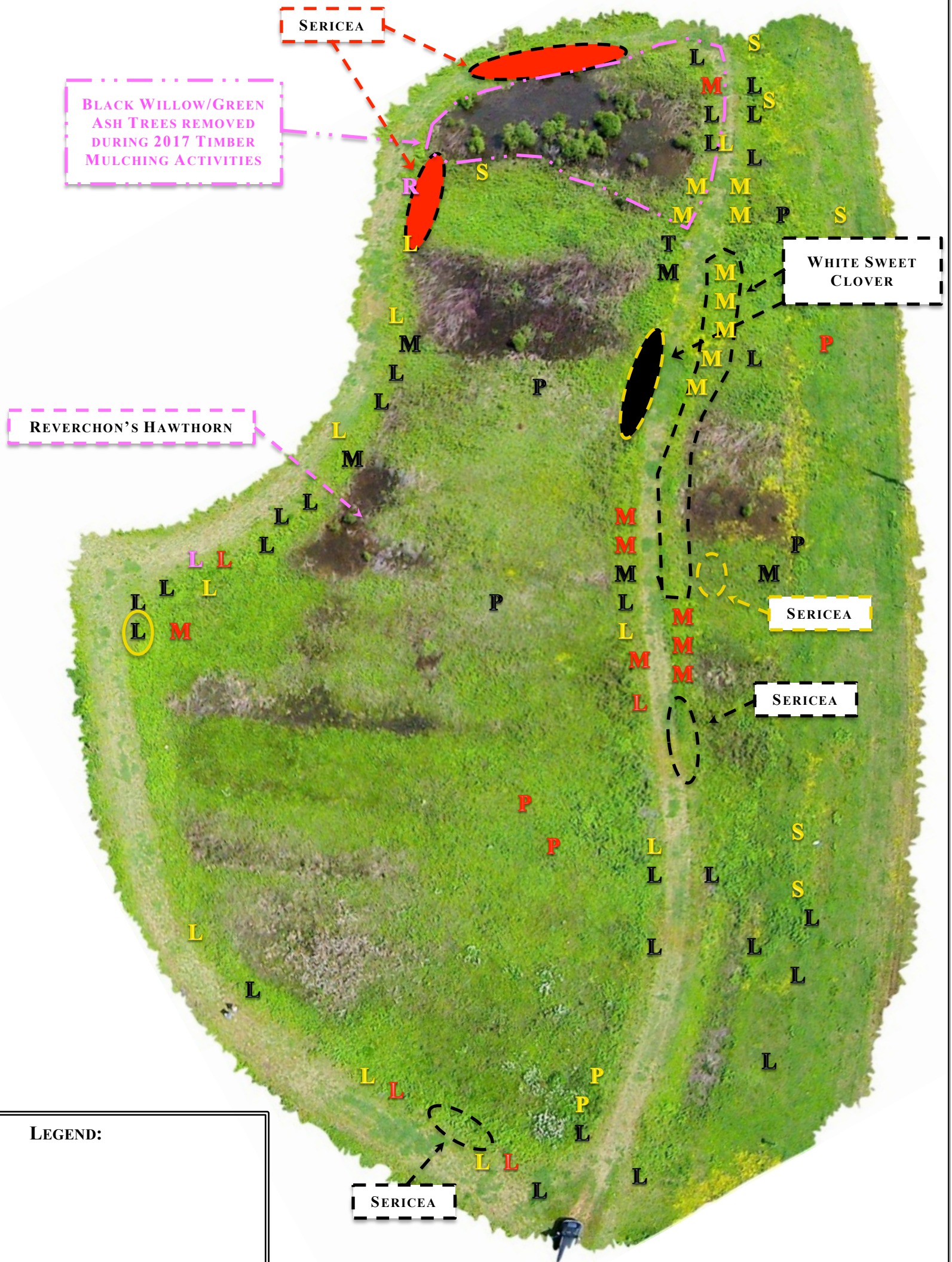
H – TREE OF HEAVEN (*AILANTHUS ALTISSIMA*)

A SOLID CIRCLE AROUND A LETTER REPRESENT THAT THE INVASIVE SPECIES WAS OBSERVED AT THE SAME LOCATION ANOTHER MONITORING YEAR.

A DASHED CIRCLE INDICATES A LARGE PATCH OF THE INVASIVE SPECIES INDICATED IN THE ASSOCIATED TEXT BOX.



2013 – 2017 Invasive Species Monitoring Map Wetland Cell E-3



LEGEND:

BLUE – 2013

RED – 2014

BLACK – 2015

YELLOW – 2016

PINK – 2017

L – SERICEA LESPEDEZA (*LESPEDEZA CUNEATA*)

M – WHITE SWEET CLOVER (*MELILOTUS ALBUS*)

P – CALLERY PEAR (*PYRUS CALLERYANA*)

S – JOHNSONGRASS (*SORGHUM HALEPENSE*)

N – NODDING THISTLE (*CARDUS NUTANS*)

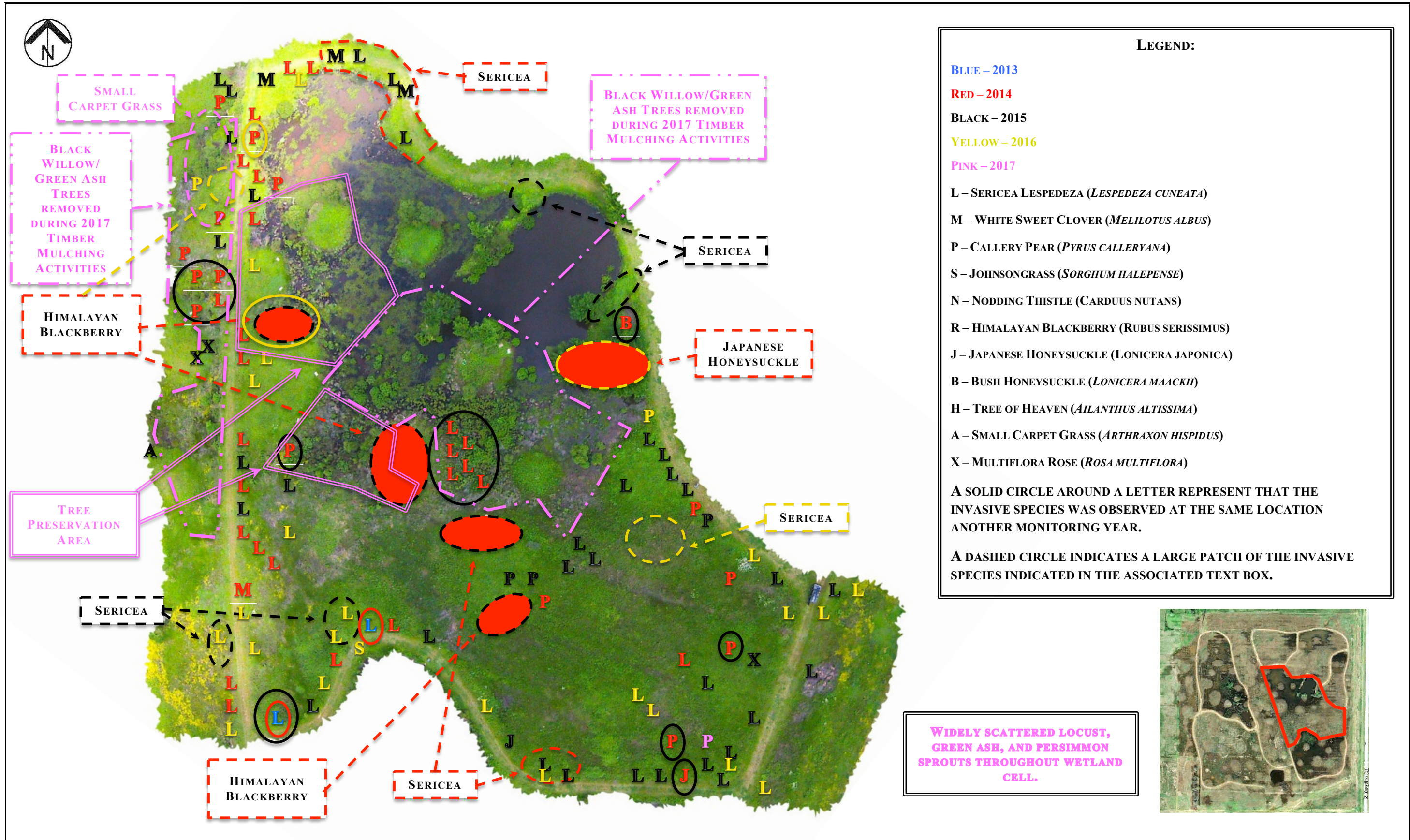
R – HIMALAYAN BLACKBERRY (*RUBUS SERISSIMUS*)

A SOLID CIRCLE AROUND A LETTER REPRESENT THAT THE INVASIVE SPECIES WAS OBSERVED AT THE SAME LOCATION ANOTHER MONITORING YEAR.

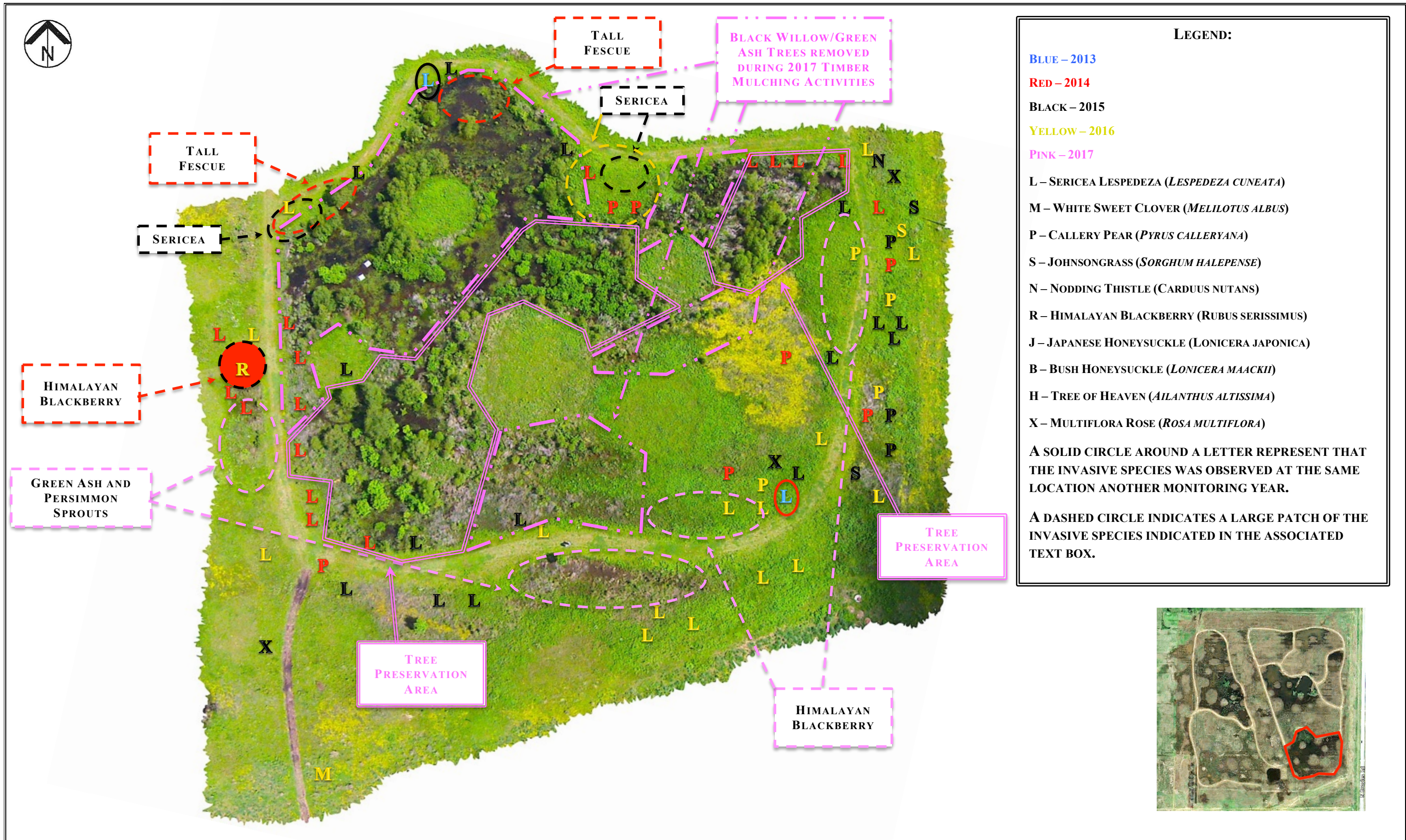
A DASHED CIRCLE INDICATES A LARGE PATCH OF THE INVASIVE SPECIES INDICATED IN THE ASSOCIATED TEXT BOX.



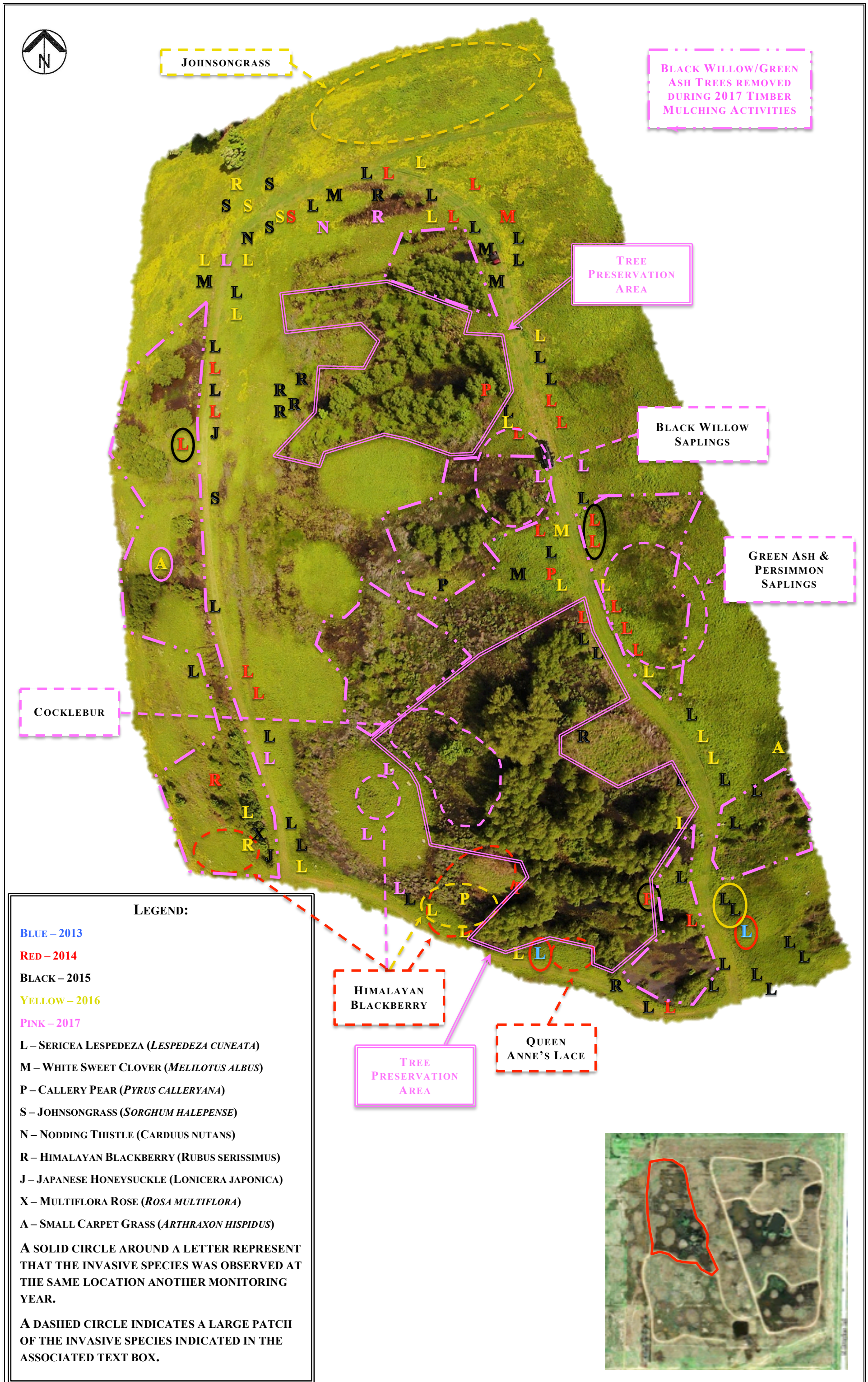
# 2013 – 2017 Invasive Species Monitoring Map Wetland Cell E-4



# 2013 – 2017 Invasive Species Monitoring Map Wetland Cell E-5



2013 – 2017 Invasive Species Monitoring Map Wetland Cell W-1



JOHNSONGRASS

BLACK WILLOW/GREEN ASH TREES REMOVED DURING 2017 TIMBER MULCHING ACTIVITIES

TREE PRESERVATION AREA

BLACK WILLOW SAPPLINGS

GREEN ASH & PERSIMMON SAPPLINGS

COCKLEBUR

HIMALAYAN BLACKBERRY

QUEEN ANNE'S LACE

TREE PRESERVATION AREA

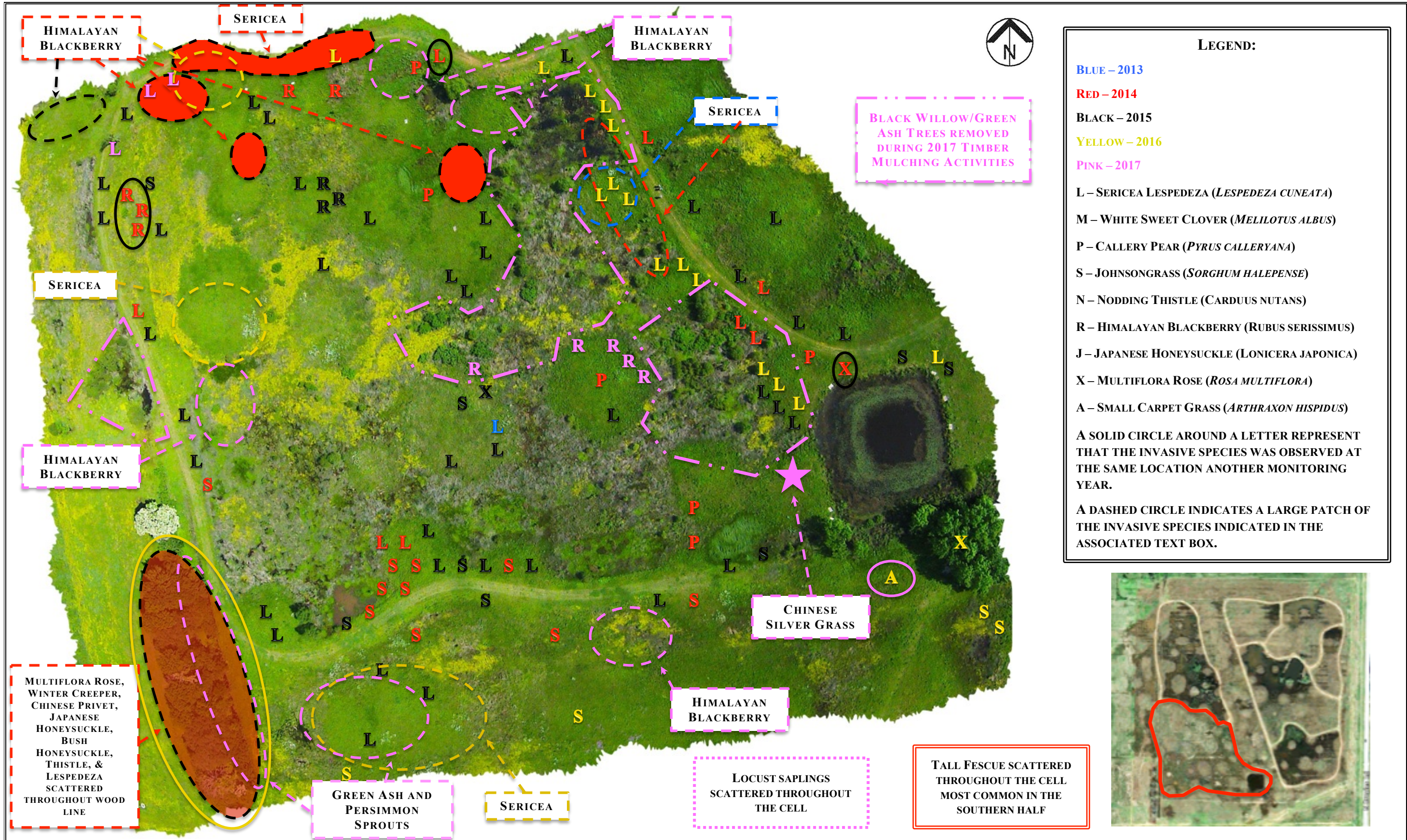


LEGEND:

- BLUE – 2013
  - RED – 2014
  - BLACK – 2015
  - YELLOW – 2016
  - PINK – 2017
  - L – SERICEA LESPEDEZA (*LESPEDEZA CUNEATA*)
  - M – WHITE SWEET CLOVER (*MELILOTUS ALBUS*)
  - P – CALLERY PEAR (*PYRUS CALLERYANA*)
  - S – JOHNSONGRASS (*SORGHUM HALEPENSE*)
  - N – NODDING THISTLE (*CARDUUS NUTANS*)
  - R – HIMALAYAN BLACKBERRY (*RUBUS SERISSIMUS*)
  - J – JAPANESE HONEYSUCKLE (*LONICERA JAPONICA*)
  - X – MULTIFLORA ROSE (*ROSA MULTIFLORA*)
  - A – SMALL CARPET GRASS (*ARTHRAOXON HISPIDUS*)
- A SOLID CIRCLE AROUND A LETTER REPRESENT THAT THE INVASIVE SPECIES WAS OBSERVED AT THE SAME LOCATION ANOTHER MONITORING YEAR.
- A DASHED CIRCLE INDICATES A LARGE PATCH OF THE INVASIVE SPECIES INDICATED IN THE ASSOCIATED TEXT BOX.



2013 – 2017 Invasive Species Monitoring Map Wetland Cell W-2



**Appendix IV**  
**Woolsey Wet Prairie**  
**2017 Master Plant Species List**

**MASTER PLANT LIST FOR WOOLSEY WET PRAIRIE - updated December 2017 - 479 taxa**

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

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

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

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

<i>Helenium amarum</i>	FACU-	HELE AMAR	bitterweed	ASTERACEAE	herb	3
<i>Helenium flexuosum</i>	FACW	HELE FLEX	purple-headed sneezeweed	ASTERACEAE	herb	1
<i>Helenium autumnale</i>	FACW	HELE AUTU	fall sneezeweed	ASTERACEAE	herb	8
<i>Helianthus grosseserratus</i>	FAC+	HELI GROS	sawtooth sunflower	ASTERACEAE	herb	3
<i>Helianthus mollis</i>	no data	HELI MOLL	ashy sunflower	ASTERACEAE	herb	3
<i>Heliotropium indicum</i> *	FAC	HELI INDI	Indian heliotrope	BORAGINACEAE	herb	21
<i>Hibiscus moscheutos</i> ssp. <i>lasiocarpus</i>	OBL	HIBI MOSC LASI	rose mallow	MALVACEAE	herb	3
<i>Hieracium gronovii</i>	UPL	HIER GRON	hawkweed	ASTERACEAE	herb	2
<i>Hordeum pusillum</i> *	FACU	HORD PUSI	little barley	POACEAE	herb	5
<i>Hypericum drummondii</i>	FACU	HYPE DRUM	nits-and-lice	CLUSIACEAE	herb	8
<i>Hypericum gymnanthum</i>	FACW	HYPE GYMN	clasping St. John's wort	CLUSIACEAE	herb	10
<i>Hypericum hypericoides</i> var. <i>multicaule</i>	FAC	HYPE HYPE MULT	creeping St. Andrew's cross	CLUSIACEAE	shrub	3
<i>Hypericum mutilum</i>	FACW	HYPE MUTI	dwarf St. John's wort	CLUSIACEAE	herb	9
<i>Hypericum punctatum</i>	FAC	HYPE PUNC	dotted St. John's wort	CLUSIACEAE	herb	8
<i>Ilex decidua</i>	FACW	ILEX DECI	deciduous holly	AQUIFOLIACEAE	shrub	22
<i>Ipomoea lacunosa</i>	FAC+	IPOM LACU	whitestar morning glory	CONVOLVULACEAE	herb	10
<i>Ipomoea pandurata</i>	FACU	IPOM PAND	wild potato vine	CONVOLVULACEAE	herb	5
<i>Isoetes melanopoda</i>	OBL	ISOE MELA	black-footed quillwort	ISOETACEAE	herb	19
<i>Isolepis carinata</i>	FACW+	ISOL CARI	bulrush	CYPERACEAE	herb	5
<i>Juncus antheratus</i>	no data	JUNC ANTH	rush	JUNCACEAE	herb	3
<i>Juncus biflorus</i>	FACW	JUNC BIFL	rush	JUNCACEAE	herb	3
<i>Juncus brachycarpus</i>	FACW	JUNC BRAC	rush	JUNCACEAE	herb	9
<i>Juncus diffusissimus</i>	FACW	JUNC DIFF	spreading rush	JUNCACEAE	herb	10
<i>Juncus effusus</i>	FACW+	JUNC EFFU	soft rush	JUNCACEAE	herb	3
<i>Juncus interior</i>	FACU	JUNC INTE	inland rush	JUNCACEAE	herb	5
<i>Juncus marginatus</i>	FACW	JUNC MARG	rush	JUNCACEAE	herb	8
<i>Juncus secundus</i>	FAC	JUNC SECU	rush	JUNCACEAE	herb	4
<i>Juncus tenuis</i>	FAC	JUNC TENU	path rush	JUNCACEAE	herb	24
<i>Juncus torreyi</i>	FACW	JUNC TORR	Torrey's rush	JUNCACEAE	herb	23
<i>Juncus validus</i>	FACW+	JUNC VALI	rush	JUNCACEAE	herb	5
<i>Juniperus virginiana</i>	FACU-	JUNI VIRG	eastern redcedar	CUPRESSACEAE	tree/sapling	8
<i>Krigia dandelion</i>	FACU	KRIG DAND	potato dandelion	ASTERACEAE	herb	7
<i>Kummerowia stipulacea</i> **	FACU-	KUMM STIP	Korean bushclover	FABACEAE	herb	3
<i>Kummerowia striata</i> **	FACU	KUMM STRI	Japanese bushclover	FABACEAE	herb	3
<i>Lactuca canadensis</i>	FACU-	LACT CANA	Canada wild lettuce	ASTERACEAE	herb	16
<i>Lactuca saligna</i> *	UPL	LACT SALI	willowleaf lettuce	ASTERACEAE	herb	21
<i>Lactuca serriola</i> *	FAC	LACT SERR	prickly wild lettuce	ASTERACEAE	herb	3
<i>Leersia oryzoides</i>	OBL	LEER ORYZ	rice cutgrass	POACEAE	herb	2
<i>Leersia virginica</i>	FACW	LEER VIRG	Virginia cutgrass	POACEAE	herb	8
<i>Lemna minuta</i>	OBL	LEMN MINU	duckweed	LEMNACEAE	herb	5
<i>Lepidium virginicum</i>	FACU	LEPI VIRG	Virginia peppergrass	BRASSICACEAE	herb	3
<i>Lespedeza cuneata</i> **	NI	LESP CUNE	sericea lespedeza	FABACEAE	herb	3
<i>Lespedeza repens</i>	no data	LESP REPE	creeping lespedeza	FABACEAE	herb	21
<i>Leucospora multifida</i>	OBL	LEUC MULT	leucospora	SCROPHULARIACEAE	herb	5
<i>Liatris pycnostachya</i> +	FACU	LIAT PYCN	prairie gayfeather	ASTERACEAE	herb	27
<i>Liatris squarrulosa</i>	FACU	LIAT SQUA	Appalachian Blazing Star	ASTERACEAE	herb	29
<i>Ligustrum sinense</i> **	FAC	LIGU SINE	Chinese privet	OLEACEAE	shrub	17
<i>Lindernia dubia</i> var. <i>anagallidea</i>	OBL	LIND ANAG	false pimpernel	SCROPHULARIACEAE	herb	10
<i>Lindernia dubia</i> var. <i>dubia</i>	OBL	LIND DUBI	false pimpernel	SCROPHULARIACEAE	herb	23
<i>Linum medium</i> var. <i>texanum</i>	FACU	LINU MEDI TEXA	stiff yellow flax	LINACEAE	herb	23

<i>Lobelia siphilitica</i>	OBL	LOBE SIPH	big blue lobelia	CAMPANULACEAE	herb	8
<i>Lobelia spicata</i>	FAC	LOBE SPIC	spike lobelia	CAMPANULACEAE	herb	5
<i>Lolium perenne</i> *	FACU	LOLI PERE	ryegrass	POACEAE	herb	5
<i>Lonicera japonica</i> **	FAC-	LONI JAPO	Japanese honeysuckle	CAPRIFOLIACEAE	woody vine	3
<i>Lonicera maackii</i> **	no data	LONI MAAC	bush honeysuckle	CAPRIFOLIACEAE	shrub	17
<i>Lonicera sempervirens</i>	FAC	LONI SEMP	trumpet honeysuckle	CAPRIFOLIACEAE	woody vine	5
<i>Ludwigia alternifolia</i>	OBL	LUDW ALTE	seedbox	ONAGRACEAE	herb	8
<i>Ludwigia glandulosa</i>	OBL	LUDW GLAN	primrose-willow	ONAGRACEAE	herb	23
<i>Ludwigia palustris</i>	OBL	LUDW PALU	creeping seedbox	ONAGRACEAE	herb	3
<i>Ludwigia peploides</i> ssp. <i>glabrescens</i>	OBL	LUDW PEPL GLAB	floating primrose-willow	ONAGRACEAE	herb	3
<i>Luzula echinata</i>	FAC	LUZU ECHI	wood rush	JUNCACEAE	herb	10
<i>Lycopus americanus</i>	OBL	LYCO AMER	American water horehound	LAMIACEAE	herb	8
<i>Lythrum alatum</i>	FACW+	LYTH ALAT	winged loosestrife	LYTHRACEAE	herb	5
<i>Maclura pomifera</i> *	FACU	MACL POMI	bois d'arc	MORACEAE	tree/sapling	3
<i>Mecardonia acuminata</i>	FACW	MECA ACUM	purple axillflower	SCROPHULARIACEAE	herb	3
<i>Medicago lupulina</i>	no data	MEDI SP.	black medic	FABACEAE	herb	16
<i>Melilotus albus</i> **	FACU-	MELI ALBU	white sweetclover	FABACEAE	herb	3
<i>Melilotus officinalis</i> *	FACU-	MELI OFFI	yellow sweetclover	FABACEAE	herb	16
<i>Melothria pendula</i>	FACW-	MELO PEND	dwarf cucumber vine	CUCURBITACEAE	herb	10
<i>Mimosa quadrivalvis</i> var. <i>nuttallii</i>	no data	MIMO QUAD NUTT	sensitive brier	FABACEAE	herb	3
<i>Miscanthus sinensis</i> **	FACU	MISC SINE	Chinese Silvergrass	POACEAE	herb	29
<i>Mollugo verticillata</i>	FAC	MOLL VERT	green carpetweed	MOLLUGINACEAE	herb	10
<i>Morus alba</i> *	UPL	MORU ALBA	white mulberry	MORACEAE	tree/sapling	20
<i>Morus rubra</i>	FAC	MORU RUBR	red mulberry	MORACEAE	tree/sapling	8
<i>Muhlenbergia schreberi</i>	FAC	MUHL SCHR	nimblewill	POACEAE	herb	8
<i>Muhlenbergia</i> sp.	no data	MUHL SP.	muhly grass	POACEAE	herb	19
<i>Myosotis macrosperma</i>	FAC	MYOS MACR	large-seeded forget-me-not	BORAGINACEAE	herb	19
<i>Myriophyllum</i> sp.	OBL	MYRI SP	water milfoil	HALORAGACEAE	herb	9
<i>Nothoscordum bivalve</i>	FAC	NOTH BIVA	crow poison	ALLIACEAE	herb	7
<i>Nuttallanthus texanus</i>	no data	NUTT TEXA	blue toadflax	SCROPHULARIACEAE	herb	5
<i>Oenothera biennis</i>	FACU	OENO BIEN	evening-primrose	ONAGRACEAE	herb	7
<i>Oenothera laciniata</i>	FACU	OENO LACI	cutleaf evening-primrose	ONAGRACEAE	herb	5
<i>Orbexilum pedunculatum</i> var. <i>pedunculatum</i>	FACU	ORBE PEDU	Sampson's snakeroot	FABACEAE	herb	5
<i>Oxalis dillenii</i>	no data	OXAL DILL	yellow wood sorrel	OXALIDACEAE	herb	3
<i>Oxalis stricta</i>	FACU	OXAL STRI	yellow wood sorrel	OXALIDACEAE	herb	27
<i>Oxalis violacea</i>	no data	OXAL VIOL	violet woodsorrel	OXALIDACEAE	herb	5
<i>Panicum anceps</i>	FAC-	PANI ANCE	beaked panicgrass	POACEAE	herb	3
<i>Panicum capillare</i>	FAC	PANI CAPI	witchgrass	POACEAE	herb	8
<i>Panicum dichotomiflorum</i>	FACW	PANI DICH	fall panicgrass	POACEAE	herb	3
<i>Panicum rigidulum</i>	FACW	PANI RIGI	rigid panicgrass	POACEAE	herb	5
<i>Panicum virgatum</i>	FAC+	PANI VIRG	switchgrass	POACEAE	herb	3
<i>Parthenocissus quinquefolia</i>	FACU	PART QUIN	Virginia creeper	VITACEAE	woody vine	19
<i>Paspalum dilatatum</i> *	FAC+	PASP DILA	Dallisgrass	POACEAE	herb	3
<i>Paspalum floridanum</i>	FACW-	PASP FLOR	Florida crowngrass	POACEAE	herb	3
<i>Paspalum laeve</i>	FACW-	PASP LAEV	field paspalum	POACEAE	herb	3
<i>Paspalum notatum</i> *	FACU+	PASP NOTA	Bahia grass	POACEAE	herb	10
<i>Paspalum pubiflorum</i>	FACW	PASP PUBI	hairyseed crowngrass	POACEAE	herb	10
<i>Paspalum setaceum</i>	FAC	PASP SETA	thin crowngrass	POACEAE	herb	4
<i>Passiflora incarnata</i>	no data	PASS INCA	passion flower	PASSIFLORACEAE	herb	3
<i>Passiflora lutea</i>	no data	PASS LUTE	yellow passion flower	PASSIFLORACEAE	herb	19



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

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

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

<i>Triodanis perfoliata</i> var. <i>biflora</i>	no data	TRIO PERF BIFL	round-leaved Venus' looking glass	CAMPANULACEAE	herb	19
<i>Triodanis perfoliata</i> var. <i>perfoliata</i>	FAC	TRIO PERF PERF	twinflower Venus' looking glass	CAMPANULACEAE	herb	5
<i>Tripsacum dactyloides</i> +	FACW	TRIP DACT	eastern gamagrass	POACEAE	herb	19
<i>Typha angustifolia</i> **	OBL	TYPH ANGU	narrowleaf cattail	TYPHACEAE	herb	7
<i>Typha domingensis</i>	OBL	TYPH DOMI	southern cattail	TYPHACEAE	herb	3
<i>Typha latifolia</i>	OBL	TYPH LATI	broadleaf cattail	TYPHACEAE	herb	14
<i>Ulmus alata</i>	FACU+	ULMU ALAT	winged elm	ULMACEAE	tree/sapling	3
<i>Ulmus americana</i>	FACW	ULMU AMER	American elm	ULMACEAE	tree/sapling	3
<i>Valerianella radiata</i>	FAC	VALE RAD	cornsalad	VALERIANACEAE	herb	5
<i>Verbascum thapsus</i> *	no data	VERB THAP	woolly mullein	SCROPHULARIACEAE	herb	11
<i>Verbena bracteata</i>	FACU-	VERB BRAC	bigbract vervain	VERBENACEAE	herb	16
<i>Verbena hastata</i>	FAC	VERB HAST	blue vervain	VERBENACEAE	herb	3
<i>Verbena simplex</i>	OBL	VERB SIMP	vervain	VERBENACEAE	herb	5
<i>Verbena stricta</i>	no data	VERB STRI	hoary vervain	VERBENACEAE	herb	21
<i>Verbena urticifolia</i>	FAC+	VERB URTI	white vervain	VERBENACEAE	herb	5
<i>Vernonia arkansana</i>	FAC	VERN ARKA	Arkansas ironweed	ASTERACEAE	herb	10
<i>Vernonia baldwinii</i>	UPL	VERN BALD	Baldwin's ironweed	ASTERACEAE	herb	8
<i>Vernonia missurica</i>	FAC+	VERN MISS	Missouri ironweed	ASTERACEAE	herb	3
<i>Veronica arvensis</i> *	NI	VERO ARVE	corn speedwell	SCROPHULARIACEAE	herb	5
<i>Veronica peregrina</i>	FAC+	VERO PERS	necklace weed	SCROPHULARIACEAE	herb	5
<i>Vicia sativa</i> *	FACU	VICI SATI	common vetch	FABACEAE	herb	5
<i>Vicia villosa</i> *	no data	VICI VILL	vetch	FABACEAE	herb	19
<i>Viola sagittata</i>	FAC	VIOL SAGI	arrowleaf violet	VIOLACEAE	herb	24
<i>Vitis cinerea</i>	FACW	VITI CINE	grayback grape	VITACEAE	herb	23
<i>Vitis vulpina</i>	FAC+	VITI VULP	fox grape	VITACEAE	woody vine	3
<i>Vulpia octoflora</i>	FACU	VULP OCTO	sixweeks fescue	POACEAE	herb	21
<i>Wolffia brasiliensis</i>	OBL	WOLF BRAS	wolffia	LEMNACEAE	herb	11
<i>Xanthium strumarium</i>	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 2017. (n=2)**

\*/\*\* = nonnative/invasive species (97/479 = 20.3% of total)

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

**STRATA:**

tree =  $\geq 5$  in dbh and  $\geq 20$  ft tall

sapling = 0.4 to  $< 5$  in dbh and  $\geq 20$  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 Shackelford, 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 Shackelford & 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

29 = Jeff Hickle, 2017 Growing Season

**Scientific Nomenclature according to Checklist of the Vascular Plants of Arkansas**

**Arkansas Vascular Flora Committee. 2006.**

**Appendix V**  
**2017 Woolsey Wet Prairie**  
**Surplus Wetland Credit Ledger Report**



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





REPLY TO  
ATTENTION OF

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

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.

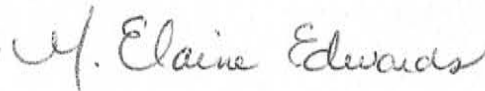
The additional areas (referred to as South, West, and North Buffer) cannot generate buffer credit for this project. If you are interested in expanding the mitigation area into these areas, please submit a mitigation bank prospectus and we will evaluate these areas at that time.

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  
Chief, Regulatory Division

Enclosures

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Copy Furnished:

Environmental Consulting Operations, Inc.

Mr. Bruce Shackelford, 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