Vegetation and Wildlife Surveys at the National Renewable Energy Laboratory, National Wind Technology Center

July 2010 – May 2011

Walsh Environmental Scientists and Engineers, LLC
Boulder, Colorado

NREL Technical Monitor: Tom Ryon

NREL is a national laboratory of the U.S. Department of Energy
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Subcontract Report
NREL/SR-1900-70462
July 2018

Contract No. DE-AC36-08GO28308

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NATIONAL RENEWABLE ENERGY LABORATORY

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2010-2011 Vegetation and Wildlife Surveys at the National Renewable Energy Laboratory, National Wind Technology Center

Jefferson County, Colorado

July 11, 2011

Purchase Order Number 19601000

Technical Monitor: Thomas Ryon

Prepared for

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NATIONAL RENEWABLE ENERGY LABORATORY

Prepared by

Walsh
an ecology and environment company

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

LIST OF ACRONYMS

ABPP	Avian and Bat Protection Plan
CDOW	Colorado Division of Wildlife
CNHP	Colorado Natural Heritage Program
DOE	U.S. Department of Energy
EA	Environmental Assessment
EERE	Energy Efficiency and Renewable Energy
EO	Executive Order
GIS	Geographic Information Systems
GPS	Global Positioning System
NEPA	National Environmental Policy Act
NREL	National Renewable Energy Laboratory
NWTC	National Wind Technology Center
RFETS	Rocky Flats Environmental Technology Site
RMRS	Rocky Mountain Remediation Services
USFWS	U.S. Fish and Wildlife Service
Walsh	Walsh Environmental Scientists and Engineers, LLC

EXECUTIVE SUMMARY

The primary objective of this year-long study was to update the National Wind Technology Center (NWTC) vegetation and wildlife baseline conditions, excluding avian species. These baseline conditions will be used to support future National Environmental Policy Act (NEPA) analyses. NWTC is located in northern Jefferson County and is a laboratory center of the National Renewable Energy Laboratory (NREL), a national laboratory of the U.S. Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy, and operated by the Alliance for Sustainable Energy, LLC.

NREL has been conducting vegetation and wildlife surveys at NWTC since 1996. Prior to the current study, Plantae (2000) completed a site characterization of vegetation communities and noxious weeds, Monahan (1996) conducted a raptor study, and Schmidt et al. (2003) conducted a bird and bat use and fatality study.

Concurrent with this study, Tetra Tech, Inc. is completing avian and mortality surveys. For this reason, the present report contains no avian observations. Walsh Environmental Scientists and Engineers, LLC (Walsh) conducted a separate bat study and report (Appendix E).

Background research methods included a review of prior studies conducted at NWTC and a review of species tracked by the Colorado Natural Heritage Program (CNHP), specific to the NWTC area. Field methods included walking transects for mapping of vegetation communities and noxious weeds and observations for general wildlife occurrences throughout the site (mammals, herpetofauna, and invertebrates) during four seasons. Several targeted surveys for wildlife were conducted including: nocturnal playback surveys for owls, amphibian call surveys, motion-detection cameras for mammalian carnivores, and small mammal live trapping.

The CNHP query revealed a number of imperiled species; however, none of these were observed during the yearlong surveys. The majority of vegetation at NWTC belongs to the mixed-grass prairie association of the grassland formation. Within that association, the largest and most widespread community type is the xeric mixed grassland, with a small area of mesic mixed grassland. Other mapped vegetation communities at NWTC include ponderosa pine woodland, upland shrubland, palustrine emergent wetland, riparian fringe wetland, groundwater seep wetland, seasonal pond, disturbed, and ornamental trees/shrubs. Noxious weeds were identified and mapped.

General wildlife surveys found species characteristic of the habitats onsite. Mammal observations included mule deer (*Odocoileus hemionus*), American elk (*Cervus elaphus*), and desert cottontail (*Sylvilagus audubonii*). Coyote sign (scat) was observed. Herpetofauna observations included two amphibian species: boreal chorus frog (*Pseudacris maculata*) and Woodhouse's toad (*Bufo woodhousii*). Invertebrates observed were commonly occurring species of several genera.

Playback surveys for owl species detected only great horned owl (*Bubo virginianus*). During amphibian call surveys, a boreal chorus frog was detected; additional individuals were detected beyond the boundaries of NWTC. No carnivores were recorded using the motion-detecting monitors. Small mammal trapping resulted in a high species richness with six species captured onsite over two survey periods. The capture rate was also high, at 15 percent.

Significant findings of this study include:

- Since the site was last mapped (DOE 1998, Plantae 2000), some observed trends in vegetation patterns include a general increase in invasive and noxious weed species

diversity and coverage throughout the various plant communities as well as a shift in native species composition to include more upland species and fewer species with a wetland indicator status of facultative or wetter. Some possible factors that may be contributing to these apparent trends could include general drying of soils as well as changes in land use since 2000.

- The NWTC site contains 12 plant species found on the State of Colorado Noxious Weed List.
- No detections of regionally important Special Status Species (mammals or invertebrates) as defined by Colorado Division of Wildlife (CDOW), U.S. Fish and Wildlife Service (USFWS) and CNHP.
- Wildlife surveys detected common genera and species expected for the habitats and region of NWTC. In addition, four species were added to the list of species previously documented onsite: boreal chorus frog, Woodhouse's toad, masked shrew, western harvest mouse, meadow vole, and American elk.
- High species richness for small mammals indicates that the site has high biodiversity value, especially for small mammals and their predators.

INTRODUCTION

This year-long wildlife and vegetation study was conducted to update the National Wind Technology Center (NWTC) vegetation and wildlife baseline conditions. These updated baseline conditions will be used to support future National Environmental Policy Act (NEPA) analyses. NWTC is a laboratory center of the National Renewable Energy Laboratory (NREL), a national laboratory of the U.S. Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy, and operated by the Alliance for Sustainable Energy, LLC.

NWTC is located on approximately 305 acres in Jefferson County, Colorado, south of State Highway 128 and east of State Highway 93, between the cities of Boulder and Golden. The legal description of the property area is: T2S, R70W, portions of Sections 3 and 4 (Figure 1).

NREL has been conducting vegetation and wildlife surveys at NWTC since 1996. Prior to the current study, Plantae (2000) completed a site characterization of vegetation communities and noxious weeds, Monahan (1996) conducted a raptor study, and Schmidt et al. (2003) conducted a bird and bat use and fatality study. More recently, Walsh conducted a bat study in 2010 (see Appendices).

The current effort involved conducting four seasons of vegetation and wildlife surveys beginning in July 2010 and ending in May 2011. This report presents the results of these surveys.

Concurrent avian monitoring studies by Tetra Tech, Inc. were conducted beginning January 2010 to September 2011. The results of these surveys are presented in a separate report.

METHODS

Background Research

Walsh compiled past wildlife and vegetation surveys conducted on the NWTC site (Plantae Consulting Services, 2000; Schmidt et al., 2003; Rocky Mountain Remediation Services, 1998; and Monahan, 1996). In order to support the most efficient comparison of current data with the previous studies, methods from these previous surveys were integrated into the current effort.

The *Site-Wide Environmental Assessment* (EA) *of National Renewable Energy Laboratory's National Wind Technology Center* (DOE 2002) was reviewed as part of the background research of wildlife occurrences on NWTC.

A query was submitted to the CNHP of Colorado State University for known locations of rare and/or imperiled plant and animal species and terrestrial arthropods specific to genera of concern within and up to a two-mile radius of the NWTC. For this project, Special Status Species are defined as those species listed by the Colorado Division of Wildlife (CDOW 2010) and the U.S. Fish and Wildlife Service (USFWS 2010) as Threatened, Endangered, Candidate, Proposed, or Species of Special Concern.

Field Work

For this project the seasons are as follows: summer (May, June and July), fall (August, September, and November), winter (December, January, and February), and spring (March, April and May). This was to provide continuity with other NREL studies and other similar surveys conducted at NREL's South Table Mountain site in Golden, Colorado.

NWTC Boundary	Conservation Management Areas	Groundwater Seep Wetland	Riparian Fringe Wetland
Ephemeral Drainage	Plant Communities	Mesic Mixed Grassland	Seasonal Pond
Prairie Dog Relocation Area	Palustrine Emergent Wetland	Ornamental Trees and Shrubs	Upland Shrubland
Building/Road/Structure	Disturbed	Ponderosa Pine Woodland	Xeric Mixed Grassland

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Figure 1. Vegetation Mapping at the National Renewable Energy Laboratory, National Wind Technology Center, 2010 and 2011

Vegetation Mapping

Vegetation mapping and characterization were performed following methods described in Plantae (2000). Major plant communities were the basis for both efforts. For the current effort, the previously characterized location and area of all major plant communities on the site were checked against current rectified aerial photography and ground-truthed in the field on August 4 and 5, October 13, 19, and 21, 2010; and May 6 and 9, 2011.

During the ground-truthing effort, transects were walked at variable intervals through each previously-mapped community. In smaller communities with general linear configurations, including the upland shrubland, the ponderosa pine woodland, and the riparian fringe wetland communities, transects were walked from one end of the community to the other. Short parallel transects were then walked back and forth across the community, perpendicular to the long transect. General conditions such as the location each community and visual estimates of dominant and flowering species for each community type were recorded. Comprehensive plant species lists for each community were updated, as necessary. Observations of on-the-ground discrepancies found between the previous mapping effort and current conditions were noted using visual estimation. Representative photographs of all plant communities were collected. Plant taxonomic authority follows Weber and Wittmann (2001).

In the more extensive plant communities, including the xeric mixed grassland and developed areas, parallel transects were walked through different portions of each community. In the xeric mixed grassland, parallel transects were walked through a portion of the site west of Row 1, between Rows 1 and 2, between Rows 2 and 3, between Rows 3 and 4, east of Rows 4, in the northern portion of the project area both west and east of the buildings, and in the south portion of the project area, on either side of the south road (Figure 1).

Noxious Weeds

The location of weed populations defined by the Colorado Noxious Weed List (CDOA 2010) was assessed by walking transects across the site in August 2010. Populations of weeds that occurred in a diffuse pattern with individual or small numbers of plants scattered throughout the landscape were noted but not mapped as distinct polygons. Weed populations with a high density of plants per square meter were mapped as such. Digital location data were collected using Global Positioning System (GPS) receiver units and downloaded into a Geographic Information System (GIS) database. These data were used to estimate weed population size.

General Wildlife Surveys

General wildlife surveys were conducted in each season, concurrent with other surveys, as appropriate. These surveys included site-wide observations for large mammals, mammalian predators, reptiles and amphibians, and terrestrial arthropods specific to genera of concern as found in the CHNP query response (Appendix A) in appropriate habitats. In addition, any Special Status wildlife species observed were recorded. All wildlife observations were identified to species and locations were documented as GPS points. Habitat associations for wildlife are matched to the vegetation mapping.

Targeted Wildlife Species

Targeted wildlife species surveys were conducted in addition to the general surveys described above. Targeted wildlife surveys included nocturnal surveys for owls and amphibians, carnivore camera surveys, and small mammal trapping surveys. In addition, any Special Status species observed were recorded.

Nocturnal Owl and Amphibian Surveys

Nocturnal playback surveys were conducted for owl species with a possibility to occur at NWTC: northern saw-whet owl (*Aegolius acadicus*) and northern pygmy-owl (*Glaucidium gnoma*). Surveys were conducted using a protocol adapted from the U.S. Forest Service (Francis & Bradstreet 1997). The timing of these surveys corresponds to the regional peak period of calling activity for breeding nocturnal owls. Surveys were conducted at a series of three points along a predetermined route. Points were selected to maximize the potential for detection of owls and efficiently survey NWTC. Two playback stations were located in the western portion of the site in the ponderosa pine (*Pinus ponderosa*) woodland located in the western portion of the site. A third point was added at the recommendation of NREL staff in an area where a third owl species, great horned owl (*Bubo virginianus*), had been observed. This was located just east of the intersection of Row 4 and the road along the southern boundary of the site. Great horned owls were noted whenever they were observed. One species, eastern screech-owl (*Megascops asio*), was not included in surveys as its preferred breeding habitat plains cottonwood (*Populus tremuloides*) riparian woodland does not occur on NWTC.

Playback/response surveys were conducted on February 7 and 18. Playback/response involved playing 30 seconds of a recorded call of a single species followed by 30 second intervals of listening for a response. This pattern was repeated for five minutes for northern saw-whet owl, followed by five minutes of the same pattern for the northern pygmy-owl, for an overall total of 10 minutes of playback/response at each sample point.

Walsh conducted acoustical surveys for bats. Details of the methods and results of this work are presented in a separate report titled *Bat Acoustical Surveys at the National Renewable Energy Laboratory, National Wind Technology Center, Jefferson County, Colorado, May 6, 2011* (Appendix E).

Amphibian call surveys occurred on May 3, 4, and June 2, 2011. Seven predetermined survey points were visited near wetland areas, 30 to 60 minutes after sunset. Points were selected to maximize the potential for detection of amphibians (wetlands and seasonal ponds) and efficiently survey NWTC. After arrival at a survey point, surveyors waited quietly for one minute, then began a five-minute listening period. The observers documented each species heard vocalizing and recorded a calling index value adapted for use across North America following a U.S. Geological Survey protocol (Droege 2010): 0 = no frogs, of a given species, can be heard calling; 1 = individual calls, not overlapping; 2 = calls are overlapping; but individuals are still distinguishable; 3 = numerous frogs can be heard; chorus is constant and overlapping.

Carnivore Camera Surveys

Walsh used five motion-detecting camera setups for the carnivore camera surveys (Trailmaster™ monitors with connected film cameras). The monitors are passive sensing units that detect infrared waves and motion. Monitors recorded all interruption incidents of a cone-shaped beam to trigger the cameras. Surveys occurred for a total of five days (four consecutive nights) during each of the four seasons: July (summer), August (fall), November (winter), and February (spring). One roll of 24 exposure film was used per camera for each season of deployment. Five survey locations were selected based on potential carnivore use areas as evaluated by topography, tracks observed, vegetation, and staff knowledge as well as minimal disruption to/from NTWC research activities. The equipment was attached to existing metal T-posts and trees using straps and clamps and each camera was baited with a Scented Predator Survey Disk (USDA Pocatello Supply Depot 2010). Camera film was developed to assess what animals, including carnivores,

were photographed on the site. The camera sites were checked for tracks once each season when the cameras were taken down.

Small Mammal Surveys

Walsh conducted small mammal trapping along six transects in three vegetation communities: one in xeric mixed grassland/Ponderosa pine woodland, three in xeric mixed grassland, and two in riparian fringe wetland. Two small mammal live-trapping surveys occurred, one August 24 to 26, 2010, and another May 2 to 5, 2011. Each survey took place over three consecutive nights. Two-hundred and fifty Sherman live traps were placed five meters apart along the transects, resulting in a total of 750 trap nights for each survey.

The protocol employed standard field procedures for small mammal trapping and followed the guidelines approved by the Animal Care and Use Committee of the American Society of Mammalogists (Sikes et al. 2011). Traps were baited with sweet horse feed, and a ball of polyester batting was placed inside each trap for insulation and bedding to prevent hypothermia.

The species, sex, and age of each trapped animal was determined and recorded each morning. The animals were released at the trap station, and the traps were closed and then reopened late in the day. Traps were washed at the end of the trapping session in a 10 percent bleach solution to prevent transmission of hantavirus.

Data from the small mammal trapping were entered into an Excel spreadsheet. Quality assurance/quality control was conducted by cross-referencing the Excel spreadsheet with the original data sheets.

RESULTS

Background Research

The results of the CNHP database query for the NWTC site indicate that it is located within the Rocky Flats Grassland Network of Conservation Areas (NCA) and the southeast portion of the site is located within the Rocky Flats Potential Conservation Area (PCA). Table 1 summarizes the results of the CNHP species and natural community query for NWTC (Appendix A).

Table 1. Summary of CNHP Rare and/or Imperiled Species and Natural Communities Known From or Likely to Occur Within a Two-mile Radius of NREL's National Wind Technology Center

Common Name	Scientific Name
Mammals	
Black-tailed prairie dog	*Cynomys ludovicianus*
Meadow jumping mouse subsp.	*Zapus hudsonius preblei*
Birds	
Ferruginous hawk	*Buteo regalis*
Bald eagle	*Haliaeetus leucocephalus*
Lewis's woodpecker	*Melanerpes lewis*
Insects	
Arogos skipper	*Atrytone arogos*

Table 1. Summary of CNHP Rare and/or Imperiled Species and Natural Communities Known From or Likely to Occur Within a Two-mile Radius of NREL's National Wind Technology Center

Common Name	Scientific Name
Moss's elfin	*Callophrys mossii schryveri*
Hops feeding azure	*Celastrina humulus*
Mottled dusky wing	*Erynnis martialis*
Ottoe skipper	*Hesperia ottoe*
Cross-line skipper	*Polites origenes*
Regal fritillary	*Speyeria idalia*
Natural Communities	
Xeric tallgrass prairie	*Andropogon gerardii – Schizachyrium scoparium Western Great Plains herbaceous vegetation*
Xeric tallgrass prairie	*Andropogon gerardii – Sporobolus heterolepis Western foothills herbaceous vegetation*
Xeric tallgrass prairie	*Andropogon gerardii – Sporobolus heterolepis Western foothills herbaceous vegetation*
Great Plains mixed grass prairie	*Hesperostipa comate Colorado Front Range herbaceous vegetation*
Great Plains mixed grass prairie	*Hesperostipa neomexicana Herbaceous vegetation*
Foothills ponderosa pine scrub woodlands	*Pinus ponderosa / Cercocarpus montanus / Andropogon gerardii Wooded herbaceous vegetation*
Foothills riparian woodland	*Populus angustifolia / Salix irrorata Woodland*
Vascular Plants	
Dwarf wild indigo	*Amorpha nana*
Forktip three-awn	*Aristida basiramea*
Sedge sp.	*Carex oreocharis*
Rocky Mountain sedge	*Carex saximontana*
Yellow hawthorn	*Crataegus chrysocarpa*
Frostweed	*Crocanthemum bicknellii*
Gay feather	*Liatris ligulistylis*
Wavy-leaf stickleaf	*Nuttallia sinuata*

Walsh reviewed and field verified Special Status Species listed within the CNHP report that were likely to occur onsite. No Special Status Species were observed during all field work conducted during year long surveys conducted at NWTC.

Vegetation Mapping

Conservation Management Areas

As discussed in the 2002 NWTC Sitewide EA (DOE 2002) approximately 60 acres of land within NWTC site boundaries have been designated as Conservation Management Areas not only to prevent development within critical wind corridors but also to protect the site's natural resources. Future building and development are not allowed in ephemeral drainages, hillside seeps, a seasonal pond, mesic mixed grassland (includes tall-grass prairie species), or a prairie dog re-location area (Figure 1).

Plant Communities

The majority of the vegetation on the NWTC site belongs to the mixed-grass prairie association of the grassland formation (Weaver and Clements 1938). Mixed-grass prairie is defined by the presence of grass species typical of the tall-grass or true prairie such as big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), and prairie dropseed (*Sporobolus heterolepis*), with species more typical of the short-grass prairie such as blue grama (*Chondrosum gracile*) and buffalo grass (*Buchlöe dactyloides*). Intermediate grasses (mid-grasses) such as the needle grasses (*Hesperostipa* and *Nassella* spp.), wheatgrasses (*Pascopyrum, Agropyron, Elytrigia, Elymus,* and *Thinopyrum* spp.), and bluegrasses (*Poa* spp.) are also important constituents of mixed-grass prairie.

The grasslands on the NWTC site comprise a mosaic of smaller vegetation units that could be delineated and defined based on the presence of two to five key plant species. However, for the purposes of this survey, the grasslands in the NWTC project area fall into the xeric mixed grassland community type identified and classified primarily on available soils and soil moisture, reflected in xeric mixed grassland plant species assemblages.

A number of changes in vegetation patterns were noted since the NWTC site was previously mapped (DOE 1998, Plantae 2000). These observed changes will be discussed by specific plant community, below. The vegetation map is shown in Figure 1. Lists of plant species associated with each plant community are located in Appendix B. Representative photographs of each plant community are found in Appendix C.

Xeric Mixed Grassland

Xeric mixed grassland is by far the largest and most widespread community type on the NWTC site (Photo 1). These areas do not have access to regular soil moisture (xeric conditions) and are dominated by typical short- and mixed-grass prairie species. This plant community includes a large variety of native grass species as well as a diverse forb component, typical of mixed grasslands. Dominant species noted include yucca (*Yucca glauca*), crested wheatgrass (*Agropyron cristatum*), cheatgrass (*Anisantha techtorum*), smooth brome (*Bromopsis inermis*), and little bluestem. Species flowering in late spring 2011 include little bluestem, cheatgrass, sand lily (*Leucocrinum montanum*), wild iris (*Iris missouriensis*), Lambert locoweed (*Oxytropis lambertii*), mouse-ear (*Cerastium strictum*), western wallflower (*Erysimum capitatum*), and prairie golden pea (*Thermopsis rhombifolia*). Plant species found in this grassland are listed in Table 1 of Appendix B.

Mesic Mixed Grassland

A distinctive single area dominated by big bluestem was mapped as mesic mixed grassland in the southwestern portion of the NWTC site by Plantae (2000). The relative size of the area, as well as the complete dominance of big bluestem, were distinctive enough to designate this community in the current survey (Photo 2). Dominant species noted include big bluestem, smooth brome, Canada thistle (*Breea arvensis*), and Canada bluegrass (*Poa compressa*). Species flowering in late spring 2011 include Lambert locoweed. Plant species found in this grassland are listed in Table 2 of Appendix B.

Ponderosa Pine Woodland

One woodland habitat, defined by a single community, the ponderosa pine woodland, occurs in the northwestern corner of the site along a granite outcrop (Photo 3). This small area supports a very diverse native plant community including common grassland and foothills species, as well as a number of introduced and noxious weeds. Dominant species noted include ponderosa pine, smooth brome, crested wheatgrass, and green needlegrass (*Nassella viridula*). Species flowering in late spring 2011 include sand lily, western snowberry (*Symphoricarpus occidentalis*), groundsel (*Senecio* sp.), and wax current (*Ribes cereum*). Plant species found in this woodland are listed in Table 3 of Appendix B.

At the beginning of the 2000 growing season, the most dense and widespread diffuse knapweed (*Acosta diffusa*) population on the NWTC site occurred among the trees in this habitat (Plantae 2000). In the intervening ten years, diffuse knapweed has become ubiquitous across all of the upland plant communities.

Upland Shrubland

A small upland shrub community is located to the southeast of the ponderosa pine woodland, where the same ridge arises to a lesser degree from the surrounding grassland community (Photo 4). This rocky ridge supports shrub species interspersed with grasses and forbs representative of the surrounding grasslands. Dominant species noted include western snowberry, wax current (*Ribes cereum*), Canada wild rye (*Elymus canadensis*), Canada bluegrass, Kentucky bluegrass (*Poa pratense*), and little bluestem. Species flowering in late spring 2011 include prairie goldenpea. Plant species found in this shrubland are listed in Table 4 of Appendix B.

An isolated group of approximately eight hawthorn (*Crataegus erthyropoda*) shrubs occurs along the western site boundary, within the NWTC site boundary. These trees are at the top of the slope and occur directly east of an active area of construction disturbance, which is outside the NWTC site boundary and southeast of Coal Creek (Photo 10).

Palustrine Emergent Wetland

Two wetlands on the site fall into the palustrine emergent category. The first, south of Row 2, is a linear depression on the southern side of the south road. This area appears to have developed as the result of soil excavation intercepting sufficient surface water run-off from the adjacent road to support sedge species (*Carex* spp.). A second wetland is located on the southern boundary in an area previously disturbed from the neighboring industrial activities. This wetland comprises a center of cattails (*Typha angustifolia*) surrounded by a stand of coyote willow (*Salix exigua*).

Two palustrine emergent wetlands were mapped in the mesic mixed grassland in the 2000 growing season. These areas appear to have dried considerably in the intervening ten years. The small wetland pockets of cattails (*Typha* spp.) that occurred in the southern portions of this area

are no longer present, apparently replaced, by large stands of Canada thistle. Dead remnants of Baltic rush (*Juncus balticus*) can be found in the area litter (prior years' herbaceous vegetation). Dominant species noted include smooth brome. Plant species found in this wetland are listed in Table 5 of Appendix B.

Riparian Fringe Wetland

Areas of riparian fringe wetland occur along the two ephemeral drainages on the NWTC site (Figure 1). Both drainages occur in the northeastern portion of the site, one flowing east and one flowing north. Both show evidence of intermittent surface flow. The northern-most drainage is a tributary of Coal Creek and the second drainage is a tributary to Rock Creek.

Surface flow in the drainage to the northeast appears to be augmented by outflow from the groundwater seep wetland on the western bank (see below). The second and larger drainage (RF-1) conducts surface flows through the center of the site off to the eastern fence line. The upper reaches of this drainage are a shallow grassland swale that begins between Rows 3 and 4. This channel deepens as it flows east across the site. At its eastern reaches, this drainage clearly intercepts subsurface water, although not in sufficient quantities to produce consistent surface flow. Dominant species noted include Canada thistle, Baltic rush, common evening-primrose (*Oenothera villosa*), smooth brome, and western wheatgrass (*Pascopyrum smithii*). Plant species found in these riparian fringe communities are listed in Table 6 of Appendix B.

Groundwater Seep Wetland

Two areas of groundwater seep wetland were located on the NWTC site. The first occurs west of the ponderosa pine woodland, in the northwestern portion of the site along the northern fenceline (Photo 7). The species in and surrounding this draw comprise more upland species than noted in 2000.

A very small area of this wetland community occurs on the banks of the northern drainage (Photo 8). This community is a clearly demarcated area of primarily wetland plants amidst the surrounding grassland. Fifty plant species were identified in this community in 2000, many of which also occur in the riparian fringe wetland to the south. Dominant species noted include smooth brome, mullein species (*Verbascum* spp.), and common teasel (*Dipsacus fullonum*). Species flowering in late spring 2011 include common teasel, common dandelion (*Taraxicum officinale*), and hawthorn. Plant species found in these groundwater seep wetlands are listed in Table 7 of Appendix B.

Seasonal Pond

A seasonal pond occurs at the northwestern corner of the site, west of the southern terminus of the ponderosa pine woodland (Photo 9). This area appears to depend on an elevated spring and early summer water table for the hydric soil moisture conditions that support this community. Observers have noted that the pond depression often contains standing water in the spring and early summer in some years (Plantae 2000). However, no standing water was observed in this area during the late summer 2010 survey or during the late spring 2011 survey. These drier soil conditions are reflected in a shift of dominant plant species in this community between the 2000 and 2010-2011 survey periods. Dominant species noted include moth mullein (*Verbascum blattaria*), Canada bluegrass, Kentucky bluegrass, smooth brome, and Canada thistle. Plant species found in this area are listed in Table 8 of Appendix B.

Disturbed

These plant associations reflect surface disturbance due to human activities on the site. These areas include roadsides, pad sites, parking lot perimeters, construction sites, and storage areas. Some of these areas have been revegetated and now include a combination of species from surrounding natural plant communities, reclamation species, and adventive (non-native) or ruderal (native or adventive, disturbance colonizer) species. Dominant species noted include smooth brome. Plant species found in this grassland are listed in Table 9 of Appendix B.

Ornamental Trees/Shrubs

Disturbed areas around the buildings have been landscaped and planted with a combination of native and ornamental trees and shrubs. The trees include multiple species of junipers (*Sabina* spp.) and pines (*Pinus* spp.) interspersed with ornamental deciduous trees. Shrubs in these areas are mainly chokecherry (*Padus virginiana*) and rose (*Rosa* spp.) bushes.

Noxious Weeds

A list of noxious weeds found at NWTC is shown in Table 2. Noxious weed populations are illustrated in Figure 2.

Table 2. Noxious Weed Species Identified at the National Wind Technology Center, Colorado August, 2010

Common Name	Scientific Binomial	Estimated Area (acres)
Canada thistle	***Breea arvensis***	6.0
Cheatgrass	*Anisantha tectorum*	*
Common mullein	*Verbascum thapsus*	0.8
Common teasel	*Dipsacus fullonum*	1.8
Chicory	*Cichorium intybus*	0.05
Dalmatian toadflax	*Linaria dalmatica*	3.5
Diffuse knapweed	***Acosta diffusa***	10.5**
Leafy spurge	***Euphorbia esula***	0.1
Musk thistle	***Carduus nutans***	3.2
Sulfur cinquefoil	*Potentilla recta*	0.3
Scotch thistle	***Onopordum acanthium***	0.3
Whitetop	***Cardaria draba***	0.03

Species in bold font are on the list of top ten priority weeds for Colorado.

*Cheatgrass was pervasive throughout the site and was therefore not mapped.

**Diffuse knapweed is found throughout the site and the estimated area is for higher densities of plants per square meter.

Canada Thistle,

Canada Thistle,
Common Mullein,
Bull Thistle

Canada Thistle,
Common Mullein,
Musk Thistle

North Road

Canada Thistle,
Common Mullein

Sulfur Cinquefoil,
Common Mullein,
Diffuse Knapweed

Musk Thistle,
Canada Thistle,
Sulfur Cinquefoil,
Diffuse Knapweed

Common Teasel,
Canada Thistle,
Diffuse Knapweed

Scotch Thistle,
Musk Thistle

ROW 1

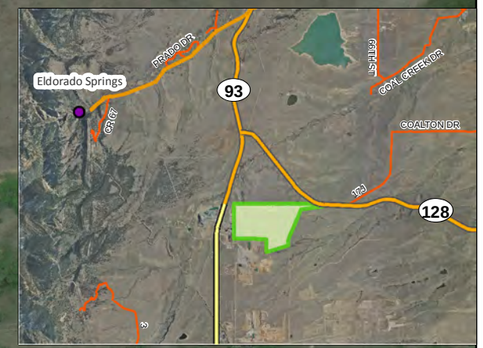
ROW 2

ROW 3

ROW 4

South Road

Musk Thistle,
Dalmatian Toadflax



1:5,400

500 250 0 500 Feet

1 in = 450 feet

N

Walsh
Environmental Scientists and Engineers, LLC
an ecology and environment company

NWTC Boundary
Canada Thistle
Chicory
Dalmatian Toadflax
Diffuse Knapweed
Leafy Spurge
Musk Thistle
Sulfur Cinquefoil
White Top
Various Species
(See Label)

Figure 2. Weed Mapping at the National Renewable Energy Laboratory, National Wind Technology Center, 2010 and 2011

U:\Projects\900758.0001.020_nrel_nwtc\gis\map_mxd\Figure 2 Weed Mapping at NREL_mxd_2010 and 2011.mxd

General Wildlife Surveys

The results of the general wildlife surveys found species typical of the region observed at NWTC. No Special Status wildlife or terrestrial arthropod species were detected during the four seasons of surveys. Mule deer (*Odocoileus hemionus*) and desert cottontail (*Sylvilagus audubonii*) were the most commonly observed mammals, seen in a variety of vegetation communities. Woodhouse's toad (*Bufo woodhousii*) and boreal chorus frog (*Pseudacris maculata*) were the only detected herpetofauna. Terrestrial arthropods included commonly observed butterfly species such as western white (*Pontia occidentalis*) and orange sulphur (*Colias eurytheme*), occurring mostly in xeric mixed grasslands during the summer season. All observations and the associated vegetation community are documented in Table 3. Observation points are documented in Figure 3.

During the fall surveys, three wildlife species were detected. Only signs (scat) of coyote (*Canis latrans*) and mule deer (tracks, scat, and beds) were found. Woodhouse's toad was detected four times, but only as road-killed individuals. In these cases, the nearest vegetation community is noted for these individuals. In the winter, only mule deer were detected: a group of three in the solar array, and three individuals (detected by a monitor camera) in the northwestern Conservation Management Area. In the spring, a group of 16 mule deer were detected in the conservation easement along the southern boundary of the project area. Desert cottontail rabbit were detected in four locations: three around buildings and one within abandoned black-tailed prairie dog (*Cynomys ludovicianus*) burrows. In the summer, signs for mule deer and American elk (*Cervus canadensis*) were observed. NWTC staff have frequently observed elk on the site over the last five to seven years (Tim Johansson via Thomas Ryon, NREL, personal communication), and a boreal chorus frog was observed where the Row Four Road intersects an upper drainage for Rock Creek. A cottontail rabbit was observed on the northern side of the Industrial User Facility. Note: the identification of the cottontails as the desert cottontail was based on habitat, as the three species of cottontails common to the Front Range are very difficult to distinguish in the field (Armstrong et al. 2011).

Table 3. General Wildlife Observations at the National Renewable Energy Laboratory National Wind Technology Center, 2010 – 2011

Common Name	Scientific Name	Vegetation Community Code*
Mammals		
Desert cottontail	*Sylvilagus audubonii*	BRS
American elk (tracks only)	*Cervus canadensis*	XMG
Coyote (scat only)	*Canis latrans*	XMG
Mule deer (tracks, scats and beds)	*Odocoileus hemionus*	RFW
Amphibians		
Woodhouse's toad (deceased)	*Bufo woodhousii*	XMG
Boreal chorus frog	*Pseudacris maculata*	RFW, SP
Terrestrial Arthropods		
Checkered white	*Pontia protodice*	RFW

Common Name	Scientific Name	Vegetation Community Code*
Western white	*Pontia occidentalis*	XMG
Cabbage white	*Pieris rapae*	RFW
Orange sulphur	*Colias eurytheme*	XMG
Dainty sulphur	*Nathalis iole*	XMG
Gray hairstreak	*Strymon melinus*	RFW
Aphrodite fritillary	*Speyeria aphrodite*	RFW
Common wood nymph	*Cercyonis pegala*	RFW

*Vegetation community code: XMG= Xeric mixed grassland, RFW=Riparian fringe wetland, PEW=Palustrine emergent wetland, BRS=Building/road/structure, SP=Seasonal pond.

The list of all wildlife species observed from all surveys combined is shown in Appendix D.

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- Small Owl Stations (S1-3)
- Amphibian Call Stations (A1-7)
- Carnivore Camera Stations (C1-5)
- Mammal Trapping Transect (with number of traps)
- Conservation Management Areas
- NWTC Boundary

Figure 3. Amphibian Call, Small Owl, Carnivore Camera, and Small Mammal Trapping Points and Transects at the National Renewable Energy Laboratory, National Wind Technology Center, 2010 and 2011

U:\Projects\900750.0001.020 - nrel_nwtc\gis\mxd\Figure 3 Amphibian Call etc. trapping stations_transects at NWTC 2010 and 2011.mxd

Targeted Wildlife

Nocturnal Wildlife Surveys

Nocturnal playback surveys for northern saw-whet owl and northern pygmy-owl failed to detect or elicit any responses from those species. A duetting pair of great horned owls were detected at S2 on February 7.

During the amphibian call surveys boreal chorus frogs were detected on May 3 and 4 at two points: A5 and A7 (Figure 3), however the frogs were outside the boundaries of NWTC. The index value assigned to each observation was 3, meaning that numerous frogs were heard and the chorus was constant and overlapping. On June 2, boreal chorus frogs were detected at points A3 and A5 outside the boundaries of NWTC with an index value of 2; calls were overlapping but individuals were still distinguishable. A single boreal chorus frog (index value 1) was detected at A2 near a dry ephemeral pond within the boundaries of NWTC.

Carnivore Camera Surveys

No carnivores were recorded using the motion-detecting monitors. Two photographs were captured of mule deer.

Small Mammal Surveys

Small mammal trapping results are summarized in Table 4. In August 2010, a total of 99 individual small mammals were captured, represented by five species (Table 4). There were 31 recaptures over the four survey nights. Species captured were masked shrew (*Sorex cinereus*), deer mouse (*Peromyscus maniculatus*), meadow vole (*Microtus pennsylvanicus*), prairie vole (*M. ochrogaster*), and Mexican woodrat (*Neotoma mexicana*). The masked shrew was captured in the northeast drainage on Transect C, and represents a new occurrence record for the site. Deer mice were captured throughout, meadow and prairie voles were captured in the eastern most drainages (Transects B and C), and Mexican woodrats were captured in the western draw on Transect A (Figure 3).

In May 2011, a total of 63 individual small mammals were captured, representing four species (Table 4). There were 26 recaptures. Species captured were deer mouse, western harvest mouse (*Reithrodontomys megalotis*), meadow vole, and Mexican woodrat. In this trapping event, the deer mice were captured throughout, the western harvest mice were captured in Transects D and E, the lone meadow vole was captured in Transect B, and the lone Mexican woodrat was captured in Transect A (Figure 3).

In August 2010, with 750 trap nights and a total of 130 captures (99 individuals and 31 recaptures), there was a 17 percent capture rate. In May 2011, with 89 captures (63 individual captures and 26 recaptures), there was a 12 percent capture rate.

For the two years combined, the overall capture rate was 15 percent (219 captures out of 1500 trap nights) and there was a species richness of 6: masked shrew, deer mouse, western harvest mouse, meadow vole, prairie vole, and Mexican woodrat.

Table 4. Small Mammal Captures at the National Wind Technology Center, 2010 and 2011.

Species	Xeric Mixed Grassland	Xeric Mixed Grassland/Ponderosa Pine Woodland	Riparian Fringe Wetland	Total
Fall 2010				
Masked Shrew (*Sorex cinereus*)	0	0	2	2
Deer Mouse (*Peromyscus maniculatus*)	38(13)	13(5)	6(1)	57(19)
Mexican Woodrat (*Neotoma mexicana*)	0	3	0	3
Prairie Vole (*Microtus ochrogaster*)	2	1	16(5)	19(5)
Meadow Vole (*Microtus pennsylvanicus*)	0	0	11(7)	11(7)
Vole (*Microtus* sp.)	0	0	7	7
Total				**99(31)**
Summer 2011				
Western Harvest Mouse (*Reithrodontomys megalotis*)	2	0	0	2
Deer Mouse (*Peromyscus maniculatus*)	37(21)	13(4)	6(1)	56(26)
Mexican Woodrat (*Neotoma mexicana*)	0	1	0	1
Prairie Vole (*Microtus ochrogaster*)	0	2	0	2
Meadow Vole (*Microtus pennsylvanicus*)	0	0	2	2
Total				**63(26)**
2010 and 2011 Combined				
Total				**162(57)**

All values based on 750 trap-nights. There were 2 closed traps in 2010 and 21 closed traps in 2011. Values in parentheses ( ) indicate recaptures.

The list of all wildlife species observed from all surveys combined is shown in Appendix D.

Avian Survey Results from Tetra Tech

Avian surveys conducted by Tetra Tech, Inc. include the following:

- Fixed point
- Breeding bird
- Raptor migration
- Bird and Bat mortality

These surveys were conducted beginning January 2010 to September 2011. The results of these surveys are presented in a separate report.

DISCUSSION

Background Research

A number of species were listed in the CNHP query. Other than for arthropods, Special Status Species surveys were not conducted as part of the current study. If one such species was encountered, Walsh would have made a noted, but none of these were found in 2010-2011. This is likely due to a number of reasons, including:

- Some records date as far back as 1984, and anthropogenic activities since then may have extirpated these populations from NWTC
- Some records are from habitats that occur within two miles but thus habitat is lacking or marginal on NWTC for some species, such as Ute Ladies'-tresses, certain arthropods and Preble's meadow jumping mouse.
- In some cases, the occurrence of favorable moisture or climatic conditions at a future time may cause species to germinate or return to the site.

Vegetation Mapping

Conservation Management Areas

Improvements in geospatial analysis and mapping precision since 2000 are likely the reason why the location of the mesic mixed grassland area, as it was mapped in 2010, and the original Conservation Management Area, as it was mapped in 2000, do not overlap with greater precision (Figure 1). In 2010, Walsh ground-truthed the mesic mixed grassland area with sub-foot precision using a Trimble GPS unit. In addition, the appearance of a general drying trend in the area could explain why the mesic mixed grassland has apparently contracted in size since 2000.

Plant Communities

A number of changes in the vegetation patterns were noted since these areas were previously mapped (DOE 1998, Plantae 2000). Overall observed trends in vegetation patterns include a general increase in invasive and noxious weed species diversity and extent across the site and a broad shift in native species composition toward more upland species and fewer species with a wetland indicator status of facultative or wetter. Some possible factors that may be contributing to these apparent trends could include general drying of soils as well as changes in land use, including surface disturbing activities, since 2000. Vegetation mapping is shown in Figure 1.

The wetlands noted on the site have not been jurisdictionally delineated. Due to a dry winter in 2010, followed by a dry spring in 2011, borders of wetland communities were not able to be confirmed with assurance for this report.

Xeric Mixed Grassland

The DOE's vegetation mapping effort characterized the majority of the NWTC site as xeric tall-grass prairie in 1998, defined by the dominance of characteristic tall-grass prairie species, most especially big bluestem and little bluestem (DOE 1998). However, this was not found to be the typical condition when the site was mapped in 2000 by Plantae. Instead, at that time, as now, the site supports a diverse matrix of grass species typical of mixed grassland, including distinctive, but very small patches of big bluestem, with the one exception discussed below. It would not be accurate to describe the site as dominated by tall-grass prairie species. Neither does the site experience the climatic conditions or soils that further define tall-grass prairie.

Mesic Mixed Grassland

A single area of big bluestem was mapped as mesic mixed grassland in the southwest portion of the site by Plantae in 2000. The relative size of this area, as well as the complete dominance of big bluestem, were distinctive enough to designate this community separately. The current mapping effort found this area much reduced in size and of an entirely different character. While big bluestem is still a dominant grass species here, it no longer occurs in a monoculture stand, as described in Plantae (2000). Dominant graminoids observed in 2010-2011 include big bluestem, Canada bluegrass, and cheatgrass. Canada thistle is the dominant forb.

Ponderosa Pine Woodland

It has been speculated that this forested habitat may represent remnants of a widespread pine forest that once occupied this entire area prior to human timbering and burning (Clark et al. 1980). This now isolated woodland patch serves as bat foraging habitat and as vegetation cover for various mammal and bird species that may not otherwise visit the open grassland mesa top. The understory of this community is composed of a mixture of shrubs, grassland and foothills plant species (Plantae, 2000).

Upland Shrubland

The isolated group of hawthorns along the western site boundary do not comprise a plant community. The soils and characteristics of the herbaceous layer associated with the hawthorns are contiguous with those of the surrounding xeric mixed grassland. Because this group of trees is upslope and southeast of stretches of Coal Creek, it is possible that groups of hawthorns within the creek's riparian fringe provided a seed source for the hawthorns within the project boundary.

Palustrine Emergent Wetland

Current field observations found these areas, referred to as cattail seeps in Plantae 2000, are no longer dominated by cattails. In addition, Baltic rush appears to have thrived in these areas at one time, as evidenced by its litter remnants. Although Baltic rush is an obligate wetland species in Region 5 (Reed 1988), it is able to persist in an area for several years after its water source is no longer present.

Riparian Fringe Wetland

The two areas of riparian fringe wetland occur along two ephemeral drainages and support wetland plant species not found anywhere else on the NWTC site. This community is a mixture of typical grassland species with those most often found in wetland or riparian areas, as well as introduced species and some noxious weeds.

Groundwater Seep Wetland

The full sun conditions of this area have allowed common teasel to thrive. It is now the dominant species surrounding the seep and is beginning to spread to the south toward the riparian fringe and ephemeral drainage. Native species diversity has decreased since 2000, likely are a result of the competitive pressure exerted by the expansion of the common teasel.

Seasonal Pond

The seasonal pond represents an unusual habitat feature in the surrounding xeric mixed grasslands. As observed by Plantae in 2000, the area apparently only holds water as a result of seasonal surface run-off. Saturated soils were not observed in the seasonal pond during site visits due to the general lack of precipitation at those specific times. The general drying trend observed in other vegetation communities throughout NWTC appears to have caused a shift in dominant vegetation in the seasonal pond area as well. This site is no longer dominated by mesic species, such as sedges (*Carex* spp.), spike-rush (*Eleocharis* sp.), and rushes (*Juncus* spp.), observed by Plantae in 2000 and instead supports upland grasses and several ruderal forb species.

Disturbed

Figure 1 shows a Building/Road/Structure category for anthropogenic features. As is often the case, disturbed areas at the NWTC site appear to show a high correlation with weed populations. Although noxious weed populations occur throughout the NWTC site, larger populations appear to occur near locations where human activities have disturbed the soil surface. Surface disturbance such as building footprints and road construction often leave areas of bare ground where colonizing weeds tend to establish more quickly than amidst established native vegetation. Examples of noxious weed populations establishing and spreading as an apparent result of surface disturbance include populations of Dalmatian toadflax (*Lineria dalmatica*) associated with access roads between Rows 3 and 4 and south of this area; diffuse knapweed populations associated with the testing and research buildings north of the North Road; and populations of Canada and musk thistle (*Carduus nutans*) on all sides of the new seven-acre solar array west of Row 2 (Figure 2).

Noxious Weeds

The NWTC site contains 12 plant species (Table 2) found on the State of Colorado Noxious Weed List. Of these, five are included in the top ten priority weeds for Colorado, as listed in the Colorado Weed Management Act. These species are the most widespread and cause the greatest economic impact to the state and should be considered a priority for the weed management plan developed for the NWTC site.

Many of the noxious weeds found on the site occur in small populations such as leafy spurge (*Euphorbia esula*), whitetop (*Cardaria draba*), common teasel, chicory (*Cichorium intybus*), and scotch thistle (*Onopordum acanthium*). However, due to the large areas of disturbance on the NWTC site, they are likely to spread if these populations are not actively controlled.

Diffuse knapweed is scattered throughout the entire site and represents a large threat to native plant diversity. In addition, musk thistle (*Carduus nutans*), dalmation toadflax, and Canada thistle are found in large populations and appear to be spreading.

Many of the same species of noxious weeds detected in 2010 were also noted when the site was surveyed in 2000 by Plantae, with diffuse knapweed once more covering a large portion of the site. However, it appears many weed populations have increased since 2000, likely in response to surface disturbance associated with three multi-megawatt wind turbines, the former and current prairie dog colony locations, the recent installation of multi-megawatt wind turbines, a new seven acre solar array, and other new facilities.

Because weed populations are now mapped and in a GIS database, baseline cover estimates for the 12 noxious weed species have been established and can be used for comparisons with future weed monitoring efforts.

General Wildlife Surveys

Species detected during the four seasons of general wildlife surveys were typical of wildlife to be expected in the area. Most were previously documented in the EA (DOE 2002). No Special Status Species of wildlife or terrestrial arthropods were observed. The EA relied on an inventory of wildlife conducted by the DOE of the nearby Rocky Flats Environmental Technology Site (RFETS) which included the NWTC in 1992. Thus a larger area was covered for the EA (DOE 2002) than in the present study, and more wildlife species were included in the EA than in the current study. Thus the differences in species are likely a result of spatial differences between the two studies. The level of effort for surveys in DOE (2002) is not stated and thus comparisons with the present study cannot be made in that regard.

NWTC is documented as resident, summer, and winter range for mule deer and overall, summer, winter, and production range for American elk (NDIS 2011). The EA (DOE 2002) did not document American elk which are increasing on nearby City of Boulder Open Space in the Coal Creek drainage immediately northwest of the site (Steve Jones, personal communication; Scott Severs, Walsh, personal observation). Also NWTC staff has frequently observed elk on-site over the last five to seven years (Tim Johansson via Thomas Ryon, NREL, personal communication). Two additional species not accounted for in the EA but observed during the current surveys included boreal chorus frog and Woodhouse's toad.

Targeted Wildlife Species

Nocturnal Wildlife Surveys

The remnant and small nature of the ponderosa pine forest, and the presence of great horned owls which are a known predator of small owls, likely precluded the presence of northern saw-whet and northern pygmy-owls on the site. Saw-whet owls generally prefer mature and old growth stands of coniferous forests (Rasmussen et. al. 2008) and pygmy-owls generally prefer mixed conifer and deciduous habitats (Holt and Petersen 2000). Both rely on snags for nesting and the NWTC site is mostly devoid of this habitat feature. Preferable hunting and nesting habitats can be found on nearby City of Boulder Open Space properties. Eastern screech-owl (*Megascops asio*) has been found on adjoining properties in upland shrub habitat (Brenda Beatty – NREL, personal communication). However, this species was not included in surveys as its preferred breeding habitat, plains cottonwood (*Populus tremuloides*) riparian woodland, does not occur on NWTC.

Amphibian call surveys only detected the vocalizations of one species, boreal chorus frog at NWTC. General wildlife surveys also and Woodhouse's toad within the property. Dryer than average conditions on NWTC from August 2010 to March 2010 may have influenced detections of calling amphibians.

Carnivore Camera Surveys

Although no carnivores were photographed by the motion detection monitors, general wildlife surveys did note coyote scat once at NWTC. The carnivore cameras were operating within normal parameters during the survey as evidenced by the two exposures taken of mule deer. This technology is influenced by the motion of vegetation however, which led to nearly all rolls of film being fully exposed. An additional examination of the area around the scent disks did not yield any observations of tracks. The surrounding land uses, habitats, and topography of NWTC does not lend itself to any concentrated areas of carnivore activity or focused movements. NWTC staff has often observed coyotes onsite and on surrounding lands (David Sprowls, NREL, personal communication). Coyotes are known to breed and rear young on the Rocky Flats Wildlife Refuge (previously known as RFETS; Thomas Ryon, NREL, personal communication).

Small Mammal Surveys

The overall capture rate was 15 percent, indicative of a reasonably high general abundance of small mammals. Capture rates of small mammals vary due to a number of factors including location, season, year, precipitation, and in relation to land use and habitat type.

There was a higher number of captures in 2010 than in 2011, due to the higher number of voles in 2010. There were 37 individuals captured in 2010 and only 4 individuals captured in 2011 of both meadow and prairie voles combined. This was likely due to a very dry 2011 winter and spring east of the mountains, as both species are associated with riparian areas or general drainage basins (Armstrong et al. 1994). Furthermore, small mammal densities are known to fluctuate widely over time (Smith et al. 2009). During both trapping events, five species were captured. The masked shrew was captured in 2010 but not in 2011, whereas the western harvest mouse was captured in 2011 but not in 2010. Otherwise, species representation was the same. Although not captured, burrow holes and runways of the thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*) were observed in the xeric mixed grassland. This species was reported present in 2002 (DOE 2002) and likely is still present.

The species richness of six captured species of small mammals in 2010-2011 at NWTC is high relative to Walsh's extensive trapping experience all along the Front Range. This is likely due, in part, to the combination of different habitat types found on the site. It also indicates that the site does have biodiversity value, especially for small mammals. Small mammals, in turn, support biodiversity by serving as prey to many species of predators including snakes, raptors, and coyotes.

The previous work (DOE 2002) found four species, deer mouse, prairie vole, thirteen-lined ground squirrel, and Mexican woodrat. Other than the thirteen-lined ground squirrel, all those species were captured during the present surveys as well as the masked shrew and western harvest mouse. It is not known if the species richness has increased, or more likely, the trapping effort was greater and/or that conditions favoring the moisture-dependent masked shrew and meadow vole were present in 2010.

Of the three habitats sampled, xeric mixed grassland and xeric mixed grassland/Ponderosa pine woodland had three small mammal species each, whereas the riparian fringe wetland had four

species. Riparian corridors are known to be favored habitats for many faunal species, small mammals included.

The possibility of the occasional occurrence of a Preble's meadow jumping mouse (*Zapus hudsonius preblei*) on one of the two riparian fringe wetlands, tributaries of Coal Creek (Transect C) and Rock Creek (Transect B), or the draw in the Conservation Management Area on the west side of the site (Transect A) should not be ruled out, especially during wet years (Figure 3). Both Coal Creek and Rock Creek are known to be occupied by this mouse, listed as threatened under the Endangered Species Act. Preble's mice occur on the adjacent Rocky Flats Wildlife Refuge (previously known as RFETS), where their dispersal and daily movements have been studied (Ryon 1999). There also was an unexpected 1997 off-site capture of a Preble's mouse in close vicinity to the site. That occurrence was in a roadside gully on the western side of SH93 (ETS 1997, as cited in DOE 2002) and tributary to Coal Creek. Preble's mice have the ability to move into the headwater tributaries on the NWTC, however the habitat is marginal and the value of such movements would be difficult to determine. This headwater tributary may be accessed by transient individuals seeking suitable habitat or could be used as hibernation sites, perhaps in years when other more suitable habitat is occupied. Transient individuals could move through the site to access other suitable habitat areas in Coal Creek or Rock Creek on the Rocky Flats Wildlife Refuge. However, such movements are likely very rare. It is important to note that the vegetation types that a Preble's mouse would possibly use on the NWTC are already Conservation Management Areas and these areas will be protected from impacts for a variety of environmentally related reasons, including preservation of wetlands, water quality and site diversity.

RECOMMENDATIONS

Based on the observations discussed above, there are several measures and recommendations that could minimize impacts to native vegetation communities and wildlife in relation to the presence of the wind testing development activities on site. These include:

- Develop the smallest possible footprint for turbines, access roads, and other infrastructure. For example, if a new road is needed, determine what can be the narrowest width and shortest extent, or use a two-track rather than a proper road.
- Minimize disturbance to native plant communities to benefit native grassland species of amphibians, reptiles, birds, and mammals.
- To protect native plant community biodiversity, eradicate small weed populations, monitor for new weed infestations, and actively manage weeds on-site through NREL's aggressive weed control program (DOE 2002, Jefferson County Nature Association 2009).
- As suggested by Avian Power Line Interaction Committee (APLIC 2006), fit new power and communication towers with perch guards; design powerline conductor spacing to minimize the potential for raptor electrocutions (52 inches apart for raptors); design transmission lines to have the top two wires (lightning/ground wires) made visible.
- Equip permanent meteorological towers with Bird Flight Diverters to minimize the potential for avian collisions with guy wires, or utilize meteorological towers that are constructed without the use of guy wires.
- Adhere to Executive Order (EO) 13186 - Responsibilities of Federal Agencies to Protect Migratory Birds (January 17, 2001); the memorandum of understanding (MOU) between

DOE and USFWS regarding EO 13186 (November 13, 2006); and the MOU between the Trustee Council for Natural Resources at Rocky Flats, and DOE's Office of Energy Efficiency and Renewable Energy (EERE) (June 30, 2009).

- Consider preparation of an Avian and Bat Protection Plan (ABPP) as part of the ongoing site activities.

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APPENDIX A

Colorado Natural Heritage Program Data Query Response

Colorado Natural Heritage Program Terminology Cheat Sheet For Conservation Data Provided in Environmental Review Reports & Program Related Web-links

Selected Web Links:

Colorado Natural Heritage Program: CNHP is a leading source in the state for the biodiversity information that is essential for effective planning and successful conservation efforts. CNHP is a nonprofit organization, and is a sponsored program of the College of Natural Resources, Department of Fishery and Wildlife Biology at Colorado State University. We are also a member of the Natural Heritage Network, an international network of partners that use the same scientific methodology to enable planners, scientists and policy-makers to monitor the status of species and natural communities from state, national, and global perspectives.

http://www.cnhp.colostate.edu/ - CNHP's home page. See related links on our home page to products and services available such as environmental review, data requests, biological assessments, publications, and more. Staff contacts are available here as well.

CSU:

http://welcome.colostate.edu/ - We are an independent non-profit that is a sponsored program at Colorado State University, but other state natural heritage programs are often a part of state government.

http://warnercnr.colostate.edu/ - The Warner College of Natural Resources at CSU, where CNHP is housed.

NatureServe: NatureServe works in partnership with 85 independent Natural Heritage programs and Conservation Data Centers that gather scientific information on rare species and ecosystems in the United States, Latin America, and Canada (the Natural Heritage Network).

http://www.natureserve.org/ - also see conservation information and data available on

http://www.natureserve.org/explorer/ - for detailed information on species and natural communities.

http://www.landscope.org/ - the conservation guide to America's natural places providing an online resource for the land-protection community and the public.

Environmental Review Report Attribute Definitions

Attribute_Label: **Highest EO Rank**

Attribute_Label_Definition:
The EO rank assigned to each occurrence represents a comparative evaluation summarizing several factors. These include quality (how closely the occurrence matches the EO specifications including maturity, size, numbers, etc.), condition (how much has the site and the element occurrence itself has been damaged or altered from its optimal condition and character), viability (the long-term prospects for continued existence of the occurrence), and defensibility (the extent to which the occurrence can be protected from anthropogenic factors that might otherwise degrade or destroy it). The rank is assigned on the basis of recent fieldwork by a knowledgeable individual. The best occurrence of an element in a state may bot necessarily be assigned an "A" rank. It may be assigned a lower rank if somewhere else in the element's global range, there are occurrences that merit a higher rank. Blank values indicate that the rank is under scientific review.

Attribute_Domain_Values:
A - Excellent
B - Good
C - Fair
D - Poor
E - Extant (existence verified, but quality cannot be assessed)
F - Failed to find
H - Historical
I - Introduced
O - Obscure
X - Extirpated
*Split ranks indicate uncertainty about the assigned rank

Attribute_Label: **Global Rank**

Attribute_Label_Definition:
The global element rank that best characterizes the relative rarity or endangerment of the element worldwide. Global ranks are derived primarily by staff at the Central Heritage Conservation Science Department, unless CNHP has lead responsibility for that element.

Attribute_Domain_Values:
G1 - Globally critically imperiled; typically 5 or fewer occurrences
G2 - Globally imperiled; typically 6 to 20 occurrences
G3 - Globally vulnerable; typically 21 to 100 occurrences
G4 - Globally apparently secure; usually > 100 occurrences
G5 - Globally demonstrably secure although it may be rare in parts of its range
G#G# - A range between two of the numeric ranks; indicates uncertainty about the rarity of the element
G? - Unranked; element is not yet ranked globally
GU - Unrankable; not enough information is known
GH - Historically known with hopes of rediscovery

GX - Extinct; unlikely to be rediscovered
T# - Rank applies to a subspecies or variety
Q - Taxonomic status is questionable
C - Element is extant only in captivation or cultivation
*Other factors, in addition to the number of occurrences, may be considered when assigning a global rank

Attribute_Label: **State Rank**

Attribute_Label_Definition:
The state element rank that best characterizes the relative rarity or endangerment of the element statewide. State ranks are derived by CNHP staff.

Attribute_Domain_Values:
S1 - State critically imperiled; typically 5 or fewer occurrences
S2 - State imperiled; typically 6 to 20 occurrences
S3 - State vulnerable; typically 21 to 100 occurrences
S4 - State apparently secure; usually > 100 occurrences
S5 - State demonstrably secure
S#S# - A range between two of the numeric ranks; indicates uncertainty about the rarity of the element
S? - Unranked; element is not yet ranked in the state
SU - Unrankable; not enough information is known
SH - Historically known with hopes of rediscovery
SX - Extinct; unlikely to be rediscovered
SE - An exotic established in the state; native to a nearby region
SA - Accidental; includes species (usually birds or butterflies) recorded once or twice or only at very great intervals, hundreds or thousands of miles outside their usual range
B - Rank refers to the breeding population of the element
N - Rank refers to the nonbreeding population of the element
C - Element is extant only in captivation or cultivation
*Other factors, in addition to the number of occurrences, may be considered when assigning a state rank

Attribute_Label: **Fed Listed**

Attribute_Label_Definition:
The federal legal status of the species as assigned by the U.S. Fish and Wildlife Service.

Attribute_Domain_Values:
C - ESA candidate
LE - Listed endangered
LE-PDL - Listed endangered, proposed delisting
LT - Listed threatened
PT - Proposed threatened
(PS) - Partial status; infraspecific taxon or population has federal status but the entire species does not - status in only a portion of the species' range
(LE-XN) - Listed as endangered; a nonessential experimental population exists in Colorado

*Blank values indicate no federal legal status per USFWS

Attribute_Label: **Fed Sens**
Attribute_Label_Definition:
Denotes species considered sensitive by the U.S. Forest Service and/or the Bureau of Land Management (does NOT include ESA status).
Attribute_Domain_Values:
BLM - Legal status assigned by the Bureau of Land Management
FS - Legal status assigned by the U.S. Forest Service
FS/BLM - Legal status assigned by both the U.S. Forest Service and the Bureau of Land Management
*Blank values indicate no federal legal status per BLM or USFS

Attribute_Label: **State Listed**
Attribute_Label_Definition:
The state legal status of vertebrate or invertebrate species as assigned by the Colorado Division of Wildlife.
Attribute_Domain_Values:
E - State endangered; elements of native wildlife whose prospects for survival or recruitment within this state are in jeopardy
T - State threatened; elements that are not in immediate jeopardy of extinction, but are vulnerable due to small numbers, restricted throughout its range, or experiencing low recruitment or survival
SC- Special concern
*Blank values indicate no state legal status per CDOW

Attribute_Label: **Precision**
Attribute_Label_Definition:
Precision refers to the accuracy of the location of the element occurrence. CNHP compiles data from a variety of sources including published and unpublished literature, herbaria and museum labels, personal communication, and documentation of actual field surveys conducted by CNHP staff, Forest Service personnel, or other knowledgeable individuals. The level of spatial uncertainty, then, varies from occurrence to occurrence.
Attribute_Domain_Values:
S - Seconds precision; essentially an "X" marks the spot"; mapable to within approximately 3 arc seconds of latitude and longitude
M - Minutes precision; mapable within approximately 2 square miles
G - General precision; mapable within approximately two USGS 7.5 minute quadrangles

Data Dictionary for
Network of Conservation Areas
Transcription Reports from the
Colorado Natural Heritage Program

This Data Dictionary defines terms used in Network of Conservation Areas (NCA) Reports exported by the Colorado Natural Heritage Program (CNHP) from our Biodiversity Tracking and Conservation System (BIOTICS) database.

Introduction to Network of Conservation Areas
A Network of Conservation Areas (NCA) will fit one of the following definitions:

A. A landscape area that encompasses Potential Conservation Areas (PCAs) that share similar species or natural communities and ecological processes. NCAs include unoccupied or unsurveyed areas that are within the same ecological system that the species or natural communities require. NCAs contain PCAs with an obvious repeating pattern (that is, the same species or natural communities are in each associated PCA).

B. A mostly intact, lightly fragmented landscape that supports wide-ranging species and large scale disturbances. NCAs include unoccupied or unsurveyed areas that demonstrate the connectivity of the landscape. NCAs contain PCAs that may occur at a variety of ecological scales.

Potential Conservation Area
In order to successfully protect populations or occurrences, it is necessary to delineate conservation areas. These potential conservation areas focus on capturing the ecological processes that are necessary to support the continued existence of a particular element of natural heritage significance. Potential conservation areas may include a single occurrence of a rare element or a suite of rare elements or significant features.

The goal of the process is to identify a land area that can provide the habitat and ecological processes upon which a particular element or suite of elements depends for their continued existence. The best available knowledge of each species' life history is used in conjunction with information about topographic, geomorphic, and hydrologic features, vegetative cover, as well as current and potential land uses. The proposed boundary does not automatically exclude all activity. It is hypothesized that some activities will cause degradation to the element or the process on which they depend, while others will not. Consideration of specific activities or land use changes proposed within or adjacent to the preliminary conservation planning boundary should be carefully considered and evaluated for their consequences to the element on which the conservation unit is based.

Element Occurrence
An Element Occurrence (EO) is defined as a specific example of an Element at a geographic location characterized by a habitat capable of sustaining or contributing to the survival of the species, or by a landscape that supports the ecological integrity of the community.

Element
A biodiversity unit of conservation attention and action for which a Heritage Conservation Status Rank is assigned.

Elements may be recognized at any taxonomic level (although typically are only recognized at the species level and below for organisms, and the Ecological System, Alliance, and Association levels for communities).

Elements may also be recognized for biodiversity units for which there is no systematic hierarchy (e.g., animal assemblages, community Complexes).

Elements may be native or exotic at a particular location and collectively represent the full array of biological and ecological diversity for the geographic area covered. Elements may serve as the

targets of Heritage inventory. Typically, these targets include native, regularly occurring vulnerable species (including infraspecific taxa and populations) and exemplary ecological communities.

REPORT HEADER

Name
The official CNHP site name, usually corresponding to a local place name or nearby geographic feature.

Site Code
Unique identifier previously used in the BCD for a site record.

IDENTIFIERS

Site ID
Unique identifier for a site.

Site Class
Value that indicates whether a site is a Potential Conservation Area (PCA) or Network of Conservation Areas (NCA).

Domain values for Site Class are:

PCA
NCA

Site Alias
Other names commonly associated with the NCA. These can include informal names, old site names, names used by other offices or cooperating organizations, or the original survey site name.

Site Relations
Comments that explain the relationship between this site and any nested, overlapping, or adjacent sites.

LOCATORS

Nation
State

Latitude
Degrees, Minutes, Seconds. Datum is NAD 27. Calculated in GIS.

Longitude
Degrees, Minutes, Seconds. Datum is NAD 27. Calculated in GIS.

Quad Code
Calculated in GIS.

Quad Name
Calculated in GIS.

County
Calculated in GIS.

Watershed Code
U.S.G.S. 8-digit hydrologic unit code. Calculated in GIS.

Watershed Name
U.S.G.S. watershed name. Calculated in GIS.

Site Directions *[provided with Level 1 data only]*
Specific directions to the site provided by the designer or version author.

SITE DESCRIPTION

Minimum Elevation
Minimum elevation provided by the designer or version author.

Maximum Elevation
Maximum elevation provided by the designer or version author.

Site Description
General visual description (or word picture) of the principal physical and natural features on the site.

Key Environmental Factors
Description of the driving factors or key environmental variables that are known to exert a major influence on the biota at the site (e.g., seasonal flooding, wind, soil type).

Climate Description
General comments concerning climate and weather patterns, wind patterns, seasonal and annual variations, as well as temperature and precipitation patterns characteristic of the site.

Land Use History
Comments concerning past land uses on this site (such as mining, logging, shifting cultivation, etc.).

Cultural Features
Comments concerning any historic, cultural, or archaeological features found on the site (e.g., pictographs, petroglyphs, burial mounds, prehistoric artifacts).

SITE DESIGN

Site Map
Indicates whether a site boundary was field verified or drawn from desktop references.

Domain values for Site Map are:
P – partial; drawn from desktop references
Y – field verified by CNHP personnel

Mapped Date
Date site boundary was last redrawn.

Designer
CNHP biologist responsible for drawing the site boundary.

Boundary Justification
Explanation of the biological rationale used to determine the ecological boundaries for the site.

Primary Area
Area of the NCA polygon. Calculated in GIS.

OTHER/PROTECTION/MANAGEMENT RANKS

Other Values Rank
Value that indicates the rating that best describes the significance of the site in terms of its aesthetic, recreational, open space, and other ecological values; this includes its role in maintaining ecosystem health (e.g., by providing game and wildlife habitat, aquifer recharge functions, erosion control).

Domain values for Other Values are:
V1 - Outstanding values
V2 - High values
V3 - Moderate values
V4 - No known values
V5 - Negative or counter values
V? - Unknown
(null) - Not assessed

Other Values Comments
Comments that justify the rating assigned for the site in the Other Values field.

Protection Urgency Rank
Value that indicates the rating that best describes the urgency to protect the Site. The urgency for protection action (not to be confused with the urgency for management action) will generally increase with impending threats to the site until legal, political, or other administrative measures are taken.

Domain values for Protection Urgency are:

P1 - Immediately threatened/outstanding opportunity
P2 - Threat/opportunity within 5 years
P3 - Definable threat/opportunity, but not within 5 years
P4 - No threat or special opportunity
P5 - No action to be taken on this site
P? - Unknown

Protection Urgency Comments
Comments that justify the rating assigned for the site in the Protection Urgency field.

Management Urgency Rank
Value that indicates the rating that best describes the urgency to manage one or more Elements at the site. The urgency for management action (not to be confused with the urgency for legal protection action) requires stewardship intervention in order to maintain EOs at the site.

Domain values for Management Urgency are:

M1 - Essential within 1 year to prevent loss
M2 - Essential within 5 years to prevent loss
M3 - Needed within 5 years to maintain quality
M4 - Not needed now; no current threats; may need in future
M5 - Not needed; no threats anticipated
M? - Unknown

Management Urgency Comments
Comments that justify the rating assigned for the site in the Management Urgency field.

LAND MANAGEMENT ISSUES

Land Use Comments
Description of the current and past land use, improvements, and structures on the site.

Natural Hazard Comments
Description of the potential natural hazards (e.g., cliffs, caves, waterfalls) on the site, along with any precautions that should be taken by stewards.

Exotics Comments
Description of potentially damaging exotic (i.e., alien) flora and fauna (e.g., kudzu, honeysuckle, purple loosestrife, periwinkle, English ivy, feral goats, pigs) on the site.

Offsite
Description of off-site land uses (e.g., farming, logging, grazing, dumping, watershed diversion), and how these uses might affect the site and management of the site.

Information Needs
Summary of the information that is still needed in order to effectively manage the site.

Management Needs
Summary of the expected management needs for the site.

Managed Area Relations
Explanation of the site/Managed Area relationship, if a Managed Area has been (or will be) established to protect the site.

Protection Comments
Summary of the general level of protection currently afforded the site that indicates the current protection status of component Tracts.

ASSOCIATED POTENTIAL CONSERVATION AREAS

(PCAs known from the area of a given NCA.)

Potential Conservation Area
In order to successfully protect populations or occurrences, it is necessary to delineate conservation areas. These potential conservation areas focus on capturing the ecological processes that are necessary to support the continued existence of a particular element of natural heritage significance. Potential conservation areas may include a single occurrence of a rare element or a suite of rare elements or significant features.

The goal of the process is to identify a land area that can provide the habitat and ecological processes upon which a particular element or suite of elements depends for their continued existence. The best available knowledge of each species' life history is used in conjunction with information about topographic, geomorphic, and hydrologic features, vegetative cover, as well as current and potential land uses. The proposed boundary does not automatically exclude all activity. It is hypothesized that some activities will cause degradation to the element or the process on which they depend, while others will not. Consideration of specific activities or land use changes proposed within or adjacent to the preliminary conservation planning boundary should be carefully considered and evaluated for their consequences to the element on which the conservation unit is based.

PCA Site ID
Unique identifier for the PCA associated with this NCA.

PCA Site Name
The official CNHP site name for the PCA associated with this NCA.

PCA Biological Diversity Significance
The Biodiversity Significance Rank of the PCA associated with this NCA. This value indicates the rating that best describes the significance of the PCA in terms of its biological diversity.

Domain values for Biodiversity Significance are:

B1: Outstanding Biodiversity Significance
B2: Very High Biodiversity Significance
B3: High Biodiversity Significance

B4: Moderate Biodiversity Significance
B5: General interest/open space

REFERENCES

Reference ID
The identifier for a reference available for this NCA.

Full Citation
Formal citation for a reference associated with the NCA.

ADDITIONAL TOPICS

Additional Topics
Specific comments on any significant additional nonstandard topics that have not been formally addressed by one of the standard fields in this record.

VERSION

Version Date
Date report information for the NCA was last reviewed or updated.

Version Author
Author of the current version of the transcription in this report.

Data Dictionary for
Potential Conservation Area
Transcription Reports from the
Colorado Natural Heritage Program

This Data Dictionary defines terms used in Potential Conservation Area (PCA) Reports exported by the Colorado Natural Heritage Program (CNHP) from our Biodiversity Tracking and Conservation System (BIOTICS) database.

Introduction to Potential Conservation Areas
In order to successfully protect populations or occurrences, it is necessary to delineate conservation areas. These potential conservation areas focus on capturing the ecological processes that are necessary to support the continued existence of a particular element of natural heritage significance. Potential conservation areas may include a single occurrence of a rare element or a suite of rare elements or significant features.

The goal of the process is to identify a land area that can provide the habitat and ecological processes upon which a particular element or suite of elements depends for their continued existence. The best available knowledge of each species' life history is used in conjunction with information about topographic, geomorphic, and hydrologic features, vegetative cover, as well as current and potential land uses. The proposed boundary does not automatically exclude all activity. It is hypothesized that some activities will cause degradation to the element or the process on which they depend, while others will not. Consideration of specific activities or land use changes proposed within or adjacent to the preliminary conservation planning boundary should be carefully considered and evaluated for their consequences to the element on which the conservation unit is based.

Element Occurrence
An Element Occurrence (EO) is defined as a specific example of an Element at a geographic location characterized by a habitat capable of sustaining or contributing to the survival of the species, or by a landscape that supports the ecological integrity of the community.

Element
A biodiversity unit of conservation attention and action for which a Heritage Conservation Status Rank is assigned.

Elements may be recognized at any taxonomic level (although typically are only recognized at the species level and below for organisms, and the Ecological System, Alliance, and Association levels for communities).

Elements may also be recognized for biodiversity units for which there is no systematic hierarchy (e.g., animal assemblages, community Complexes).

Elements may be native or exotic at a particular location and collectively represent the full array of biological and ecological diversity for the geographic area covered. Elements may serve as the targets of Heritage inventory. Typically, these targets include native, regularly occurring vulnerable species (including infraspecific taxa and populations) and exemplary ecological communities.

REPORT HEADER

Name
The official CNHP site name, usually corresponding to a local place name or nearby geographic feature.

Site Code
Unique identifier previously used in the BCD for a site record.

IDENTIFIERS

Site ID
Unique identifier for a site.

Site Class
Value that indicates whether a site is a Potential Conservation Area (PCA) or Network of Conservation Areas (NCA).

Domain values for Site Class are:
PCA
NCA

Site Alias
Other names commonly associated with the PCA. These can include informal names, old site names, names used by other offices or cooperating organizations, or the original survey site name.

Network of Conservation Areas (NCA)
A Network of Conservation Areas (NCA) will fit one of the following definitions:

A. A landscape area that encompasses Potential Conservation Areas (PCAs) that share similar species or natural communities and ecological processes. NCAs include unoccupied or unsurveyed areas that are within the same ecological system that the species or natural communities require. NCAs contain PCAs with an obvious repeating pattern (that is, the same species or natural communities are in each associated PCA).

B. A mostly intact, lightly fragmented landscape that supports wide-ranging species and large scale disturbances. NCAs include unoccupied or unsurveyed areas that demonstrate the connectivity of the landscape. NCAs contain PCAs that may occur at a variety of ecological scales.

NCA Site ID
Site ID of the NCA associated with this PCA.

NCA Site Code
Site code of the NCA associated with this PCA.

NCA Site Name
Official CNHP site name of the NCA associated with this PCA.

Site Relations
Comments that explain the relationship between this site and any nested, overlapping, or adjacent sites.

LOCATORS

Nation
State

Latitude
Degrees, Minutes, Seconds. Datum is NAD 27. Calculated in GIS.

Longitude
Degrees, Minutes, Seconds. Datum in NAD 27. Calculated in GIS.

USGS 7.5 Minute Quadrangle
Calculated in GIS.

- **Quad Code**
- **Quad Name**

County
Calculated in GIS.

Watershed Code
8 digit U.S.G.S. hydrological unit code. Calculated in GIS.

Watershed Name
U.S.G.S. watershed name. Calculated in GIS.

Township/Range/Section (TRS) - Public Land Survey System
Calculated in GIS.

- **Township/Range**
- **Section**
- **Meridian**
- **TRS Note**

Site Directions *[provided with Level 1 data only]*
Specific directions to the site provided by the designer or version author.

SITE DESCRIPTION

Minimum Elevation
Minimum elevation provided by the designer or version author.

Maximum Elevation
Maximum elevation provided by the designer or version author.

Site Description
General visual description (or word picture) of the principal physical and natural features on the site.

Key Environmental Factors
Description of the driving factors or key environmental variables that are known to exert a major influence on the biota at the site (e.g., seasonal flooding, wind, soil type).

Climate Description
General comments concerning climate and weather patterns, wind patterns, seasonal and annual variations, as well as temperature and precipitation patterns characteristic of the site.

Land Use History
Comments concerning past land uses on this site (such as mining, logging, shifting cultivation, etc.).

Cultural Features
Comments concerning any historic, cultural, or archaeological features found on the site (e.g., pictographs, petroglyphs, burial mounds, prehistoric artifacts).

SITE DESIGN

Site Map
Indicates whether a site boundary was field verified or drawn from desktop references.

Domain values for Site Map are:

P – partial; drawn from desktop references
Y – field verified by CNHP personnel

Mapped Date
Date site boundary was last redrawn.

Designer
CNHP biologist responsible for drawing the site boundary.

Boundary Justification
Explanation of the biological rationale used to determine the ecological boundaries for the site.

Primary Area
Area of PCA polygon. Calculated in GIS.

SITE SIGNIFICANCE

Biodiversity Significance Rank
Value that indicates the rating that best describes the significance of the site in terms of its biological diversity.

Domain values for Biodiversity Significance are:

B1: Outstanding Biodiversity Significance
B2: Very high Biodiversity Significance
B3: High Biodiversity Significance
B4: Moderate Biodiversity Significance
B5: General interest/open space
B?: Unknown

Biodiversity Significance Comments
Comments that justify the rating assigned for the site in the Biodiversity Significance field.

Other Values Rank
Value that indicates the rating that best describes the significance of the site in terms of its aesthetic, recreational, open space, and other ecological values; this includes its role in maintaining ecosystem health (e.g., by providing game and wildlife habitat, aquifer recharge functions, erosion control).

Domain values for Other Values are:

V1 - Outstanding values
V2 - High values
V3 - Moderate values
V4 - No known values
V5 - Negative or counter values
V? - Unknown
(null) - Not assessed

Other Values Comments
Comments that justify the rating assigned for the site in the Other Values field.

Protection Urgency Rank *[provided with Level 1 data only]*
Value that indicates the rating that best describes the urgency to protect the site. The urgency for protection action (not to be confused with the urgency for management action) will generally increase with impending threats to the site until legal, political, or other administrative measures are taken.

Domain values for Protection Urgency are:

P1 - Immediately threatened/outstanding opportunity
P2 - Threat/opportunity within 5 years
P3 - Definable threat/opportunity, but not within 5 years
P4 - No threat or special opportunity
P5 - No action to be taken on this site
P? - Unknown

Protection Urgency Comments *[provided with Level 1 data only]*
Comments that justify the rating assigned for the site in the Protection Urgency field.

Management Urgency Rank *[provided with Level 1 data only]*
Value that indicates the rating that best describes the urgency to manage one or more Elements at the site. The urgency for management action (not to be confused with the urgency for legal protection action) requires stewardship intervention in order to maintain EOs at the site.

Domain values for Management Urgency are:

M1 - Essential within 1 year to prevent loss
M2 - Essential within 5 years to prevent loss
M3 - Needed within 5 years to maintain quality
M4 - Not needed now; no current threats; may need in future
M5 - Not needed; no threats anticipated
M? - Unknown

Management Urgency Comments *[provided with Level 1 data only]*
Comments that justify the rating assigned for the site in the Management Urgency field.

LAND MANAGEMENT ISSUES

Land Use Comments
Description of the current and past land use, improvements, and structures on the site.

Natural Hazard Comments
Description of the potential natural hazards (e.g., cliffs, caves, waterfalls) on the site, along with any precautions that should be taken by stewards.

Exotics Comments
Description of potentially damaging exotic (i.e., alien) flora and fauna (e.g., kudzu, honeysuckle, purple loosestrife, periwinkle, English ivy, feral goats, pigs) on the site.

Offsite
Description of off-site land uses (e.g., farming, logging, grazing, dumping, watershed diversion), and how these uses might affect the site, Elements on the site, and management of the site.

Information Needs
Summary of the information that is still needed in order to effectively manage the site and Elements on it.

Management Needs *[provided with Level 1 Data only]*
Summary of the expected management needs for the site and the Elements on it.

Managed Area Relations *[provided with Level 1 Data only]*
Explanation of the site/Managed Area relationship, if a Managed Area has been (or will be) established to protect the site.

Protection Comments *[provided with Level 1 Data only]*
Summary of the general level of protection currently afforded the site that indicates the current protection status of component Tracts.

ASSOCIATED ELEMENTS OF BIODIVERSITY

(Tracked Elements known from the area of a given PCA.)

Element
A biodiversity unit of conservation attention and action for which a Heritage Conservation Status Rank is assigned.

Elements may be recognized at any taxonomic level (although typically are only recognized at the species level and below for organisms, and the Ecological System, Alliance, and Association levels for communities).

Elements may also be recognized for biodiversity units for which there is no systematic hierarchy (e.g., animal assemblages, community Complexes).

Elements may be native or exotic at a particular location and collectively represent the full array of biological and ecological diversity for the geographic area covered. Elements may serve as the targets of Heritage inventory. Typically, these targets include native, regularly occurring vulnerable species (including infraspecific taxa and populations) and exemplary ecological communities.

Element State ID
Unique state identifier for an Element.

State Scientific Name
State scientific name for an Element having occurrences associated with this PCA.

State Common Name
State common name for an Element having occurrences associated with this PCA.

Global Rank
The global element rank that best characterizes the relative rarity or endangerment of the element worldwide. Factors other than the number of occurrences may be considered when assigning a global rank. Global ranks are derived primarily by staff at the Central Heritage Conservation Science Department, unless CNHP has lead responsibility for that element.

Domain values for Global Rank are:

G1 - Globally critically imperiled; typically 5 or fewer occurrences
G2 - Globally imperiled; typically 6 to 20 occurrences
G3 - Globally vulnerable; typically 21 to 100 occurrences
G4 - Globally apparently secure; usually > 100 occurrences
G5 - Globally demonstrably secure although it may be rare in parts of its range
G#G# - A range between two of the numeric ranks; indicates uncertainty about the rarity of the element
G? - Unranked; element is not yet ranked globally
GU - Unrankable; not enough information is known
GH - Historically known with hopes of rediscovery
GX - Extinct; unlikely to be rediscovered
T# - Rank applies to a subspecies or variety
Q - Taxonomic status is questionable

C - Element is extant only in captivation or cultivation
GNR - Not ranked globally

State Rank
The state element rank that best characterizes the relative rarity or endangerment of the element statewide. Factors other than the number of occurrences may be considered when assigning a state rank. State ranks are derived by CNHP staff.

Domain values for State Rank are:

S1 - State critically imperiled; typically 5 or fewer occurrences
S2 - State imperiled; typically 6 to 20 occurrences
S3 - State vulnerable; typically 21 to 100 occurrences
S4 - State apparently secure; usually > 100 occurrences
S5 - State demonstrably secure
S#S# - A range between two of the numeric ranks; indicates uncertainty about the rarity of the element
S? - Unranked; element is not yet ranked in the state
SU - Unrankable; not enough information is known
SH - Historically known with hopes of rediscovery
SX - Extinct; unlikely to be rediscovered
SE - An exotic established in the state; native to a nearby region
SA - Accidental; includes species (usually birds or butterflies) recorded once or twice or only at very great intervals, hundreds or thousands of miles outside their usual range
B - Rank refers to the breeding population of the element
N - Rank refers to the nonbreeding population of the element
C - Element is extant only in captivation or cultivation
SNR – Not ranked in the state

Driving Site Rank
Yes or No, indicates whether this EO is the EO which is driving the biodiversity rank of this PCA. A combination of Global Imperilment Rank, State Imperilment Rank, and EO Rank factors determine if a given EO drives the biodiversity rank of a PCA that supports it.

REFERENCES

Reference ID
The identifier for a reference available for this PCA.

Full Citation
Formal citation for a reference associated with the PCA.

ADDITIONAL TOPICS

Additional Topics
Specific comments on any significant additional nonstandard topics that have not been formally addressed by one of the standard fields in this record.

VERSION

Version Date
Date report information for the PCA was last reviewed or updated.

Version Author
Author of the current version of the transcription in this report.

Potential Conservation Area (PCA) Report

Name Coal Creek below Rocky Flats **Site Code** S.USCOHP*27227

IDENTIFIERS

Site ID 2501 **Site Class** PCA

Site Alias None

Network of Conservation Areas (NCA)

NCA Site ID	NCA Site Code	NCA Site Name
2527	S.USCOHP*27435	Rocky Flats Grasslands

Site Relations Shares a small portion of its northern boundary with Doudy Draw (S.USCOHP2*2605). Contained in Marshall Mesa (S.USCOHP*5663) and Rocky Flats Grassland (S.USCOHP*27435).

LOCATORS

Nation United States **Latitude** 395559N

State Colorado **Longitude** 1051214W

Quad Code	Quad Name
39105-H2	Louisville

County

Watershed Code	Watershed Name
10190005	St. Vrain

Township/Range	Section	Meridian	Note
001S070W	27	6P	
001S070W	26	6P	
001S070W	23	6P	
001S070W	35	6P	
001S070W	34	6P	
001S070W	25	6P	
001S070W	33	6P	
001S070W	24	6P	
001S070W	28	6P	

SITE DESCRIPTION

Minimum Elevation	5,500.00	**Feet**	1,676.40	**Meters**
Maximum Elevation	6,050.00	**Feet**	1,844.04	**Meters**

Site Description

This site is located in southeastern Boulder County, immediately north of the boundary with Jefferson County, southwest of the town of Superior. Coal Creek originates in the southwestern corner of Boulder County, near the town of Wondervu. It makes a southward loop into Jefferson County, emerging onto the Rocky Flats terrace, and then turning north to re-enter Boulder County at the northern edge of Rocky Flats. In southern Boulder County, Coal Creek runs through open grasslands below mesas. Historically, the floodplain was likely somewhat wide and meandering, but is now entrenched within low terraces. The creek itself is only 10-20 ft. (3-6 m) across. Water levels are probably never very high in this creek, because there are numerous diversions along the creek. The riparian vegetation is between 164-410 ft. (50-125 m) across, including low shrubs on terraces above the creek. These vegetated terraces may be remnants of when the floodplain was wider, or they may be able to access groundwater recharging from the stream. Within the site, Coal Creek contains a long, continuous stretch of foothills riparian vegetation extending from near the Boulder/Jefferson county line downstream to the town of Superior. The riparian vegetation includes a continuous overstory of mature and regenerating cottonwood trees over dense tall shrubs. Both plains cottonwood (*Populus deltoides*) and narrowleaf cottonwood (*Populus angustifolia*) contribute to the cottonwood overstory, and though the association name is *Populus angustifolia / Salix irrorata* woodland, this occurrence contains higher cover of plains cottonwood than narrowleaf cottonwood since it is located at a lower elevation than most occurrences. Dominant shrubs within the riparian channel include bluestem willow (*Salix irrorata*) and narrowleaf willow (*Salix exigua*), though upper terraces contain more cerro hawthorn (*Crataegus erythropoda*) and American plum (*Prunus americana*). Yellow hawthorn *(Crataegus chrysocarpa)* has been documented here as well. The surrounding dry grasslands are strongly dominated by non-native species.

Potential Conservation Area (PCA) Report

Name Coal Creek below Rocky Flats **Site Code** S.USCOHP*27227

Key Environmental Factors

No Data

Climate Description

No Data

Land Use History

Historic land use includes grazing, gravel mining, and water diversions.

Cultural Features

No Data

SITE DESIGN

Site Map Y - Yes **Mapped Date** 06/03/2008

Designer Decker, K.L. and J.M. Lemly

Boundary Justification

The boundary includes the occurrences and a buffer against direct disturbance. The natural processes are not completely contained within the boundary, and off-site activities within the larger watershed have the potential to impact the elements of biodiversity present in the area.

Primary Area 1,504.47 **Acres** 608.84 **Hectares**

SITE SIGNIFICANCE

Biodiversity Significance Rank B3: High Biodiversity Significance

Biodiversity Significance Comments

This site supports a fair (C-ranked) occurrence of a globally imperiled (G2/S2) *Populus angustifolia / Salix irrorata* riparian woodland, two occurrences of the federally Threatened and globally imperiled (G5T2/S1) Preble's meadow jumping mouse (*Zapus hudsonius preblei*) in fair condition, and a fair to poor (CD-ranked) occurrence of the state imperiled (G5/S1B) Bald Eagle (*Haliaeetus leucocephalus*). Additionally, Boulder County has documented Ferruginous Hawk (*Buteo regalis*) nests and an occurrence of the state rare plant (G5/S2S3) fragrant indigobush (*Amorpha nana*), but these are not in the CNHP database at this time.

Other Values Rank No Data

Other Values Comments

No Data

LAND MANAGMENT ISSUES

Land Use Comments

Cattle grazed the area for decades and likely grazed right into the riparian corridor. In addition, there were gravel mining operations in the floodplain.

Natural Hazard Comments

No Data

Exotics Comments

The upland grasslands are strongly dominated by non-native hay grasses and invasive weeds e.g., Kentucky bluegrass (*Poa pratensis*), timothy (*Phleum pratense*), orchard grass (*Dactylis glomerata*), cheatgrass (*Anisantha tectorum*), jointed goatgrass (*Aegilops cylindrical*) and smooth brome (*Bromus inermis*), as well as the following non-native forbs: Canada thistle (*Cirsium arvense*), bouncing bet (*Saponaria officinalis*), and bull thistle (*Cirsium vulgare*), chicory (*Cichoruim intybus*), common mullein (*Verbascum thaspus*), common teasel (*Dipsacus fullonum*), cut-leaved teasel (*Dipsacus laciniatus*), diffuse knapweed (*Centaurea diffusa*), musk thistle (*Carduus nutans*), poison hemlock (*Conium maculatum*), Russian olive (*Elaeagnus angustifolia*), Scotch thistle (*Onopordum acanthium*), and sulphur cinquefoil (*Potentilla recta*).

Offsite

No Data

Information Needs

No Data

ASSOCIATED ELEMENTS OF BIODIVERSITY

Element State ID	State Scientific Name	State Common Name	Global Rank	State Rank	Driving Site Rank
24827	*Populus angustifolia / Salix irrorata* Woodland	Foothills Riparian Woodland	G2	S2	Yes

Potential Conservation Area (PCA) Report

Name Coal Creek below Rocky Flats **Site Code** S.USCOHP*27227

21289	*Zapus hudsonius preblei*	Meadow Jumping Mouse Subsp	G5T2	S1	No
21289	*Zapus hudsonius preblei*	Meadow Jumping Mouse Subsp	G5T2	S1	No
21249	*Haliaeetus leucocephalus*	Bald Eagle	G5	S1B,S3N	No

REFERENCES

Reference ID	Full Citation
195190	Neid, S., J. Lemly, K. Decker and D. Culver. 2009. Final Report: Survey of Critical Biological Resources in Boulder County 2007-2008. Colorado Natural Heritage Program, Fort Collins, CO.

ADDITIONAL TOPICS

Additional Topics

No Data

VERSION

Version Date 06/03/2008

Version Author Decker, K.L. and J.M. Lemly

Potential Conservation Area (PCA) Report

Name Doudy Draw **Site Code** S.USCOHP2*2605

IDENTIFIERS

Site ID 1552 **Site Class** PCA

Site Alias None

Network of Conservation Areas (NCA)

NCA Site ID	NCA Site Code	NCA Site Name
-		No Data

Site Relations Overlaps Marshall Mesa (S.USCOHP*5663) and Rocky Flats Grassland (S.USCOHP*27435) and shares a small portion of its boundary with Coal Creek below Rocky Flats (S.USCOHP*27227).

LOCATORS

Nation United States **Latitude** 395543N

State Colorado **Longitude** 1051456W

Quad Code	Quad Name
39105-H2	Louisville
39105-H3	Eldorado Springs

County

Boulder (CO)

Jefferson (CO)

Watershed Code	Watershed Name
10190005	St. Vrain

Township/Range	Section	Meridian	Note
001S070W	29	6P	
001S070W	31	6P	
001S070W	30	6P	
002S070W	06	6P	
001S070W	32	6P	
002S071W	01	6P	
002S070W	05	6P	
001S071W	36	6P	
001S070W	28	6P	
001S070W	33	6P	
001S070W	27	6P	
001S070W	21	6P	
001S070W	22	6P	
001S071W	25	6P	
001S070W	20	6P	

SITE DESCRIPTION

Minimum Elevation	5,640.00	**Feet**	1,719.00	**Meters**
Maximum Elevation	5,760.00	**Feet**	1,756.00	**Meters**

Site Description

The Doudy Draw site is located about 1 mile east of Eldorado Springs and is part of a large contiguous piedmont grassland. It supports important habitat for several rare species. This site is on the apron of alluvial and colluvial deposits below the Flatirons. It is characterized generally by southwest to northeast trending fingers of Quaternary alluvium that have ponderosa pine (*Pinus ponderosa*) savanna. The savanna quickly grades into grassland habitat off the pediments. Perennial and intermittent drainages dissect the area, which is also traversed by the South Boulder Diversion Canal. Soils are mostly very cobbly sandy loam and terrace escarpments. The majority of the site is City of Boulder Open Space. The savanna has a relatively dense canopy, especially near the mountain front and the ditch. Young ponderosa pine trees generally range from 10-14" dbh. There are sparse shrubs beneath the canopy. Skunkbush (*Rhus trilobata*) and mountain mahogany (*Cercocarpus montanus*) are most common. Herbaceous cover is variable depending on canopy cover. Grassland openings have needle-and-thread (*Hesperostipa comata*), big bluestem (*Andropogon*

gerardii), blue wildrye (*Elymus glaucus*), squirreltail (*Elymus elymoides*), and others. Forbs are frequent but diversity is relatively low. The grasslands below the savanna are on the mesa tops and intervening valleys. Grasses are diverse and include big bluestem and prairie dropseed (*Sporobolus heterolepis*) in a mosaic with needle-and-thread (*Hesperostipa comata*), western wheatgrass (*Pascopyrum smithii*), mountain muhly (*Muhlenbergia montana*), and little bluestem (*Schizachyrium scoparium*) plant associations. Forb diversity is high with porter aster (*Aster porteri*), buckwheat (*Eriogonum umbellatum*), false goldenaster (*Heterotheca villosa*), small sunflower (*Helianthus pumilus*), and soapweed (*Yucca glauca*) being common. Shrubs like skunkbush, chokecherry (*Prunus virginiana*), American plum (*Prunus americana*), hawthorn (*Crataegus erythropoda*), and prickly rose (*Rosa sayi*), form inclusions or scattered copses in the grassland and on the edge of the savanna, often near seeps. Non-natives are prevalent, especially annuals like cheatgrass (*Bromus tectorum*) and alyssum (*Alyssum parviflorum*). Mesa tops are fairly unweedy except for early spring occurrences of *Alyssum*, and areas of dalmation toadflax (*Linaria dalmatica*). Valley bottoms are somewhat weedy with smooth brome (*Bromus inermis*), cheatgrass, chicory (*Cichorium intybus*), and knapweed (*Centaurea diffusa*). This site contains habitat for northern leopard frog (*Rana pipiens*). It also provides nest sites and foraging area for Northern Goshawk (*Accipiter gentilis*), Peregrine Falcon (*Falco peregrinus*), and Northern Pygmy-owl (*Glaucidium gnoma*). Bats use the site including fringed myotis (*Myotis thysanodes*), and Townsend's big-eared bat (*Plecotus townsendii*). A prairie dog (*Cynomys ludovicianus*) colony is within the site.

Key Environmental Factors

Quaternary alluvium

Climate Description

Annual precipitation is 15-20 inches. Mean annual air temperature is 48-52 degrees F., and the frost-free season is about 140-155 days.

Land Use History

Doudy Draw had one of the original settlements of Boulder City before Colorado gained statehood. It was grazed and farmed for hay and wheat.

Cultural Features

No Data

SITE DESIGN

Site Map P - Partial **Mapped Date** 10/29/2008

Designer Neid, S.L.

Boundary Justification

Boundary is drawn to include occurrences and adjacent areas of suitable habitat within City of Boulder Open Space. Boundary will protect occurrences from direct surface disturbances. This site is part of a large contiguous grassland with similar processes.

Primary Area 3,663.43 **Acres** 1,482.54 **Hectares**

SITE SIGNIFICANCE

Biodiversity Significance Rank B2: Very High Biodiversity Significance

Biodiversity Significance Comments

The site supports a good (B-ranked) occurrence of the globally imperiled (G2/S1S2) *Andropogon gerardii - Sporobolus heterolepis* xeric tallgrass prairie, a good to fair (BC-ranked) occurrence of a globally critically imperiled (G1G2/S1S2) *Hesperostipa comata* Great Plains mixed grass prairie and a good (B-ranked) occurrence of the globally imperiled (G2/S2?) *Pinus ponderosa / Cercocarpus montanus / Andropogon gerardii* foothills ponderosa pine scrub woodland. Rare invertebrates include two good (B-ranked) occurrences of the globally vulnerable (G3/S2S3) mottled dusky wing (*Erynnis martialis*), a good (B-ranked) occurrence of the globally vulnerable (G3G4/S2) Ottoe skipper (*Hesperia ottoe*) and a good (B-ranked) occurrence of the globally vulnerable (G3/S2) Arogos skipper (*Atrytone arogos*). Rare plants include a poor (D-ranked) occurrence of the globally imperiled (G2G3/S2) and Federally Threatened Ute ladies' tresses (*Spiranthes diluvialis*), a good (B-ranked) occurrence of the state rare (G5/S2) prairie violet (*Viola pedatifida*) and extant occurrences of the state rare (G5/S1) Rocky Mountain sedge (*Carex saximontana*), the state rare (G5/S2) frostweed (*Crocanthemum bicknellii*) and the state rare (G5/S2S3) dwarf wild indigo (*Amorpha nana*). Preble's meadow jumping mouse (*Zapus hudsonius preblei*) (G5T2/S1) has been documented in poor condition, but is not contained in the boundary and not a target for this particular site.

Other Values Rank V1 - Outstanding values

Potential Conservation Area (PCA) Report

Name Doudy Draw **Site Code** S.USCOHP2*2605

Other Values Comments

Open space recreation including jogging, hiking, cycling, horseback riding is common. General wildlife habitat exists for bears, mountain lions, and especially birds. Observed many bird watchers in area during the summer months. Suitable for homesites. Many homesites are adjacent to open space boundaries and on South Boulder Creek.

LAND MANAGMENT ISSUES

Land Use Comments

No Data

Natural Hazard Comments

No Data

Exotics Comments

Non-native species include smooth brome (*Bromus inermis*), bull thistle (*Cirsium vulgare*), Canada thistle (*Cirsium arvense*), musk thistle (*Carduus nutans*), leafy spurge (*Euphorbia esula*), myrtle spurge (*Euphorbia myrsinites*), cheatgrass (*Bromus tectorum*), Dalmation toadflax (*Linaria dalmatica*), diffuse knapweed (*Centaurea diffusa*), jointed goatgrass (*Aegilops cylindrica*), and St. Johnswort (*Hypericum perforatum*). Russian olive (*Elaeagnus angustifolia*) and houndstongue (*Cynoglossum officinale*) occur in the drainage bottoms.

Offsite

Highway 170 (Eldorado Springs Rd) is to the north. Housing developments are to the northeast and southwest (along South Boulder Creek). An electrical substation is immediately adjacent to the west. Eldorado Springs State Park is to the west which receives a high volume of traffic during the summer months.

Information Needs

A 1984 field survey located a globally rare sedge, *Carex oreocharis*. More field work is needed to search for this plant.

ASSOCIATED ELEMENTS OF BIODIVERSITY

Element State ID	State Scientific Name	State Common Name	Global Rank	State Rank	Driving Site Rank
17998	*Spiranthes diluvialis*	Ute ladies' tresses	G2G3	S2	No
18073	*Viola pedatifida*	prairie violet	G5	S2	No
18073	*Viola pedatifida*	prairie violet	G5	S2	No
19678	*Erynnis martialis*	Mottled Dusky Wing	G3	S2S3	No
20956	*Amorpha nana*	dwarf wild indigo	G5	S2S3	No
24587	*Pinus ponderosa / Cercocarpus montanus / Andropogon gerardii* Wooded Herbaceous Vegetation	Foothills Ponderosa Pine Scrub Woodlands	G2	S2?	Yes
24703	*Hesperostipa comata* Colorado Front Range Herbaceous Vegetation	Great Plains Mixed Grass Prairie	G1G2	S1S2	Yes
24483	*Andropogon gerardii - Sporobolus heterolepis* Western Foothills Herbaceous Vegetation	Xeric Tallgrass Prairie	G2	S1S2	Yes
22544	*Carex saximontana*	Rocky Mountain sedge	G5	S1	No
19893	*Hesperia ottoe*	Ottoe Skipper	G3G4	S2	No
19678	*Erynnis martialis*	Mottled Dusky Wing	G3	S2S3	No
16895	*Atrytone arogos*	Arogos Skipper	G3	S2	No
21235	*Crocanthemum bicknellii*	frostweed	G5	S2	No
21725	*Falco peregrinus anatum*	American Peregrine Falcon	G4T4	S2B	No

REFERENCES

Reference ID	Full Citation
195190	Neid, S., J. Lemly, K. Decker and D. Culver. 2009. Final Report: Survey of Critical Biological Resources in Boulder County 2007-2008. Colorado Natural Heritage Program, Fort Collins, CO.
161922	Pineda, Phyllis M. 1996. Field Survey (Butterflies) to the City of Boulder Open Space and Mountain Parks, Larimer County and Cheesman Reservoir. Field Season 1996.

Potential Conservation Area (PCA) Report

Name Doudy Draw **Site Code** S.USCOHP2*2605

ADDITIONAL TOPICS

Additional Topics

Original site design by Pague, C.A. 1994-09-12.

VERSION

Version Date 10/29/2008

Version Author Neid, S.L.

Potential Conservation Area (PCA) Report

Name Marshall Mesa **Site Code** S.USCOHP*5663

IDENTIFIERS

Site ID 730 **Site Class** PCA

Site Alias None

Network of Conservation Areas (NCA)

NCA Site ID	NCA Site Code	NCA Site Name
2527	S.USCOHP*27435	Rocky Flats Grasslands

Site Relations Overlaps Coal Creek below Rocky Flats (S.USCOHP*27227) and Doudy Draw (S.USCOHP2*2605). Contained in Rocky Flats Grasslands (S.USCOHP*27435).

LOCATORS

Nation United States **Latitude** 395610N

State Colorado **Longitude** 1051156W

Quad Code	Quad Name
39105-H2	Louisville

County

Watershed Code	Watershed Name
10190005	St. Vrain

Township/Range	Section	Meridian	Note
001S070W	22	6P	
001S070W	21	6P	
001S069W	30	6P	
002S070W	02	6P	
001S070W	36	6P	
001S070W	34	6P	
001S070W	26	6P	
001S070W	24	6P	
001S070W	28	6P	
001S070W	13	6P	
001S070W	15	6P	
001S070W	14	6P	
001S070W	33	6P	
001S070W	23	6P	
001S070W	25	6P	
001S069W	31	6P	
001S070W	35	6P	
002S070W	01	6P	
001S069W	19	6P	
001S070W	27	6P	

SITE DESCRIPTION

Minimum Elevation	5,600.00	**Feet**	1,707.00	**Meters**
Maximum Elevation	5,800.00	**Feet**	1,768.00	**Meters**

Site Description

The Marshall Mesa site is part of the large outwash plain of the foothills of the Colorado Front Range below Eldorado Mountain. It consists of large, rolling mesas and swales bisected by the Coal and Rock creek drainages--southwest to northeast trending tributaries of Boulder Creek. Bedrock geology of the mesa is Cretaceous shale (Laramie Formation) capped with a mosaic of Quaternary alluvium (Machette 1975, Malde 1955). The surficial alluvium deposits are a mosaic of Rocky Flats, Verdos, and Slocum deposits interspersed with Piney Creek terrace deposits. All of the bedrock layers have differing proportions of calcium carbonate; the soils in the area tend to be enriched (Moreland and Moreland 1975). This site is strongly dominated by grassland systems. There are some relatively small patches of ponderosa pine (*Pinus ponderosa*) savanna on north-facing slopes on the north side. The savanna has a variable expression with some areas of

Potential Conservation Area (PCA) Report

Name Marshall Mesa **Site Code** S.USCOHP*5663

scattered ponderosa pine and/or Rocky Mountain juniper (*Juniperus scopulorum*) and others supporting scrubby copses of skunkbush (*Rhus trilobata*), mountain mahogany (*Cercocarpus montanus*), ceanothus (*Ceanothus herbaceous, C. fendleri*), and occasional shrubby cinquefoil (*Dasiphora fruticosa*). The gravelly, well-drained soils of the mesa tops are covered with grassland mosaic dominated by mid- and tallgrass species. On the west end, the species composition is characterized by big bluestem (*Andropogon gerardii*), porcupine grass (*Hesperostipa spartea*), prairie dropseed (*Sporobolus heterolepis*), sideoats grama (*Bouteloua curtipendula*), needle-and-thread (*Hesperostipa comata*), western wheatgrass (*Pascopyrum smithii*), purple threeawn (*Aristida purpurea*), junegrass (*Koeleria macrantha*), mountain muhly (*Muhlenbergia montana*), little bluestem (*Schizachyrium scoparium*), and others. Forbs are very diverse and include soapweed (*Yucca glauca*), wavy-leaved thistle (*Cirsium undulatum*), scurfpea (*Psoralea tenuiflora*), blanketflower (*Gaillardia aristata*), hedgehog cactus (*Echinocereus viridiflorus*), prickly pear cactus (*Opuntia* spp.), mariposa lily (*Calochortus gunnisonii*), fringed sage (*Artemesia frigida*), blazing star (*Liatris punctata*), and many others. Dwarf indigo (*Amorpha nana*) and slimleaf milkweed (*Asclepias stenophylla*) occur in the grasslands. Farther east along the mesas, the tallgrass species become much less common and the matrix grassland is characterized by needle-and-thread. Within this area are small patches of New Mexico feathergrass (*Hesperostipa neomexicana*) on north-facing slope crests. These grasslands support some of the highest concentrations of grassland nesting birds in the Piedmont; while more common elsewhere in the state, this site reflects a substantial eedge-of-range habitat for these species. Within the grassland are large prairie dog towns. These towns can be very weedy and dominated by bindweed (*Convolvulus arvensis*). However, they also support burrowing owl (*Athene cunicularia*). This also supports northern leopard frog (*Rana pipiens*) and wavy-leaf stickleaf (*Nuttallia sinuata*). The portion of this site that overlaps with Doudy Draw historically contained ottoe skipper (*Hesperia ottoe*), crossline skipper (*Polites origenes*), Arogos skipper (*Atrytone arogos*), and dusted skipper (*Atrytonopsis hianna*).

Key Environmental Factors

Outwash mesa of Quaternary alluvium

Climate Description

Annual precipitation is 12 to 18 inches. Mean annual air temperature is 48-52 degrees F., and the frost-free season is about 140-155 days.

Land Use History

Grazing, coal mining.

Cultural Features

No Data

SITE DESIGN

Site Map Y - Yes **Mapped Date** 10/29/2008

Designer Neid, S.L.

Boundary Justification

Site includes extensive mesa tops, swales, and sideslope scrubby ponderosa pine savanna. The boundary was drawn to contain biodiversity occurrences with some buffer.

Primary Area 6,760.28 **Acres** 2,735.80 **Hectares**

SITE SIGNIFICANCE

Biodiversity Significance Rank B2: Very High Biodiversity Significance

Biodiversity Significance Comments

The site supports an excellent to good (AB-ranked) occurrence of the globally imperiled (G2?/S2) *Andropogon gerardii - Schizachyrium scoparium* xeric tallgrass prairie, a good and a good to fair (BC-ranked) occurrence of the globally vulnerable (G3/S3) *Hesperostipa neomexicana* Great Plains mixed grass prairie, a fair (C-ranked) occurrence of the state rare (G5/S2) prairie violet (*Viola pedatifida*), a poor (D-ranked) occurrence of the state rare (G5/S2S3) dwarf wild indigo (*Amorpha nana*) and an extant occurrence of the state rare (G4/S3) black-tailed prairie dog (*Cynomys ludovicianus*).

Other Values Rank No Data

Other Values Comments

No Data

LAND MANAGMENT ISSUES

Land Use Comments

No Data

Potential Conservation Area (PCA) Report

Name Marshall Mesa **Site Code** S.USCOHP*5663

Natural Hazard Comments

No Data

Exotics Comments

Weeds include diffuse knapweed (*Centaurea diffusa*), cheatgrass (*Bromus tectorum*), chicory (*Cichorium intybus*), teasel (*Dipsacus fullonum*), Dalmation toadflax (*Linaria dalmatica*), jointed goatgrass (*Aegilops cylindrica*), musk thistle (*Carduus nutans*), scotch thistle (*Onopordium acanthium*), sulfur cinquefoil (*Potentilla recta*), and bindweed (*Convolvulus arvensis*).

Offsite

Housing developments; industrial sites; Superfund waste site; Community and Davidson Ditches bisect property; highways define boundaries of the site.

Information Needs

No Data

ASSOCIATED ELEMENTS OF BIODIVERSITY

Element State ID	State Scientific Name	State Common Name	Global Rank	State Rank	Driving Site Rank
18073	*Viola pedatifida*	prairie violet	G5	S2	No
22673	*Hesperostipa neomexicana* Herbaceous Vegetation	Great Plains Mixed Grass Prairie	G3	S3	No
22673	*Hesperostipa neomexicana* Herbaceous Vegetation	Great Plains Mixed Grass Prairie	G3	S3	No
17796	*Cynomys ludovicianus*	Black-tailed Prairie Dog	G4	S3	No
24870	*Andropogon gerardii - Schizachyrium scoparium* Western Great Plains Herbaceous Vegetation	Xeric Tallgrass Prairie	G2?	S2	Yes
20956	*Amorpha nana*	dwarf wild indigo	G5	S2S3	No

REFERENCES

Reference ID	Full Citation
198280	Machette, M.N. 1975. Geologic map of the Lafayette quadrangle, Adams, Boulder, and Jefferson counties, Colorado. U.S. Government Printing Office, Washington, D.C.
198281	Malde, H.E. 1955. Surficial geology of the Louisville quadrangle, Colorado. Geological Survey Bulletin 996-E. U.S. Government Printing Office, Washington, D.C.
198282	Moreland, D.C. and Moreland, R.E. 1975. Soils Survey of the Boulder County Area, Colorado. United States Department of Agriculture, Soil Conservation Service, in cooperation with the Colorado Agricultural Experiment Station. Soil Conservation Service , Washington, D.C.
195190	Neid, S., J. Lemly, K. Decker and D. Culver. 2009. Final Report: Survey of Critical Biological Resources in Boulder County 2007-2008. Colorado Natural Heritage Program, Fort Collins, CO.
161922	Pineda, Phyllis M. 1996. Field Survey (Butterflies) to the City of Boulder Open Space and Mountain Parks, Larimer County and Cheesman Reservoir. Field Season 1996.

ADDITIONAL TOPICS

Additional Topics

Original site design by Pineda, P.M. 1996-09-23.

VERSION

Version Date 10/31/2008

Version Author Neid, S.L.

Potential Conservation Area (PCA) Report

Name Rocky Flats **Site Code** S.USCOHP2*2603

IDENTIFIERS

Site ID 515 **Site Class** PCA

Site Alias Rock Creek

Site Alias Woman Creek

Network of Conservation Areas (NCA)

NCA Site ID	NCA Site Code	NCA Site Name
2527	S.USCOHP*27435	Rocky Flats Grasslands

Site Relations Contained in Rocky Flats Grasslands (S.USCOHP*27435).

LOCATORS

Nation United States **Latitude** 395315N

State Colorado **Longitude** 1051330W

Quad Code	Quad Name
39105-H2	Louisville
39105-H3	Eldorado Springs
39105-G2	Golden
39105-G3	Ralston Buttes

County

Watershed Code	Watershed Name
10190003	Middle South Platte-Cherry Creek
10190004	Clear
10190005	St. Vrain

Township/Range	Section	Meridian	Note
001S070W	35	6P	
002S070W	20	6P	
002S070W	17	6P	
002S070W	04	6P	
002S070W	11	6P	
002S070W	18	6P	
002S070W	22	6P	
002S070W	09	6P	
002S070W	16	6P	
002S070W	14	6P	
002S070W	08	6P	
002S070W	10	6P	
002S070W	19	6P	
002S070W	02	6P	
002S070W	13	6P	
002S070W	15	6P	
002S070W	03	6P	
002S070W	21	6P	

SITE DESCRIPTION

Minimum Elevation	5,400.00	**Feet**	1,646.00	**Meters**
Maximum Elevation	6,120.00	**Feet**	1,865.00	**Meters**

Site Description

The Rocky Flats site occurs on the south and west portions of the Rocky Flats alluvial fan and, to some extent, down into the colluvial valleys that dissect it. Most of the site is located on the Rocky Flats Environmental Technology Site (RFETS), a former nuclear weapons manufacturing facility overseen by the U.S. Department of Energy. RFETS is listed on the National Priorities List under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The flora is similar to other alluvial

Potential Conservation Area (PCA) Report

Name Rocky Flats **Site Code** S.USCOHP2*2603

fans in the region, although many of these natural communities are becoming increasingly threatened by urban development. The fauna has been more highly impacted by regional extirpations of some high trophic level mammals, but still retains many common animals and some rarer ones. The site is bounded by Highway 128 on the north, Coal Creek to the west, and the RFETS boundary to the south. The eastern boundary follows a rough line that follows the eastern watershed extent of Rock Creek, curves around to the west of the facility's industrial area, and runs southeast to include the wetland complexes of upper Woman Creek.

Key Environmental Factors

No Data

Climate Description

15 inches of precip. ann. Prone to high winds, sometimes reaching 80 MPH.

Land Use History

General public has been excluded from most of site for the last 20-40 years. Grazing and gravel mining have been ongoing.

Cultural Features

Some of the site is regulated by EPA and CDPHE under Superfund.

SITE DESIGN

Site Map P - Partial **Mapped Date** 12/05/1995

Designer Essington, K.D.

Boundary Justification

The boundaries include xeric tallgrass prairie, the Great Plains riparian community in Rock Creek, the Preble's meadow jumping mouse occurrence in Rock Creek and upper Woman Creek, and the invertebrate occurrences. The potential extent of xeric tallgrass prairie is documented by Western Aggregates, Inc. (1995) and, while fragmented by roads and gravel pits, is considered one occurrence by CNHP. It stretches from the northwest corner of the site south through section 16 and west for an uncertain distance across Highway 93. Field surveys and monitoring data indicate that the xeric tallgrass prairie community exists on the mesa tops in the southwest corner (section 15) of the RFETS Buffer Zone. Similar grasslands appear to extend beyond the study area, west of Highway 93, indicating that this community occurrence is part of a larger, even more viable system (Western Aggregates 1994). Therefore, CNHP has included this extension in the boundary. With the use of a Series 30 Lasico planimeter, CNHP has determined that the community is at least 2,500 acres. The boundary is also considered a "buffer area" for the rare invertebrates recorded. It is difficult to monitor the range of these animals but this "buffer area" should sufficiently protect their perceived needs by including adequate habitat size. It should be noted that the Rock Creek and Woman Creek watersheds are joined into one site. This is an atypical boundary determination by CNHP and is due to two factors. First, the xeric tallgrass prairie occurrence, equally covers both watersheds. Second, is the understanding that hydrologic inputs to Woman Creek are probably from shallow groundwater recharge in the pediments of sections 16 and 15, east of the sandstone hogback that runs north-south through the area (U.S. Department of Energy 1992, U.S. Department of Energy 1994d). Although the Woman Creek channel has been historically used for water conveyance to downstream users, and thereby contributing to flow patterns and possibly augmenting Preble's meadow jumping mouse habitat, this practice will not continue due to the construction of the Kinnear Pipeline (Hill pers. comm. 1995). It is critical that, in order to ensure natural surface water flow and continued viability of the Preble's meadow jumping mouse occurrence in Woman Creek, the groundwater recharge area be included.

Primary Area 4,981.82 **Acres** 2,016.08 **Hectares**

SITE SIGNIFICANCE

Biodiversity Significance Rank B2: Very High Biodiversity Significance

Biodiversity Significance Comments

This site supports a good (B-ranked) occurrence of a globally imperiled (G2?/S2) xeric tallgrass prairie (*Andropogon gerardii - Schizachyrium scoparium*) and a fair (C-ranked) occurrence of the globally imperiled (G5T2/S1) and federally Threatened Preble's meadow jumping mouse (*Zapus hudsonius preblei*). Unique invertebrate occurrences include a fair (C-ranked) occurrence of the globally imperiled (G2G3/S2) hops feeding azure (*Celastrina humulus*), a fair (C-ranked) occurrence of the globally vulnerable (G3G4/S2) Ottoe skipper (*Hesperia ottoe*) and a fair (C-ranked) occurrence of the globally vulnerable (G3/S2) Arogos skipper (*Atrytone arogos*).

Other Values Rank No Data

Other Values Comments

The Colorado Bird Observatory (CBO), recognizes several high priority species that use the site. These species include Lark Bunting (*Calamospiza melanocorys*), Ferruginous Hawk (*Buteo regalis*), MacGillivray's Warbler (*Opornis tolmiei*), Brewer's Sparrow (*Spizella brewerii*), and several others (U.S. Department of Energy 1995a). Although many observations of these species appear to be casual, it should not be overlooked that the area could provide essential migratory stopover habitat for these and more common species. EG& G estimated breeding population density for Grasshopper Sparrows in the prairie community (as it occurs on RFETS) to be 0.65 birds/hectare, or roughly 120 birds (U.S. Department of Energy 1995c). This species is a further indicator of the special nature not only of the site in general, but the xeric tallgrass prairie in particular. A marginal occurrence (not tracked by CNHP) of a Great Plains riparian community occurs. It is characterized by a diverse mixture of plains cottonwood, peach- leaved willow, and coyote willow (*Populus deltoides / Salix amygdaloides - Salix exigua*) with an understory of various low shrubs such as leadplant (*Amorpha fruticosa*) and snowberry (*Symphoricarpos occidentalis*). This community is rare and declining in its native conditions throughout the high plains of Colorado, Nebraska, and Kansas. Threats to this community type are primarily water development, use and management. However, exotic species, such as leafy spurge (*Euphorbia esula*) and purple loosestrife (*Lythrum elata*) are increasing problems. Despite the generally xeric nature of the area, several wetlands occur, mostly in the upper Woman Creek drainage, but also on north aspect slopes in Rock Creek. These wetland occurrences are also not among the best examples of common associations in the state due to their relatively restricted size. They don't rank as high priorities for their Natural Heritage values with respect to plant associations. This view is bolstered by recognition that the seep sites in upper Woman Creek may be enhanced by anthropogenic water impoundments (i.e. Rocky Flats Lake) to the west (U.S. Army Corps of Engineers 1994). The wetlands do, however, potentially serve other important functions and values, as do wetlands everywhere. Perhaps most important, we do not yet understand how wetland mosaics present support local populations of Preble's meadow jumping mouse. These wetlands may also retain nutrients, sediment, and metals in the water, provide food chain support both within the basin and downstream, and provide forage, cover, and nesting habitat for wildlife (Mitch and Gosselink 1994). The hillside seeps in Rock Creek support a unique tall shrubland complex (Kettler et al. 1994). Dominated by hawthorn (*Crataegus erythropoda*), chokecherry (*Prunus virginiana*), and some western snowberry (*Symphoricarpos occidentalis*), CNHP has tentatively classified it as *Crataegus erythropoda - Prunus virginiana - Symphoricarpos occidentalis* plant association. An additional unusual shrub community occurs within Rock Creek, and to some extent in Woman Creek. It is dominated by leadplant (*Amorpha fruticosa*). It occurs in floodplains of the stream channels, laterally upgradient from the Great Plains riparian community. Like the Great Plains riparian community, it is believed that this shrubland has been highly impacted by water management and exotic species intrusion, but historical records and trends are lacking.

LAND MANAGMENT ISSUES

Land Use Comments

No Data

Natural Hazard Comments

No Data

Exotics Comments

No Data

Offsite

As part of a larger, landscape-level, open space contingent, it is likely that the site is an important contributor to healthy predator-prey relationships. The size, current isolation, and relatively high quality of the area supports potentially viable population of numerous species that are typical of the natural communities at RFETS. This supports biodiversity at the landscape level by preventing biogeographic (or island) effects prevalent in many natural areas (Macarthur and Wilson 1967). This is likely to be important to some common species, but particularly so for more motile and rare species.

Information Needs

The undocumented nature of *Carex oreocharis* in Colorado suggests to CNHP that its occurrence in the site should be protected and studied further. A wider search designed to confirm or deny other occurrences throughout its range may be in order. Invertebrate Management Recommendations: Studies have shown that the Colorado Piedmont is one of the country's four most important ecoregions for the conservation of the diversity of butterflies (Opler 1994). Butterflies can be easily monitored and may be good indicators of

environmental changes. This is especially true for imperiled species, or those associated with rare habitats. To this end, CNHP encourages the Department of Energy to conduct additional studies of the species identified in this report and for other rare species known from the general area that were not confirmed. These unconfirmed elements include the rare Ottoe skipper, a globally vulnerable species recorded in xeric tallgrass prairie 3 miles southwest of the study area.

ASSOCIATED ELEMENTS OF BIODIVERSITY

Element State ID	State Scientific Name	State Common Name	Global Rank	State Rank	Driving Site Rank
19893	*Hesperia ottoe*	Ottoe Skipper	G3G4	S2	No
20146	*Celastrina humulus*	Hops Feeding Azure	G2G3	S2	No
23792	*Aristida basiramea*	forktip three-awn	G5	S1	No
16895	*Atrytone arogos*	Arogos Skipper	G3	S2	No
21289	*Zapus hudsonius preblei*	Meadow Jumping Mouse Subsp	G5T2	S1	No
24870	*Andropogon gerardii - Schizachyrium scoparium* Western Great Plains Herbaceous Vegetation	Xeric Tallgrass Prairie	G2?	S2	Yes
21289	*Zapus hudsonius preblei*	Meadow Jumping Mouse Subsp	G5T2	S1	No

REFERENCES

Reference ID	Full Citation
-	No Data

ADDITIONAL TOPICS

Additional Topics

No Data

VERSION

Version Date 12/05/1995

Version Author Essington, K.D.

Network of Conservation Areas (NCA) Report

Name Rocky Flats Grasslands **Site Code** S.USCOHP*27435

IDENTIFIERS

Site ID 2527 **Site Class** NCA

Site Alias None

Site Relations This site is designated as a Network of Conservation Areas (NCA) because it delineates a relatively intact landscape containing many smaller sites that are interrelated. It shares similar ecological processes with Coal Creek at Rocky Flats (S.USCOHP*7762), Coal Creek below Rocky Flats (S.USCOHP*27227), Marshall Mesa (S.USCOHP*5663), Rocky Flats (S.USCOHP2*2603) and Walnut Creek (S.USCOHP4*2453). Overlaps Doudy Draw (S.USCOHP2*2605).

LOCATORS

Nation United States **Latitude** 395437N

State Colorado **Longitude** 1051301W

Quad Code	Quad Name
39105-G2	Golden
39105-G3	Ralston Buttes
39105-H3	Eldorado Springs
39105-H2	Louisville

County

Watershed Code	Watershed Name
10190003	Middle South Platte-Cherry Creek
10190005	St. Vrain
10190004	Clear

Site Directions

This Network of Conservation Area is bounded to the west by the Front Range foothills and to the east by County Road 17 south of Superior. It is bounded on the north side by Route 170 and Highway 36 in Boulder County and it extends just south of Highway 72 in Jefferson County.

SITE DESCRIPTION

Minimum Elevation	5,610.00	**Feet**	1,709.93	**Meters**
Maximum Elevation	6,890.00	**Feet**	2,100.07	**Meters**

Site Description

This Network of Conservation Area incorporates part of the large outwash plain against the foothills of the Colorado Front Range. It consists of large, rolling mesas and swales. Bedrock geology of the area is Cretaceous shale (Laramie Formation and Pierre shale) capped with a mosaic of Quaternary alluvium (a mosaic of Rocky Flats, Verdos, Slocum, and Louviers deposits interspersed with Piney Creek terrace deposits). The gravelly, well-drained soils of the mesa tops are covered with grassland mosaic dominated by mid- and tallgrass species. Big bluestem (*Andropogon gerardii*) is the hallmark species, but the grassland has a remarkable diversity of grasses like porcupine grass (*Hesperostipa spartea*), prairie dropseed (*Sporobolus heterolepis*), sideoats grama (*Bouteloua curtipendula*), needle-and-thread (*Hesperostipa comata*), mountain muhly (*Muhlenbergia montana*), western wheatgrass (P*ascopyrum smithii*), and others. Forbs are likewise very diverse with many prairie relict species. The grassland expression correlates with different Quaternary alluvium layers, with many stable communities that have persisted for millennia. Stream networks that drain the area are a mix of ephemeral, intermittent, and perennial creeks. Cottonwood (*Populus deltoides*) and willow (*Salix* spp.) occur along perennial drainages. Wet meadows and swales occur in ephemeral drainages with little to no surface flow.

Key Environmental Factors

Quaternary alluvium layers including Rocky Flat, Louviers, Slocum, Verdos, Piney Creek, post-Piney Creek.

Climate Description

No Data

Land Use History

No Data

Network of Conservation Areas (NCA) Report

Name Rocky Flats Grasslands **Site Code** S.USCOHP*27435

Cultural Features

No Data

SITE DESIGN

Site Map P - Partial **Mapped Date** 11/14/2008

Designer Neid, S.L.

Boundary Justification

The Network of Conservation Area (NCA) boundary includes all known targeted occurrences and the natural processes that support them. It incorporates a large area of outwash plain in the Colorado Piedmont against the Front Range foothills. The older surfaces of Nussbaum and Rocky Flats transition to younger Verdos, Louviers, and Slocum, and then to recent alluvium progressing from west to east. The boundary is large enough to support grazing and prescribed fire regimes that could maintain the full spectrum of Piedmont grassland expressions.

Primary Area 20,844.41 **Acres** 8,435.47 **Hectares**

OTHER/PROTECTION/MANAGEMENT RANKS

Other Values Rank No Data

Other Values Comments

No Data

Protection Urgency Rank P?: Unknown

Protection Urgency Comments

This NCA has significant area of private lands. Other significant owners include the federal government (Rocky Flats), City of Boulder Open Space and Mountain Parks, and the Colorado State Land Board.

Management Urgency Rank M?: Unknown

Management Urgency Comments

Maintaining large, contiguous blocks of native grassland will continue to support the unique grassland biodiversity that occurs. Grazing and fire are management tools for maintaining the pattern of tall- and midgrass mosaic and support the bird biodiversity within the area.

LAND MANAGEMENT ISSUES

Land Use Comments

No Data

Natural Hazard Comments

No Data

Exotics Comments

No Data

Offsite

No Data

Information Needs

No Data

Management Needs

No Data

Managed Area Relations

No Data

Protection Comments

No Data

ASSOCIATED POTENTIAL CONSERVATION AREAS (PCA)

Network of Conservation Areas (NCA) Report

Name Rocky Flats Grasslands **Site Code** S.USCOHP*27435

PCA Site ID	PCA Site Name	PCA Biological Diversity Significance
730	Marshall Mesa	B2: Very High Biodiversity Significance
515	Rocky Flats	B2: Very High Biodiversity Significance
2501	Coal Creek below Rocky Flats	B3: High Biodiversity Significance
1595	Coal Creek at Rocky Flats	B3: High Biodiversity Significance
1034	Walnut Creek	B5: General Biodiversity Interest

REFERENCES

Reference ID	Full Citation
195190	Neid, S., J. Lemly, K. Decker and D. Culver. 2009. Final Report: Survey of Critical Biological Resources in Boulder County 2007-2008. Colorado Natural Heritage Program, Fort Collins, CO.

ADDITIONAL TOPICS

Additional Topics

No Data

VERSION

Lead Responsibility CNHP-Ecology Team

Version Date 11/14/2008

Version Author Neid, S.L.

Colorado State University

Knowledge to Go Places

July 23, 2010

Jenny Gerson
Ecologist
Walsh Environmental Scientists and Engineers, LLC
An Ecology & Environment company
4888 Pearl East Circle, Ste. 108
Boulder, CO 80301-2475

Dear Jenny:

The Colorado Natural Heritage Program (CNHP) is in receipt of your request for information regarding National Wind Technology Center. In response, I have searched our Biodiversity Tracking and Conservation System (BIOTICS) for natural heritage elements (occurrences of significant natural communities and rare, threatened or endangered plants and animals) documented from the vicinity of the area specified in your request, specifically within a two-mile radius of the site National Wind Technology Center boundary shapefile Walsh Environmental provided to CNHP for the purposes of this request.

The enclosed report describes natural heritage resources known from this area and gives location (by Township, Range, and Section), precision information, and the date of last observation of the element at that location. This report includes elements known to occur within the specified project site, as well as elements known from similar landscapes near the site. Please note that "precision" reflects the resolution of original data. For example, an herbarium record from "4 miles east of Colorado Springs" provides much less spatial information than a topographic map showing the exact location of the occurrence. "Precision" codes of Seconds, Minutes, and General are defined in the footer of the enclosed report.

The report also outlines the status of known elements. We have included status according to Natural Heritage Program methodology and legal status under state and federal statutes. Natural Heritage ranks are standardized across the Heritage Program network, and are assigned for global and state levels of rarity. They range from "1" for critically imperiled or extremely rare elements, to "5" for those that are demonstrably secure.

You may notice that some occurrences do not have sections listed. Those species have been designated as "sensitive" due to their rarity and threats by human activity. Peregrine falcons, for example, are susceptible to human breeders removing falcon eggs from their nests. For these species, CNHP does not normally provide location information beyond township and range. Please contact us should you require more detailed information for sensitive occurrences.

There are multiple CNHP designated Potential Conservation Areas (PCAs) and one Network of Conservation Areas (NCA) located within your project area (see enclosed PCA/NCA site reports and shapefiles). In order to successfully protect populations or occurrences, it is necessary to delineate conservation areas. These conservation areas focus on capturing the ecological processes that are necessary to support the continued existence of a particular element of natural heritage significance. Conservation areas may include a single occurrence of a rare element or a suite of rare elements or significant features.

Natural Heritage Program
COLORADO

The goal of the process is to identify a land area that can provide the habitat and ecological processes upon which a particular element or suite of elements depends for their continued existence. The best available knowledge of each species' life history is used in conjunction with information about topographic, geomorphic, and hydrologic features, vegetative cover, as well as current and potential land uses. The proposed boundary does not automatically exclude all activity. It is hypothesized that some activities will cause degradation to the element or the process on which they depend, while others will not. Consideration of specific activities or land use changes proposed within or adjacent to the preliminary conservation planning boundary should be carefully considered and evaluated for their consequences to the element on which the conservation unit is based.

The Colorado Division of Wildlife has legal authority over wildlife in the state. CDOW would therefore be responsible for the evaluation of and final decisions regarding any potential effects a proposed project may have on wildlife. If you would like more specific information regarding these or other vertebrate species in the vicinity of the area of interest, please contact the Colorado Division of Wildlife.

The information contained herein represents the results of a search of Colorado Natural Heritage Program's (CNHP) Biodiversity Tracking and Conservation System (BIOTICS), and can be used as notice to anticipate possible impacts or identify areas of interest. Care should be taken in interpreting these data. Sensitive elements are currently known from within the proposed project area, and additional, but undocumented, elements may also exist (see enclosed report). Please note that the absence of data for a particular area, species, or habitat does not necessarily mean that these natural heritage resources do not occur on or adjacent to the project site, rather that our files do not currently contain information to document their presence. CNHP information should not replace field studies necessary for more localized planning efforts, especially if impacts to wildlife habitat are possible.

Although every attempt is made to provide the most current and precise information possible, please be aware that some of our sources provide a higher level of accuracy than others, and some interpretation may be required. CNHP's data system is constantly updated and revised. Please contact CNHP for an update or assistance with interpretation of this natural heritage information.

Sincerely,

Michael Menefee
Environmental Review Coordinator

Enc.

Natural Heritage Program
COLORADO

Locations and Status of Rare and/or Imperiled Species and Natural Communities known from or likely to occur within a two-mile radius of NREL's National Wind Technology Center

Report generated: 23 July 2010

EO_ID	major group	scientific name	common name	Prec	last obs	Town/ Range	Sec	TRS Note	grank	srank	eo-rank	ESA	fed stat	st stat
7,691	Birds	*Buteo regalis*	Ferruginous Hawk	G	1993-05-17	001S070W	27		G4	S3B,S4N		-	BLM USFS	SC
5,064	Birds	*Buteo regalis*	Ferruginous Hawk	G	1984-06-01	001S070W	16		G4	S3B,S4N	H	-	BLM USFS	SC
						001S070W	21							
14,339	Birds	*Haliaeetus leucocephalus*	Bald Eagle	S	2006-99-99	001S070W			G5	S1B,S3N	CD	-	USFS	ST
12,811	Birds	*Melanerpes lewis*	Lewis's Woodpecker	G	1987-05-29	001S070W	31		G4	S4	H	-	USFS	
						001S070W	32							
						001S071W	35							
						001S071W	36							
						002S070W	05							
						002S070W	06							
						002S070W	07							
						002S070W	08							
						002S070W	17							
						002S070W	18							
						002S071W	01							
						002S071W	02							
						002S071W	10							
						002S071W	11							
						002S071W	12							
						002S071W	13							
						002S071W	14							
						002S071W	15							
9,919	Insects	*Atrytone arogos*	Arogos Skipper	S	1998-07-27	002S070W			G3	S2	B	-		
9,766	Insects	*Callophrys mossii schryveri*	Moss's Elfin	M	1970-05-03	001S070W	30		G4T3	S2S3	H	-		
926	Insects	*Celastrina humulus*	Hops Feeding Azure	S	1995-06-26	002S070W	03		G2G3	S2	C	-		
						002S070W	04							
9,207	Insects	*Erynnis martialis*	Mottled Dusky Wing	S	2008-07-01	001S070W	29		G3	S2S3	B	-		
						001S070W	30							
						001S071W	36							

precision codes: S = "seconds", location known within 100m; M = "minutes", location known within 1 mile; G = "general", location known within 5 miles

Locations and Status of Rare and/or Imperiled Species and Natural Communities known from or likely to occur within a two-mile radius of NREL's National Wind Technology Center

Report generated: 23 July 2010

EO_ID	major group	scientific name	common name	Prec	last obs	Town/ Range	Sec	TRS Note	grank	srank	eo-rank	ESA	fed stat	st stat
10,930	Insects	*Hesperia ottoe*	Ottoe Skipper	G	1973-07-10	001S070W			G3G4	S2	H	-	USFS	
3,184	Insects	*Hesperia ottoe*	Ottoe Skipper	S	1998-07-27	002S070W			G3G4	S2	B	-	USFS	
10,594	Insects	*Hesperia ottoe*	Ottoe Skipper	G	1961-07-07	001S070W			G3G4	S2	H	-	USFS	
1,091	Insects	*Polites origenes*	Cross-line Skipper	G	1972-07-04	002S070W	20		G5	S3	H	-		
5,015	Insects	*Polites origenes*	Cross-line Skipper	G	1975-07-11	002S071W	10		G5	S3	H	-		
4,500	Insects	*Speyeria idalia*	Regal Fritillary	S	1998-07-13	002S070W			G3	S1	E	-	USFS	
						002S070W								
14,279	Mammals	*Cynomys ludovicianus*	Black-tailed Prairie Dog	S	2006-99-99	001S070W	13		G4	S3	E	-	USFS	SC
						001S070W	14							
						001S070W	23							
						001S070W	24							
						001S070W	25							
						001S070W	26							
						001S070W	35							
						001S070W	36							
						002S070W	01							
						002S070W	02							
10,872	Mammals	*Zapus hudsonius preblei*	Meadow Jumping Mouse Subsp	S	1994-09-21	001S070W			G5T2	S1	B	LT		ST
						002S070W								
						002S070W								
7,665	Mammals	*Zapus hudsonius preblei*	Meadow Jumping Mouse Subsp	S	1993-07-27	002S070W			G5T2	S1	D	LT		ST
						002S070W								
7,466	Mammals	*Zapus hudsonius preblei*	Meadow Jumping Mouse Subsp	S	1997-10-01	002S070W			G5T2	S1	B	LT		ST
						002S070W								
1,724	Mammals	*Zapus hudsonius preblei*	Meadow Jumping Mouse Subsp	S	1997-08-12	001S070W			G5T2	S1	C	LT		ST
						002S070W								
6,898	Mammals	*Zapus hudsonius preblei*	Meadow Jumping Mouse Subsp	S	1993-08-11	002S070W			G5T2	S1	C	LT		ST
						002S070W								
						002S070W								

precision codes: S = "seconds", location known within 100m; M = "minutes", location known within 1 mile; G = "general", location known within 5 miles

Locations and Status of Rare and/or Imperiled Species and Natural Communities known from or likely to occur within a two-mile radius of NREL's National Wind Technology Center

Report generated: 23 July 2010

EO_ID	major group	scientific name	common name	Prec	last obs	Town/ Range	Sec	TRS Note	grank	srank	eo-rank	ESA	fed stat	st stat
						002S070W								
3,406	Mammals	*Zapus hudsonius preblei*	Meadow Jumping Mouse Subsp	S	1998-99-99	001S070W			G5T2	S1	D	LT		ST
						001S070W								
8,353	Natural Communities	*Andropogon gerardii - Schizachyrium scoparium Western Great Plains Herbaceous Vegetation*	Xeric Tallgrass Prairie	S	1994-09-01	002S070W	03		G2?	S2	B	-		
						002S070W	04							
						002S070W	08							
						002S070W	09							
						002S070W	10							
						002S070W	15							
						002S070W	16							
						002S070W	17							
						002S070W	18							
						002S070W	19							
						002S070W	20							
						002S070W	21							
14,297	Natural Communities	*Andropogon gerardii - Schizachyrium scoparium Western Great Plains Herbaceous Vegetation*	Xeric Tallgrass Prairie	S	2007-08-28	001S070W	27		G2?	S2	AB	-		
						001S070W	28							
						001S070W	33							
						001S070W	34							
14,272	Natural Communities	*Andropogon gerardii - Sporobolus heterolepis Western Foothills Herbaceous Vegetation*	Xeric Tallgrass Prairie	S	2007-07-20	001S070W	21		G2	S1S2	B	-		
						001S070W	22							
						001S070W	27							
						001S070W	28							
						001S070W	29							
						001S070W	31							
						001S070W	32							
						001S070W	33							
1,262	Natural Communities	*Andropogon gerardii - Sporobolus heterolepis Western Foothills Herbaceous Vegetation*	Xeric Tallgrass Prairie	S	1998-09-16	002S070W	07		G2	S1S2	B	-		

precision codes: S = "seconds", location known within 100m; M = "minutes", location known within 1 mile; G = "general", location known within 5 miles

Locations and Status of Rare and/or Imperiled Species and Natural Communities known from or likely to occur within a two-mile radius of NREL's National Wind Technology Center

Report generated: 23 July 2010

EO_ID	major group	scientific name	common name	Prec	last obs	Town/ Range	Sec	TRS Note	grank	srank	eo-rank	ESA	fed stat	st stat
14,280	Natural Communities	*Hesperostipa comata Colorado Front Range Herbaceous Vegetation*	Great Plains Mixed Grass Prairie	S	2007-07-20	001S070W	30		G1G2	S1S2	BC	-		
						001S070W	31							
						001S070W	32							
14,257	Natural Communities	*Hesperostipa neomexicana Herbaceous Vegetation*	Great Plains Mixed Grass Prairie	S	2007-07-02	001S070W	35		G3	S3	B	-		
						001S070W	36							
14,262	Natural Communities	*Pinus ponderosa / Cercocarpus montanus / Andropogon gerardii Wooded Herbaceous Vegetation*	Foothills Ponderosa Pine Scrub Woodlands	S	2007-07-20	001S070W	31		G2	S2?	B	-		
12,596	Natural Communities	*Populus angustifolia / Salix irrorata Woodland*	Foothills Riparian Woodland	S	2007-09-06	001S070W	23		G2	S2	C	-		
						001S070W	24							
						001S070W	26							
						001S070W	27							
						001S070W	33							
						001S070W	34							
9,884	Vascular Plants	*Amorpha nana*	dwarf wild indigo	S	1993-09-14	001S070W	31		G5	S2S3		-		
8,757	Vascular Plants	*Amorpha nana*	dwarf wild indigo	S	1998-07-01	002S070W	07		G5	S2S3	C	-		
1,460	Vascular Plants	*Amorpha nana*	dwarf wild indigo	S	2000-08-17	001S070W	27		G5	S2S3	D	-		
1,230	Vascular Plants	*Aristida basiramea*	forktip three-awn	S	1994-09-01	002S070W	09		G5	S1	E	-		
						002S070W	10							
						002S070W	15							
						002S070W	16							
14,223	Vascular Plants	*Carex oreocharis*	a sedge	S	1984-06-09	001S070W	29		G3	S1	H	-		
						001S070W	32							
14,237	Vascular Plants	*Carex saximontana*	Rocky Mountain sedge	S	2007-07-20	001S070W	31		G5	S1	E	-		

precision codes: S = "seconds", location known within 100m; M = "minutes", location known within 1 mile; G = "general", location known within 5 miles

Locations and Status of Rare and/or Imperiled Species and Natural Communities known from or likely to occur within a two-mile radius of NREL's National Wind Technology Center

Report generated: 23 July 2010

EO_ID	major group	scientific name	common name	Prec	last obs	Town/ Range	Sec	TRS Note	grank	srank	eo-rank	ESA	fed stat	st stat
14,220	Vascular Plants	*Crataegus chrysocarpa*	yellow hawthorn	M	1986-09-05	001S070W	28		G5	S1	H	-		
						001S070W	33							
13,584	Vascular Plants	*Crocanthemum bicknellii*	frostweed	S	1997-08-28	001S070W	31		G5	S2	E	-		
7,042	Vascular Plants	*Liatris ligulistylis*	gay-feather	G	9999-08-11	001S071W	12		G5?	S1S2	H	-		
13,554	Vascular Plants	*Nuttallia sinuata*	wavy-leaf stickleaf	S	1993-07-09	001S070W	31		G3	S2	E	-		
7,102	Vascular Plants	*Spiranthes diluvialis*	Ute ladies' tresses	S	2006-99-99	001S070W			G2G3	S2	D	LT		
3,213	Vascular Plants	*Viola pedatifida*	prairie violet	M	1948-04-29	001S070W	21		G5	S2	H	-		
3,964	Vascular Plants	*Viola pedatifida*	prairie violet	S	1993-05-27	001S070W	31		G5	S2	B	-		
						002S070W	06							

precision codes: S = "seconds", location known within 100m; M = "minutes", location known within 1 mile; G = "general", location known within 5 miles

APPENDIX B

Plant Community Species List Tables

Legend to classification codes:

Origin:

Refers to origin of species

N Native to the Front Range area

I Introduced or exotic species

Species:

Refers to blooming/production season for grass species

C cold season (spring/early summer)

W warm season (mid to late summer)

Life Form:

Refers to life form/strategy of species

AF annual forb

BF biennial forb

PF perennial forb

AG annual grass/graminoid (includes rushes and sedges)

PG perennial grass/graminoid (includes rushes and sedges)

SU succulent

SS subshrub

S shrub

T tree

V vine

Table 1. Xeric Mixed Grassland

Plant Species List NREL National Wind Technology Center						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Asclepias pumila		Plains milkweed	Aclepiadaceae - Milkweed Family	N	NA	PF
Yucca glauca		Yucca	Agavaceae - Agave Family	N	NA	SU
Allium textile		Wild onion	Alliaceae – Onion Family	N	NA	PF
Eremogone fendleri		Desert sandwort	Alsinaceae – Chickweed Family	N	NA	PF
Paronychia jamesii		James' nailwort	Alsinaceae – Chickweed Family	N	NA	PF
Amaranthus retroflexus		Redroot pigweed	Amaranthaceae – Amaranth Family	I	NA	AF
Rhus aromatica var. trilobata		Skunkbrush	Anacardiaceae – Sumac Family	N	NA	S
Harbouria trachypleura		Whisk broom parsley	Apiaceae – Parsley Family	N	NA	PF
Lomatium orientale		Lomatium	Apiaceae – Parsley Family	N	NA	PF
Apocynum cannabinum		Indian hemp	Apocynaceae – Dogbane Family	N	NA	PF
Asclepias speciosa		Showy milkweed	Asclepiadaceae – Milkweed Family	N	NA	PF
Achillea lanulosa		Yarrow	Asteraceae – Sunflower Family	N	NA	PF
Acosta diffusa	*Centaurea diffusa*	Diffuse knapweed	Asteraceae - Sunflower Family	I	NA	BF/PF
Ambrosia psilostachya		Western ragweed	Asteraceae – Sunflower Family	N	NA	PF
Anaphalis margaritacea		Pearly everlasting	Asteraceae – Sunflower Family	N	NA	PF
Antennaria rosea		Pussytoes	Asteraceae – Sunflower Family	N	NA	PF
Arnica fulgens		Arnica	Asteraceae – Sunflower Family	N	NA	PF
Artemisia campestris		Field sagewort	Asteraceae – Sunflower Family	N	NA	PF
Artemisia frigida		Fringed sagebrush	Asteraceae - Sunflower Family	N	NA	SS
Artemisia ludoviciana		Prairie sagewort	Asteraceae - Sunflower Family	N	NA	PF
Aster ericoides		White aster	Asteraceae - Sunflower Family	N	NA	PF
Aster porteri		White aster	Asteraceae - Sunflower Family	N	NA	PF
Breea arvensis	*Circium arvense*	Canada thistle	Asteraceae – Sunflower Family	I	NA	PF
Brickellia eupatorioides		Brickellia	Asteraceae - Sunflower Family	N	NA	PF
Carduus nutans		Musk thistle	Asteraceae - Sunflower Family	I	NA	BF
Chrysothamnus nauseosus		Rubber rabbitbrush	Asteraceae - Sunflower Family	N	NA	S
Cichorium intybus		Chicory	Asteraceae - Sunflower Family	I	NA	PF
Cirsium undulatum		Wavyleaf thistle	Asteraceae - Sunflower Family	N	NA	BF
Cirsium vulgare		Bull thistle	Asteraceae - Sunflower Family	I	NA	BF
Conyza canadensis		Horseweed	Asteraceae - Sunflower Family	N	NA	AF
Erigeron divergens		Spreading fleabane	Asteraceae - Sunflower Family	N	NA	BF
Gaillardia aristata		Blanketflower	Asteraceae - Sunflower Family	N	NA	PF
Grindelia squarrosa		Curlycup gumweed	Asteraceae - Sunflower Family	N	NA	BF
Gutierrezia sarothrae		Broom snakeweed	Asteraceae - Sunflower Family	N	NA	SS
Helianthus annuus		Common sunflower	Asteraceae - Sunflower Family	N	NA	AF
Helianthus petiolaris		Prairie sunflower	Asteraceae - Sunflower Family	N	NA	AF
Helianthus rigidus		Stiff sunflower	Asteraceae - Sunflower Family	N	NA	PF
Lactuca serriola		Prickly lettuce	Asteraceae - Sunflower Family	I	NA	BF
Liatris punctata		Dotted gayfeather	Asteraceae - Sunflower Family	N	NA	PF
Oligosporus dracunculus	*Artemisia dracunculus*	Wild tarragon	Asteraceae - Sunflower Family	N	NA	PF

Table 1. Xeric Mixed Grassland

Plant Species List NREL National Wind Technology Center						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Ratibida columnifera		Prairie coneflower	Asteraceae - Sunflower Family	N	NA	PF
Senecio crassulus		Butterweed	Asteraceae - Sunflower Family	N	NA	PF
Senecio integerrimus		Groundsel	Asteraceae - Sunflower Family	N	NA	BF/PF
Senecio spartioides		Groundsel	Asteraceae - Sunflower Family	N	NA	PF/SS
Solidago missouriensis		Prairie goldenrod	Asteraceae - Sunflower Family	N	NA	PF
Solidago mollis		Soft goldenrod	Asteraceae - Sunflower Family	N	NA	PF
Solidago nana		Goldenrod	Asteraceae - Sunflower Family	N	NA	PF
Taraxacum officinale		Common dandelion	Asteraceae - Sunflower Family	I	NA	PF
Townsendia hookeri		Easter daisy	Asteraceae - Sunflower Family	N	NA	PF
Tragopogon dubius		Goatsbeard	Asteraceae - Sunflower Family	I	NA	BF
Cynoglossum officinale		Houndstongue	Boraginaceae - Borage Family	I	NA	BF
Lithospermum incisum		Narrowleaf gromwell	Boraginaceae - Borage Family	N	NA	PF
Oreocarya virgata	*Cryptantha virgata*	Miner's candle	Boraginaceae - Borage Family	N	NA	PF
Alyssum alyssoides		Pale alyssum	Brassicaceae - Mustard Family	I	NA	AF
Cardaria draba		Whitetop	Brassicaceae - Mustard Family	I	NA	PF
Erysimum capitatum		Western wallflower	Brassicaceae - Mustard Family	N	NA	BF
Lesquerella ludoviciana		Bladderpod	Brassicaceae - Mustard Family	N	NA	PF
Sisymbrium altissimum		Tumbling mustard	Brassicaceae - Mustard Family	I	NA	AF
Coryphantha missouriensis		Yellow pincushion	Cactaceae - Cactus Family	N	NA	SU
Echinocereus viridiflorus		Hen-and-chicks	Cactaceae - Cactus Family	N	NA	SU
Opuntia fragilis		Brittle cactus	Cactaceae - Cactus Family	N	NA	SU
Opuntia macrorhiza		Plains prickly pear	Cactaceae - Cactus Family	N	NA	SU
Calochortus gunnisonii		Mariposa lily	Calochortaceae - Mariposa Family	N	NA	PF
Symphoricarpos occidentalis		Western snowberry	Caprifoliaceae - Honeysuckle Family	N	NA	S
Bassia sieversiana	*Kochia scoparia*	Kochia	Chenopodiaceae - Goosefoot Family	I	NA	AF
Chenopodium album		Common lambsquarters	Chenopodiaceae - Goosefoot Family	I	NA	AF
Kochia scoparia	*Bassia sieversiana*	Summer cypress	Chenopodiaceae - Goosefoot Family	I	NA	AF
Convolvulus arvensis		Field bindweed	Convolvulaceae - Morning Glory Family	I	NA	PF
Carex brevior		Sedge	Cyperaceae - Sedge Family	N	NA	PG
Carex filifolia		Thread-leafed sedge	Cyperaceae - Sedge Family	N	NA	PG
Tithymalus brachyceras		Spurge	Euphorbiaceae - Spurge Family	N	NA	PF
Ephorbia esula		Leafy spurge	Euphobiaceae – Spurge Family	I	NA	PF
Tithymalus montanus		Spurge	Euphorbiaceae - Spurge Family	N	NA	PF
Astragalus crassicarpus		Groundplum milkvetch	Fabaceae - Pea Family	N	NA	PF
Astragalus mollissimus		Wooly locoweed	Fabaceae - Pea Family	N	NA	PF
Astragalus sp.		Locoweed	Fabaceae - Pea Family	N	NA	PF
Dalea purpurea	*Petalostemon purpurea*	Purple prairie clover	Fabaceae - Pea Family	N	NA	PF
Glycyrrhiza lepidota		American licorice	Fabaceae - Pea Family	N	NA	PF
Lupinus argenteus		Silver lupine	Fabaceae - Pea Family	N	NA	PF

Table 1. Xeric Mixed Grassland

Plant Species List NREL National Wind Technology Center						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Melilotus albus		White sweetclover	Fabaceae – Pea Family	I	NA	BF
Melilotus officinalis		Yellow sweetclover	Fabaceae - Pea Family	I	NA	BF
Oxytropis lambertii		Lambert locoweed	Fabaceae - Pea Family	N	NA	PF
Psoralidium tenuiflora		Slimflower scurfpea	Fabaceae - Pea Family	N	NA	PF
Thermopsis rhombifolia		Prairie goldenpea	Fabaceae - Pea Family	N	NA	PF
Pneumonanthe affinis	*Gentiana affinis*	Bottle gentian	Gentianaceae - Gentian Family	N	NA	PF
Erodium cicutarium		Filaree	Geraniaceae - Geranium Family	I	NA	AF
Delphinium nuttallianum		Blue larkspur	Helleboraceae - Hellebore Family	N	NA	PF
Phacelia heterophylla	*Phacelia hastata var. leucophylla*	Scorpioweed	Hydrophyllaceae - Waterleaf Family	N	NA	PF
Hypericum perforatum		St. Johnswort	Hypericaceae - St. Johnswort family	I	NA	PF
Iris missouriensis		Wild iris	Iridaceae - Iris Family	N	NA	PF
Juncus sp.		Rush	Juncaceae - Rush Family	N	NA	PG
Leucocrinum montanum		Sand lily	Liliaceae - Lily Family	N	NA	PF
Linum lewisii		Perennial flax	Linaceaea - Flax Family	N	NA	PF
Sphaeralcea coccinea		Scarlet globemallow	Malvaceae - Mallow Family	N	NA	PF
Toxicoscordion venenosum	*Zigadenus venenosus*	Death camass	Melanthiaceae - False Hellbore Family	N	NA	PF
Calylophus serrulatus		Shrubby evening-primrose	Onagraceae - Evening-primrose Family	N	NA	SS
Gaura coccinea		Scarlet gaura	Onagraceae - Evening-primrose Family	N	NA	PF
Oenothera howardii	*Oenothera brachycarpa*	Evening-primrose	Onagraceae - Evening-primrose Family	N	NA	PF
Oenothera villosa		Common evening-primrose	Onagraceae - Evening-primrose Family	N	NA	PF
Aphyllon fasciculatum	*Orobanche fasciculata*	Broomrape	Orobanchaceae - Broomrape Family	N	NA	PF
Oxalis dillenii		Woodsorrel	Oxalidaceae - Woodsorrel Family	N	NA	PF
Argemone polyanthemos		Prickly poppy	Papaveracae - Poppy Family	N	NA	PF
Pinus ponderosa		Ponderosa pine	Pinaceae - Pine Family	N	NA	T
Plantago lanceolata		English plantain	Plantaginaceae - Plantain Family	I	NA	PF
Agropyron cristatum		Crested wheatgrass	Poaceae - Grass Family	I	C	PG
Agrostis scabra		Ticklegrass	Poaceae - Grass Family	N	C	PG
Andropogon gerardii		Big bluestem	Poaceae - Grass Family	N	W	PG
Anisantha tectorum	*Bromus tectorum*	Cheatgrass	Poaceae - Grass Family	I	C	AG
Aristida purpurea	*Aristida purpurea var. robusta*	Red three-awn	Poaceae - Grass Family	N	W	PG
Bouteloua curtipendula		Side-oats grama	Poaceae - Grass Family	N	W	PG
Bromopis inermis	*Bromus inermis*	Smooth bromegrass	Poaceae - Grass Family	I	C	PG
Buchloë dactyloides		Buffalograss	Poaceae - Grass Family	N	W	PG
Chondrosum gracile	*Bouteloua gracilis*	Blue grama	Poaceae - Grass Family	N	W	PG
Dactylis glomerata		Orchard grass	Poaceae - Grass Family	I	C	PG
Elymus canadensis		Canada wild rye	Poaceae - Grass Family	N	C	PG
Elymus trachycaulus	*Agropyron caninum ssp. majus*	Slender wheatgrass	Poaceae - Grass Family	N	C	PG

Table 1. Xeric Mixed Grassland

Plant Species List NREL National Wind Technology Center						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Koeleria macrantha	*Koeleria pyramidata*	Junegrass	Poaceae - Grass Family	N	C	PG
Lophopyrum elongatum	*Agropyron elongatum*	Tall wheatgrass	Poaceae - Grass Family	I	C	PG
Muhlenbergia montana		Mountain muhly	Poaceae - Grass Family	N	W	PG
Oryzopsis hymenoides		Indian ricegrass	Poaceae - Grass Family	N	C	PG
Panicum capillare		Witchgrass	Poaceae - Grass Family	N	W	AG
Panicum virgatum		Switchgrass	Poaceae - Grass Family	N	W	PG
Pascopyrum smithii	*Agropyron smithii*	Western wheatgrass	Poaceae - Grass Family	N	C	PG
Pleum pratense		Common timothy	Poaceae – Grass Family	I	C	PG
Poa compressa		Canada bluegrass	Poaceae - Grass Family	I	C	PG
Poa pratensis		Kentucky bluegrass	Poaceae - Grass Family	I	C	PG
Poa secunda	*Poa canbyi*	Canby bluegrass	Poaceae - Grass Family	N	C	PG
Schizachyrium scoparium	*Andropogon scoparius*	Little bluestem	Poaceae - Grass Family	N	W	PG
Sorghastrum nutans		Indian-grass	Poaceae - Grass Family	N	W	PG
Sporobolus cryptandrus		Sand dropseed	Poaceae - Grass Family	N	W	PG
Stipa comata		Needle-and-thread	Poaceae - Grass Family	N	C	PG
Stipa viridula		Green needlegrass	Poaceae - Grass Family	N	C	PG
Ipomopsis spicata		Ipomopsis	Polemoniaceae - Phlox Family	N	NA	PF
Eriogonum alatum		Winged eriogonum	Polygonaceae - Buckwheat Family	N	NA	PF
Eriogonum sp.		Wild buckwheat	Polygonaceae - Buckwheat Family	N	NA	PF
Eriogonum umbellatum		Wild buckwheat	Polygonaceae - Buckwheat Family	N	NA	PF
Pterogonum alatum	*Erigeron alatum*	Winged buckwheat	Polygonaceae - Buckwheat Family	N	NA	PF
Rumex crispus		Curly dock	Polygonaceae - Buckwheat Family	N	NA	PF
Talinum parviflorum		Prairie fameflower	Portulacaceae - Purslane Family	N	NA	PF
Crataegus erythropoda		Hawthorn	Rosaceae - Rose Family	N	NA	T
Potentilla hippiana		Wooly cinquefoil	Rosaceae - Rose Family	N	NA	PF
Potentilla recta		Sulfur cinquefoil	Rosaceae - Rose Family	I	NA	PF
Rosa sayi	*Rosa acicularis*	Prickly wild rose	Rosaceae - Rose Family	N	NA	S
Rosa woodsii		Woods rose	Rosaceae - Rose Family	N	NA	S
Commandra umbellata		Bastard-toadflax	Santalaceae - Sandelwood Family	N	NA	PF
Castilleja sessiliflora		Downy paintbrush	Scrophulariaceae - Figwort Family	N	NA	PF
Linaria genistifolia subsp. dalmatica	*Linaria dalmatica*	Dalmatian toadflax	Scrophulariaceae - Figwort Family	I	NA	PF
Penstemon virgatus		Penstemon	Scrophulariaceae - Figwort Family	N	NA	PF
Verbascum blattaria		Moth mullein	Scrophulariaceae - Figwort Family	I	NA	BF
Verbascum thapsus		Common mullein	Scrophulariaceae - Figwort Family	I	NA	BF
Verbena bracteata		Prostrate verbena	Verbebaceae - Verbena Family	N	NA	PF
Viola nuttallii		Yellow prairie violet	Violaceae - Violet Family	N	NA	PF

Table 2. Mesic Mixed Grassland

Plant Species List NREL National Wind Technology Center						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Allium textile		Wild onion	Alliaceae - Onion Family	N	NA	PF
Acosta diffusa	*Centaurea diffusa*	Diffuse knapweed	Asteraceae - Sunflower Family	I	NA	BF/PF
Ambrosia psilostachya		Western ragweed	Asteraceae – Sunflower Family	N	NA	PF
Artemisia ludoviciana		Prairie sagewort	Asteraceae - Sunflower Family	N	NA	PF
Aster porteri		White aster	Asteraceae - Sunflower Family	N	NA	PF
Breea arvensis	*Cirsium arvense*	Canada thistle	Asteraceae - Sunflower Family	I	NA	PF
Carduus nutans		Musk thistle	Asteraceae - Sunflower Family	I	NA	BF
Cirsium undulatum		Wavyleaf thistle	Asteraceae – Sunflower Family	N	NA	BF
Gaillardia aristata		Blanketflower	Asteraceae - Sunflower Family	N	NA	PF
Lactuca serriola		Prickly lettuce	Asteraceae - Sunflower Family	I	NA	BF
Liatris punctata		Dotted gayfeather	Asteraceae – Sunflower Family	N	NA	PF
Ratibida columnifera		Prairie coneflower	Asteraceae – Sunflower Family	N	NA	PF
Tragopogon dubius		Salsify	Asteraceae – Sunflower Family	I	NA	BF
Lithospermum arvense		Corn gromwell	Boraginaceae - Borage Family	I	NA	AF
Lesquerella ludoviciana		Bladderpod	Brassicaceae - Mustard Family	N	NA	PF
Thlaspi arvense		Fanweed	Brassicaceae - Mustard Family	I	NA	AF
Convolvulus arvensis		Field bindweed	Convolvulaceae - Morning Glory Family	I	NA	PF
Eleocharis palustris		Spike-rush	Cyperaceae - Sedge Family	N	NA	PG
Melilotus officinalis		Yellow sweetclover	Fabaceae - Pea Family	I	NA	BF
Psoralidium tenuiflora		Slimflower scurfpea	Fabaceae - Pea Family	N	NA	PF
Pneumonanthe affinis	*Gentiana affinis*	Bottle gentian	Gentianaceae - Gentian Family	N	NA	PF
Phaceelia heterophylla	*Phacelia hastata var. leucophylla*	Scorpionweed	Hydrophyllaceae – Waterleaf Famiy	N	NA	PF
Hypericum perforatum		St. Johnswort	Hypericaceae - St. Johnswort Family	I	NA	PF
Agrostis gigantea	*Agrostis alba*	Redtop	Poaceae - Grass Family	I	C	PG
Andropogon gerardii		Big bluestem	Poaceae - Grass Family	N	W	PG
Bouteloua curtipendula		Side-oats grama	Poaceae - Grass Family	N	W	PG
Bromopis inermis	*Bromus inermis*	Smooth bromegrass	Poaceae - Grass Family	I	C	PG
Koeleria macrantha	*Koeleria pyramidata*	Junegrass	Poaceae - Grass Family	N	C	PG
Muhlenbergia montana		Mountain muhly	Poaceae - Grass Family	N	W	PG
Panicum virgatum		Switchgrass	Poaceae - Grass Family	N	W	PG
Pascopyrum smithii	*Agropyron smithii*	Western wheatgrass	Poaceae - Grass Family	N	C	PG
Poa compressa		Canada bluegrass	Poaceae - Grass Family	I	C	PG
Poa fendleriana		Muttongrass	Poaceae - Grass Family	N	C	PG
Poa pratensis		Kentucky bluegrass	Poaceae - Grass Family	I	C	PG
Polypogon monspeliensis		Rabbitfoot grass	Poaceae - Grass Family	I	W	AG
Schizachyrium scoparium	*Andropogon scoparius*	Little bluestem	Poaceae - Grass Family	N	W	PG
Sorghastrum nutans		Indian-grass	Poaceae - Grass Family	N	W	PG
Ranunculus sp.		Buttercup	Ranunculaceae - Buttercup Family	N	NA	PF

Table 2. Mesic Mixed Grassland

Plant Species List NREL National Wind Technology Center						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Geum aleppicum		Avens	Rosaceae - Rose Family	N	NA	PF
Rosa sayi	*Rosa acicularis*	Prickly wild rose	Rosaceae - Rose Family	N	NA	S
Commandra umbellata		Bastard-toadflax	Santalaceae - Sandelwood Family	N	NA	PF
Verbascum thapsis		Common mullein	Scropulariaceae – Figwort Family	I	NA	BF
Veronica peregrina		Purslane speedwell	Scropulariaceae - Figwort Family	N	NA	AF
Typha latifolia		Common cattail	Typhaceae - Cattail Family	N	NA	PF

Table 3. Ponderosa Pine Woodland

Plant Species List NREL National Wind Technology Center						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Yucca glauca		Yucca	Agavaceae - Agave Family	N	NA	SU
Allium textile		Wild onion	Alliaceae - Onion Family	N	NA	PF
Cerastrium strictum		Mouse-ear	Alsinaceae - Chickweed Family	N	NA	PF
Eremogone fendleri		Desert sandwort	Alsinaceae - Chickweed Family	N	NA	PF
Eremogone hookeri	*Arenaria hookeri*	Desert sandwort	Alsinaceae - Chickweed Family	N	NA	PF
Paronychia jamesii		James' nailwort	Alsinaceae - Chickweed Family	N	NA	PF
Rhus aromatica var. *trilobata*		Skunkbrush	Anacardiaceae - Sumac Family	N	NA	S
Toxicodendron rydbergii		Poison ivy	Anacardiaceae - Sumac Family	N	NA	S
Harbouria trachypleura		Whisk broom parsley	Apiaceae - Parsley Family	N	NA	PF
Apocynum cannabinum		Indian hemp	Apocynaceae - Dogbane Family	N	NA	PF
Achillea lanulosa		Yarrow	Asteraceae - Sunflower Family	N	NA	PF
Acosta diffusa	*Centaurea diffusa*	Diffuse knapweed	Asteraceae - Sunflower Family	I	NA	BF/PF
Ambrosia psilostachya		Western ragweed	Asteraceae - Sunflower Family	N	NA	PF
Antennaria rosea		Pussytoes	Asteraceae - Sunflower Family	N	NA	PF
Artemisia absinthium		Wormwood	Asteraceae - Sunflower Family	N	NA	PF/SS
Artemisia ludoviciana		Prairie sagewort	Asteraceae - Sunflower Family	N	NA	PF
Aster ericoides		White aster	Asteraceae - Sunflower Family	N	NA	PF
Brickellia eupatorioides		Brickellia	Asteraceae - Sunflower Family	N	NA	PF
Breea arvensis	*Cirsium arvense*	Canada thistle	Asteraceae - Sunflower Family	I	NA	PF
Cirsium undulatum		Wavyleaf thistle	Asteraceae - Sunflower Family	N	NA	BF
Grindelia revoluta		Gumweed	Asteraceae - Sunflower Family	N	NA	PF
Grindelia squarrosa		Curlycup gumweed	Asteraceae - Sunflower Family	N	NA	BF
Gutierrezia sarothrae		Broom snakeweed	Asteraceae - Sunflower Family	N	NA	SS
Heterotheca villosa	*Chrysopsis villosa*	Hairy golden aster	Asteraceae - Sunflower Family	N	NA	SS
Lactuca serriola		Prickly lettuce	Asteraceae - Sunflower Family	I	NA	BF
Liatris punctata		Dotted gayfeather	Asteraceae - Sunflower Family	N	NA	PF
Oligosporus dracunculus	*Artemisia dracunculus*	Wild tarragon	Asteraceae - Sunflower Family	N	NA	PF
Senecio crassulus		Butterweed	Asteraceae - Sunflower Family	N	NA	PF
Senecio spartioides		Groundsel	Asteraceae - Sunflower Family	N	NA	PF/SS
Solidago mollis		Soft goldenrod	Asteraceae - Sunflower Family	N	NA	PF
Taraxacum officinale		Common dandelion	Asteraceae - Sunflower Family	I	NA	PF
Cynoglossum officinale		Houndstongue	Boraginaceae - Borage Family	I	NA	BF
Lithospermum incisum		Narrowleaf gromwell	Boraginaceae - Borage Family	N	NA	PF
Alyssum alyssoides		Pale alyssum	Brassicaceae - Mustard Family	I	NA	AF
Erysimum capitatum		Western wallflower	Brassicaceae - Mustard Family	N	NA	BF
Coryphantha vivipara var. vivipara		Nipple cactus	Cactaceae - Cactus Family	N	NA	SU
Echinocereus viridiflorus		Hen-and-chicks	Cactaceae - Cactus Family	N	NA	SU
Opuntia macrorhiza		Plains prickly pear	Cactaceae - Cactus Family	N	NA	SU

Table 3. Ponderosa Pine Woodland

Plant Species List NREL National Wind Technology Center						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Opuntia polyacantha		Plains prickly pear	Cactaceae - Cactus Family	N	NA	SU
Campanula rotundifolia		Common harebell	Campanulaceae - Bellflower Family	N	NA	PF
Symphoricarpos occidentalis		Western snowberry	Caprifoliaceae – Honeysuckle Family	N	NA	S
Townsendia hookeri		Easter daisy	Asteraceae - Sunflower Family	N	NA	PF
Symphoricarpos occidentalis		Western snowberry	Caprifoliaceae - Honeysuckle Family	N	NA	S
Chenopodium album		Common lambsquarters	Chenopodiaceae - Goosefoot Family	I	NA	AF
Convolvulus arvensis		Field bindweed	Convolvulaceae - Morning Glory Family	I	NA	PF
Carex brevior		Sedge	Cyperaceae - Sedge Family	N	NA	PG
Carex filifolia		Thread-leafed sedge	Cyperaceae - Sedge Family	N	NA	PG
Carex sp.		Sedge	Cyperaceae - Sedge Family	N	NA	PG
Astragalus mollissimus		Wooly locoweed	Fabaceae - Pea Family	N	NA	PF
Dalea purpurea	*Petalostemon purpurea*	Purple prairie clover	Fabaceae - Pea Family	N	NA	PF
Lupinus argenteus		Silver lupine	Fabaceae - Pea Family	N	NA	PF
Oxytropis lambertii		Lambert locoweed	Fabaceae - Pea Family	N	NA	PF
Psoralidium tenuiflora		Slimflower scurfpea	Fabaceae - Pea Family	N	NA	PF
Thermopsis rhombifolia		Prairie goldenpea	Fabaceae - Pea Family	N	NA	PF
Frasera speciosa		Monument plant	Gentianaceae - Gentian Family	N	NA	PF
Pneumonanthe affinis	*Gentiana affinis*	Bottle gentian	Gentianaceae - Gentian Family	N	NA	PF
Geranium caespitosum		Wild geranium	Geraniaceae - Geranium Family	N	NA	PF
Geranium viscosissimum		Sticky geranium	Geraniaceae - Geranium Family	N	NA	PF
Ribes aureum		Golden current	Grossulariaceae - Current Family	N	NA	S
Ribes cereum		Wax current	Grossulariaceae - Current Family	N	NA	S
Delphinium nuttallianum		Blue larkspur	Helleboraceae - Hellebore Family	N	NA	PF
Phacelia heterophylla	*Phacelia hastata*	Scorpioweed	Hydrophyllaceae - Waterleaf Family	N	NA	PF
Hypericum perforatum		St. Johnswort	Hypericaceae - St. Johnswort family	I	NA	PF
Monarda fistulosa		Bee balm	Lamiaceae - Mint Family	N	NA	PF
Leucocrinum montanum		Sand lily	Liliaceae - Lily Family	N	NA	PF
Calylophus serrulatus		Shrubby evening-primrose	Onagraceae - Evening-primrose Family	N	NA	SS
Oenothera coronopifolia		Combleaf evening-primrose	Onagraceae - Evening-primrose Family	N	NA	PF
Oxalis dillenii		Woodsorrel	Oxalidaceae - Woodsorrel Family	N	NA	PF
Pinus ponderosa		Ponderosa pine	Pinaceae - Pine Family	N	NA	T
Pseudotsuga menziesii		Douglas-fir	Pinaceae – Pine Family	N	NA	T
Agropyron cristatum		Crested wheatgrass	Poaceae – Grass Family	I	C	PG
Agrostis scabra		Ticklegrass	Poaceae – Grass Family	N	C	PG
Andropogon gerardii		Big bluestem	Poaceae – Grass Family	N	W	PG
Anisantha tectorum	*Bromus tectorum*	Cheatgrass	Poaceae – Grass Family	I	C	AG

Table 3. Ponderosa Pine Woodland

Plant Species List NREL National Wind Technology Center						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Aristida purpurea		Three-awn	Poaceae – Grass Family	N	W	PG
Bouteloua curtipendula		Side-oats grama	Poaceae – Grass Family	N	W	PG
Bromopis inermis	*Bromus inermis*	Smooth bromegrass	Poaceae – Grass Family	I	C	PG
Chondrosum gracile	*Bouteloua gracilis*	Blue grama	Poaceae – Grass Family	N	W	PG
Critesion jubatum	*Hordeum jubatum*	Foxtail barley	Poaceae - Grass Family	N	C	PG
Elymus elymoides	*Sitanion hystrix*	Bottletail squirreltail	Poaceae - Grass Family	N	C	PG
Hesperostipa comata	*Stipa comata*	Needle-and-thread	Poaceae - Grass Family	N	C	PG
Koeleria macrantha	*Koeleria pyramidata*	Junegrass	Poaceae - Grass Family	N	C	PG
Muhlenbergia 10ontana		Mountain muhly	Poaceae – Grass Family	N	W	PG
Nassella viridula	*Stipa viridula*	Green needlegrass	Poaceae – Grass Family	N	C	PG
Pascopyrum smithii	*Agropyron smithii*	Western wheatgrass	Poaceae - Grass Family	N	C	PG
Poa compressa		Canada bluegrass	Poaceae - Grass Family	I	C	PG
Poa pratensis		Kentucky bluegrass	Poaceae - Grass Family	I	C	PG
Schizachyrium scoparium	*Andropogon scoparius*	Little bluestem	Poaceae - Grass Family	N	W	PG
Pulsatilla patens	*Anemone patens*	Pasque flower	Ranunculaceae - Buttercup Family	N	NA	PF
Amelanchier utahensis		Serviceberry	Rosaceae - Rose Family	N	NA	S
Cerasus pumila subsp. *besseyi*	*Prunus pumila* var. *bessyi*	Sand cherry	Rosaceae - Rose Family	N	NA	S
Crataegus erythropoda		Hawthorn	Rosaceae - Rose Family	N	NA	T
Drymocallis fissa	*Potentilla fissa*	Cinquefoil	Rosaceae - Rose Family	N	NA	PF
Oreobatus deliciosus	*Rubus deliciousus*	Boulder raspberry	Rosaceae - Rose Family	N	NA	S
Padus virginiana	*Prunus virginiana*	Chokecherry	Rosaceae - Rose Family	N	NA	S
Potentilla hippiana		Wooly cinquefoil	Rosaceae - Rose Family	N	NA	PF
Potentilla ovina		Potentilla	Rosaceae - Rose Family	N	NA	PF
Potentilla recta		Sulfur cinquefoil	Rosaceae - Rose Family	I	NA	PF
Rosa arkansana		Prairie rose	Rosaceae - Rose Family	N	NA	S
Rosa woodsii		Woods rose	Rosaceae - Rose Family	N	NA	S
Galium aparine		Catchweed bedstraw	Rubiaceae - Madder Family	I	NA	AF
Galium septentrionale		Northern bedstraw	Rubiaceae - Madder Family	N	NA	PF
Commandra umbellata		Bastard-toadflax	Santalaceae - Sandelwood Family	N	NA	PF
Penstemon secundiflorus		Penstemon	Scrophulariaceae - Figwort Family	N	NA	PF
Penstemon virgatus		Penstemon	Scrophulariaceae - Figwort Family	N	NA	PF
Verbascum blattaria		Moth mullein	Scrophulariaceae - Figwort Family	I	NA	BF
Verbascum thapsus		Common mullein	Scrophulariaceae - Figwort Family	I	NA	BF
Viola nuttallii		Yellow prairie violet	Violaceae - Violet Family	N	NA	PF

Table 4. Upland Shrubland

Plant Species List NREL National Wind Technology Center						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Cerastrium strictum		Mouse-ear	Alsinaceae - Chickweed Family	N	NA	PF
Eremogone fendleri		Desert sandwort	Alsinaceae - Chickweed Family	N	NA	PF
Paronychia jamesii		James' nailwort	Alsinaceae - Chickweed Family	N	NA	PF
Rhus aromatica var. *trilobata*		Skunkbrush	Anacardiaceae - Sumac Family	N	NA	S
Toxicodendron rydbergii		Poison ivy	Anacardiaceae - Sumac Family	N	NA	S
Lomatium orientale		Lomatium	Apiaceae - Parsley Family	N	NA	PF
Achillea lanulosa		Yarrow	Asteraceae - Sunflower Family	N	NA	PF
Acosta diffusa	*Centaurea diffusa*	Diffuse knapweed	Asteraceae - Sunflower Family	I	NA	BF/PF
Ambrosia psilostachya		Western ragweed	Asteraceae - Sunflower Family	N	NA	PF
Antennaria rosea		Pussytoes	Asteraceae - Sunflower Family	N	NA	PF
Artemisia frigida		Fringed sagebrush	Asteraceae - Sunflower Family	N	NA	SS
Artemisia ludoviciana		Prairie sagewort	Asteraceae - Sunflower Family	N	NA	PF
Aster porteri		White aster	Asteraceae - Sunflower Family	N	NA	PF
Carduus nutans		Musk thistle	Asteraceae – Sunflower Family	I	NA	BF
Cirsium undulatum		Wavyleaf thistle	Asteraceae - Sunflower Family	N	NA	BF
Gallardia aristata		Blanketflower	Asteraceae – Sunflower Family	N	NA	PF
Grindelia squarrosa		Curlycup gumweed	Asteraceae – Sunflower Family	N	NA	BF
Gutierrezia sarothrae		Broom snakeweed	Asteraceae - Sunflower Family	N	NA	SS
Helianthus rigidus		Stiff sunflower	Asteraceae - Sunflower Family	N	NA	PF
Heterotheca villosa	*Chrysopsis villosa*	Hairy golden aster	Asteraceae - Sunflower Family	N	NA	SS
Lactuca serriola		Prickly lettuce	Asteraceae - Sunflower Family	I	NA	BF
Liatris punctata		Dotted gayfeather	Asteraceae - Sunflower Family	N	NA	PF
Oligosporus dracunculus	*Artemisia dracunculus*	Wild tarragon	Asteraceae - Sunflower Family	N	NA	PF
Senecio crassulus		Butterweed	Asteraceae - Sunflower Family	N	NA	PF
Solidago missouriensis		Prairie goldenrod	Asteraceae - Sunflower Family	N	NA	PF
Solidago mollis		Soft goldenrod	Asteraceae - Sunflower Family	N	NA	PF
Solidago speciosa var. *pallida*		Goldenrod	Asteraceae - Sunflower Family	N	NA	PF
Tragopogon dubius		Goatsbeard	Asteraceae - Sunflower Family	I	NA	BF
Cynoglossum officinale		Houndstongue	Boraginaceae - Borage Family	I	NA	BF
Alyssum sp.		Alyssum	Brassicaceae – Mustard Family	I	NA	AF
Erysimum capitatum		Western wallflower	Brassicaceae - Mustard Family	N	NA	BF
Sisymbrium altissimum		Tumbling mustard	Brassicaceae - Mustard Family	I	NA	AF
Echinocereus viridiflorus		Hen-and-chicks	Cactaceae - Cactus Family	N	NA	SU
Opuntia polyacantha		Plains prickly pear	Cactaceae - Cactus Family	N	NA	SU
Campanula rotundifolia		Common harebell	Campanulaceae – Bellflower Family	N	NA	PF
Symphoricarpos occidentalis		Western snowberry	Caprifoliaceae - Honeysuckle Family	N	NA	S
Bassia sieversiana	*Kochia scoparia*	Kochia	Chenopodiaceae - Goosefoot Family	I	NA	AF
Carex brevior		Sedge	Cyperaceae - Sedge Family	N	NA	PG

Table 4. Upland Shrubland

Plant Species List NREL National Wind Technology Center						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Carex filifolia		Thread-leafed sedge	Cyperaceae - Sedge Family	N	NA	PG
Euphorbia esula		Leafy spurge	Euphobiaceae – Spurge Family	I	NA	PF
Dalea purpurea	*Petalostemon purpurea*	Purple prairie clover	Fabaceae - Pea Family	N	NA	PF
Oxytropis lambertii		Lambert locoweed	Fabaceae - Pea Family	N	NA	PF
Psoralidium tenuiflora		Slimflower scurfpea	Fabaceae - Pea Family	N	NA	PF
Thermopsis divaricarpa		Prairie goldenpea	Fabaceae - Pea Family	N	NA	PF
Pneumonanthe affinis	*Gentiana affinis*	Bottle gentian	Gentianaceae - Gentian Family	N	NA	PF
Ribes cereum		Wax current	Grossulariaceae - Current Family	N	NA	S
Delphinium nuttallianum		Blue larkspur	Helleboraceae - Hellebore Family	N	NA	PF
Hypericum perforatum		St. Johnswort	Hypericaceae - St. Johnswort family	I	NA	PF
Leucocrinum montanum		Sand lily	Liliaceae - Lily Family	N	NA	PF
Linum lewisii		Perennial flax	Linaceaea - Flax Family	N	NA	PF
Calylophus serrulatus		Shrubby evening-primrose	Onagraceae - Evening-primrose Family	N	NA	SS
Pinus ponderosa		Ponderosa pine	Pinaceae – Pine Family	N	NA	T
Andropogon gerardii		Big bluestem	Poaceae - Grass Family	N	W	PG
Anisantha tectorum	*Bromus tectorum*	Cheatgrass	Poaceae - Grass Family	I	C	AG
Bromopis inermis	*Bromus inermis*	Smooth bromegrass	Poaceae - Grass Family	I	C	PG
Bouteloua curtipendula		Side-oats grama	Poaceae – Grass Family	N	W	PG
Chondrosum gracile	*Bouteloua gracilis*	Blue grama	Poaceae - Grass Family	N	W	PG
Critesion jubatum	*Hordeum jubatum*	Foxtail barley	Poaceae - Grass Family	N	C	PG
Elymus canadensis		Canada wild rye	Poaceae - Grass Family	N	C	PG
Elymus elymoides	*Sitonion hystrix*	Bottlebrush squirreltail	Poaceae – Grass Family	N	C	PG
Hesperostipa comata	*Stipa comata*	Needle-and-thread	Poaceae - Grass Family	N	C	PG
Koeleria macrantha	*Koeleria pyramidata*	Junegrass	Poaceae - Grass Family	N	C	PG
Muhlenbergia montana		Mountain muhly	Poaceae - Grass Family	N	W	PG
Nassella viridula	*Stipa viridula*	Green needlegrass	Poaceae – Grass Family			
Pascopyrum smithii	*Agropyron smithii*	Western wheatgrass	Poaceae - Grass Family	N	C	PG
Poa compressa		Canada bluegrass	Poaceae - Grass Family	I	C	PG
Poa pratense		Kentucky bluegrass	Poaceae – Grass Family	I	C	PG
Schizachyrium scoparium	*Andropogon scoparius*	Little bluestem	Poaceae - Grass Family	N	W	PG
Sorghastrum nutans		Indian-grass	Poaceae - Grass Family	N	W	PG
Eriogonum umbellatum		Wild buckwheat	Polygonaceae - Buckwheat Family	N	NA	PF
Pterogonum alatum	*Erigeron alatum*	Winged buckwheat	Polygonaceae - Buckwheat Family	N	NA	PF
Amelanchier utahensis		Serviceberry	Rosaceae - Rose Family	N	NA	S
Cerasus pumila subsp. *besseyi*	*Prunus pumila* var. *bessyi*	Sand cherry	Rosaceae - Rose Family	N	NA	S
Crataegus erythropoda		Hawthorn	Rosaceae - Rose Family	N	NA	T
Padus virginiana	*Prunus virginiana*	Chokecherry	Rosaceae - Rose Family	N	NA	S
Potentilla ovina		Potentilla	Rosaceae - Rose Family	N	NA	PF
Potentilla recta		Sulfur cinquefoil	Rosaceae - Rose Family	I	NA	PF

Table 4. Upland Shrubland

Plant Species List NREL National Wind Technology Center						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Prunus americana		Wild plum	Rosaceae - Rose Family	N	NA	S
Rosa arkansana		Prairie rose	Rosaceae - Rose Family	N	NA	S
Rosa woodsii		Woods rose	Rosaceae - Rose Family	N	NA	S
Commandra umbellata		Bastard-toadflax	Santalaceae - Sandelwood Family	N	NA	PF
Castilleja sessiliflora		Downy paintbrush	Scrophulariaceae - Figwort Family	N	NA	PF
Linerea genestifolia subsp. dalmatica	*Linerea dalmatica*	Dalmatian toadflax	Scrophulariaceae – Figwort Family	I	NA	PF
Penstemon secundiflorus		Penstemon	Scrophulariaceae - Figwort Family	N	NA	PF
Penstemon virgatus		Penstemon	Scrophulariaceae - Figwort Family	N	NA	PF
Verbascum thapsus		Common mullein	Scrophulariaceae - Figwort Family	I	NA	BF

Table 5. Palustrine Emergent Wetland

Plant Species List NREL National Wind Technology Center						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Breea arvensis	*Cirsium arvense*	Canada thistle	Asteraceae - Sunflower Family	I	NA	PF
Cardamine breweri		Bittercress	Brassicaceae - Mustard Family	N	NA	PF
Neolepia campestre	*Lepidium campestre*	Fieldcress	Brassicaceae - Mustard Family	I	NA	BF
Symphoricarpos occidentalis		Western snowberry	Caprifoliaceae - Honeysuckle Family	N	NA	S
Carex nebrascensis		Nebraska sedge	Cyperaceae - Sedge Family	N	NA	PG
Eleocharis palustris		Spike-rush	Cyperaceae - Sedge Family	N	NA	PG
Scirpus pallidus		Bulrush	Cyperaceae - Sedge Family	N	NA	PG
Juncus arcticus		Rush	Juncaceae - Rush Family	N	NA	PG
Juncus balticus		Baltic rush	Juncaceae - Rush Family	N	NA	PG
Juncus effusus		Rush	Juncaceae - Rush Family	N	NA	PG
Juncus longistylis		Rush	Juncaceae - Rush Family	N	NA	PG
Juncus tenuis		Rush	Juncaceae - Rush Family	N	NA	PG
Juncus torreyi		Torrey's rush	Juncaceae - Rush Family	N	NA	PG
Marrubium vulgare		Horehound	Lamiaceae - Mint Family	I	NA	PF
Mentha arvensis		Fieldmint	Lamiaceae - Mint Family	N	NA	PF
Epilobium cilatum		Willow herb	Onagraceae - Evening-primrose Family	N	NA	PF
Oenothera villosa		Common evening-primrose	Onagraceae - Evening-primrose Family	N	NA	PF
Andropogon gerardii		Big bluestem	Poaceae - Grass Family	N	W	PG
Anisantha tectorum	*Bromus tectorum*	Cheatgrass	Poaceae - Grass Family	I	C	AG
Critesion jubatum	*Hordeum jubatum*	Foxtail barley	Poaceae - Grass Family	N	C	PG
Koeleria macrantha	*Koeleria pyramidata*	Junegrass	Poaceae - Grass Family	N	C	PG
Pascopyrum smithii	*Agropyron smithii*	Western wheatgrass	Poaceae - Grass Family	N	C	PG
Poa compressa		Canada bluegrass	Poaceae - Grass Family	I	C	PG
Poa pratensis		Kentucky bluegrass	Poaceae - Grass Family	I	C	PG
Polypogon monspeliensis		Rabbitfoot grass	Poaceae - Grass Family	I	W	AG
Schizachyrium scoparium	*Andropogon scoparius*	Little bluestem	Poaceae - Grass Family	N	W	PG
Geum aleppicum		Yellow avens	Rosaceae - Rose Family	N	NA	PF
Padus virginiana subsp. *melanocarpa*	*Prunus virginiana*	Chokecherry	Rosaceae - Rose Family	N	NA	S
Galium aparine		Catchweed bedstraw	Rubiaceae - Madder Family	I	NA	AF
Populus angustifolia		Narrowleaf cottonwood	Salicaceae - Willow Family	N	NA	T
Salix amygdaloides		Peach-leaf willow	Salicaceae - Willow Family	N	NA	T
Salix exigua		Sandbar willow	Salicaceae - Willow Family	N	NA	S
Veronica peregrina		Purslane speedwell	Scropulariaceae - Figwort Family	N	NA	AF
Typha latifolia		Common cattail	Typhaceae - Cattail Family	N	NA	PF
Typha angustifolia		Narrow-leaved cattail	Typhaceae - Cattail Family	N	NA	PF

Table 6. Riparian Fringe Wetland

Plant Species List NREL National Wind Technology Center						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Lomatium orientale		Lomatium	Apiaceae - Parsley Family	N	NA	PF
Asclepias speciosa		Showy milkweed	Asclepiadaceae - Milkweed Family	N	NA	PF
Achillea lanulosa		Yarrow	Asteraceae - Sunflower Family	N	NA	PF
Acosta diffusa	*Centaurea diffusa*	Diffuse knapweed	Asteraceae - Sunflower Family	I	NA	BF/PF
Ambrosia psilostachya		Western ragweed	Asteraceae - Sunflower Family	N	NA	PF
Ambrosia trifida		Giant ragweed	Asteraceae – Sunflower Family	I	NA	AF
Arnica fulgens		Arnica	Asteraceae - Sunflower Family	N	NA	PF
Artemisia ludoviciana	*Populus deltoides*	Prairie sagewort	Asteraceae - Sunflower Family	N	NA	PF
Aster ericoides		White aster	Asteraceae - Sunflower Family	N	NA	PF
Breea arvensis	*Cirsium arvense*	Canada thistle	Asteraceae - Sunflower Family	I	NA	PF
Brickellia eupatorioides		Brickellia	Asteraceae - Sunflower Family	N	NA	PF
Carduus nutans		Musk thistle	Asteraceae - Sunflower Family	I	NA	BF
Cichorium intybus		Chicory	Asteraceae - Sunflower Family	I	NA	PF
Conyza canadensis		Horseweed	Asteraceae – Sunflower Family	N	NA	AF
Erigeron divergens		Spreading fleabane	Asteraceae - Sunflower Family	N	NA	BF
Gaillardia aristata		Blanketflower	Asteraceae - Sunflower Family	N	NA	PF
Grindelia squarrosa		Curlycup gumweed	Asteraceae – Sunflower Family	N	NA	BF
Helianthus annuus		Common sunflower	Asteraceae – Sunflower Family	N	NA	AF
Heterotheca villosa	*Chrysopsis villosa*	Hairy golden aster	Asteraceae – Sunflower Family	N	NA	SS
Lactuca serriola		Prickly lettuce	Asteraceae - Sunflower Family	I	NA	BF
Liatris punctata		Dotted gayfeather	Asteraceae - Sunflower Family	N	NA	PF
Onopordum acanthium		Scotch thistle	Asteraceae - Sunflower Family	I	NA	BF
Ratibida columnifera		Prairie coneflower	Asteraceae – Sunflower Family	N	NA	PF
Senecio crassulus		Butterweed	Asteraceae - Sunflower Family	N	NA	PF
Senecio integerrimus		Grounsel	Asteraceae - Sunflower Family	N	NA	BF/PF
Solidago missouriensis		Prairie goldenrod	Asteraceae - Sunflower Family	N	NA	PF
Tragopogon dubius		Goatsbeard	Asteraceae - Sunflower Family	I	NA	BF
Cynoglossum officinale		Houndstongue	Boraginaceae - Borage Family	I	NA	BF
Nasturtium officinale		Watercress	Brassicaceae - Mustard Family	I	NA	PF
Alyssum minus		Alyssum	Brassicaceae – Mustard Family	I	NA	AF
Neolepia campestre	*Lepidium campestre*	Fieldcress	Brassicaceae - Mustard Family	I	NA	BF
Noccaea montana		Wild candytuft	Brassicaceae - Mustard Family	N	NA	AF
Rorippa sinuata		Spreading yellowcress	Brassicaceae - Mustard Family	N	NA	PF
Sisymbrium altissimum		Tall tumblemustard	Brassicaceae - Mustard Family	I	NA	AF
Thlaspi arvense		Field pennycress (Fanweed)	Brassicaceae - Mustard Family	I	NA	AF
Opuntia macrorhiza		Plains prickly pear	Cactaceae - Cactus Family	N	NA	SU
Campanula rotundifolia		Common harebell	Campanulaceae - Bellflower Family	N	NA	PF
Lobelia siphilitica		Blue cardinal flower	Campanulaceae - Bellflower Family	N	NA	PF
Symphoricarpos occidentalis		Western snowberry	Caprifoliaceae - Honeysuckle Family	N	NA	S
Saponaria officinalis		Bouncing Bet	Caryophyllaceae - Pink Family	I	NA	PF

Table 6. Riparian Fringe Wetland

Plant Species List NREL National Wind Technology Center						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Bassia sieversiana	*Kochia scoparia*	Kochia	Chenopodiaceae – Goosefoot Family	I	NA	AF
Chenopodium album		Common lambsquarters	Chenopodiaceae – Goodefoot Family	I	NA	AF
Tradescantia occidentalis		Spiderwort	Commelinaceae - Spiderwort Family	N	NA	PF
Maianthemum stellatum	*Smilacina stellata*	False solomon's seal	Convallariaceae - Mayflower Family	N	NA	PF
Convolvulus arvensis		Field bindweed	Convolvulaceae - Morning Glory Family	I	NA	PF
Carex hystricina		Sedge	Cyperaceae - Sedge Family	N	NA	PG
Carex languinosa		Sedge	Cyperaceae - Sedge Family	N	NA	PG
Carex nebrascensis		Nebraska sedge	Cyperaceae - Sedge Family	N	NA	PG
Carex utriculata	*Carex rostrata*	Sedge	Cyperaceae - Sedge Family	N	NA	PG
Eleocharis palustris		Spike-rush	Cyperaceae - Sedge Family	N	NA	PG
Dalea purpurea	*Petalostemon purpurea*	Purple prairie clover	Fabaceae - Pea Family	N	NA	PF
Glycyrrhiza lepidota		American licorice	Fabaceae - Pea Family	N	NA	PF
Lupinus argenteus		Silver lupine	Fabaceae - Pea Family	N	NA	PF
Medicago sativa		Alfalfa	Fabaceae - Pea Family	I	NA	PF
Melilotus officinalis		Yellow sweetclover	Fabaceae - Pea Family	I	NA	BF
Psoralidium tenuiflora		Slimflower scurfpea	Fabaceae - Pea Family	N	NA	PF
Thermopsis rhombifolia		Prairie goldenpea	Fabaceae - Pea Family	N	NA	PF
Ribes aureum		Golden current	Grossulariaceae - Current Family	N	NA	S
Phacelia heterophylla	*Phacelia hastata*	Scorpionweed	Hydrophyllaceae - Waterleaf Family	N	NA	PF
Hypericum perforatum		St. Johnswort	Hypericaceae - St. Johnswort family	I	NA	PF
Iris missouriensis		Wild iris	Iridaceae - Iris Family	N	NA	PF
Juncus nodosus		Knotted rush	Juncaceae - Rush Family	N	NA	PG
Carex simulata		Rush	Juncaceae - Rush Family	N	NA	PG
Juncus articulates		Rush	Juncaceae - Rush Family	N	NA	PG
Juncus balticus		Baltic rush	Juncaceae - Rush Family	N	NA	PG
Juncus bufonius		Toad rush	Juncaceae - Rush Family	N	NA	AG
Juncus effusus		Rush	Juncaceae - Rush Family	N	NA	PG
Juncus ensifolius		Rush	Juncaceae - Rush Family	N	NA	PG
Juncus longistylis		Rush	Juncaceae - Rush Family	N	NA	PG
Juncus sp.		Rush	Juncaceae - Rush Family	N	NA	PG
Marrubium vulgare		Horehound	Lamiaceae - Mint Family	I	NA	PF
Mentha arvensis		Fieldmint	Lamiaceae - Mint Family	N	NA	PF
Monarda fistulosa		Bee balm	Lamiaceae - Mint Family	N	NA	PF
Nepeta cataria		Catnip	Lamiaceae - Mint Family	I	NA	PF
Lemna turionifera		Duckweed	Lemnaceae - Duckweed Family	N	NA	PF
Calylophus serrulatus		Shrubby evening-primrose	Onagraceae - Evening-primrose Family	N	NA	SS
Epilobium cilatum		Willow herb	Onagraceae - Evening-primrose Family	N	NA	PF

Table 6. Riparian Fringe Wetland

Plant Species List NREL National Wind Technology Center						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Gaura parviflora		Smallflower gaura	Onagraceae - Evening-primrose Family	N	NA	AF
Oenothera villosa		Common evening-primrose	Onagraceae - Evening-primrose Family	N	NA	PF
Oxalis dillenii		Woodsorrel	Oxalidaceae - Woodsorrel Family	N	NA	PF
Argemone polyanthemos		Prickly poppy	Papaveracae - Poppy Family	N	NA	PF
Pinus ponderosa		Ponderosa pine	Pinaceae - Pine Family	N	NA	T
Plantago lanceolata		English plantain	Plantaginaceae - Plantain Family	I	NA	PF
Plantago major		Common plantain	Plantaginaceae - Plantain Family	I	NA	PF
Agropyron cristatum		Crested wheatgrass	Poaceae - Grass Family	I	C	PG
Agrostis gigantea	*Agrostis alba*	Redtop	Poaceae - Grass Family	I	C	PG
Agrostis scabra		Ticklegrass	Poaceae - Grass Family	N	W	PF
Andropogon gerardii		Big bluestem	Poaceae - Grass Family	N	W	PG
Anisantha tectorum	*Bromus tectorum*	Cheatgrass	Poaceae - Grass Family	I	C	AG
Bromopis inermis	*Bromus inermis*	Smooth bromegrass	Poaceae - Grass Family	I	C	PG
Buchloë dactyloides		Buffalograss	Poaceae - Grass Family	N	W	PG
Critesion jubatum	*Hordeum jubatum*	Foxtail barley	Poaceae - Grass Family	N	C	PG
Dactylis glomerata		Orchard grass	Poaceae - Grass Family	I	C	PG
Danthonia spicata		Poverty oatgrass	Poaceae - Grass Family	N	C	PG
Elymus trachycaulus	*Agropyron caninum*	Slender wheatgrass	Poaceae - Grass Family	N	C	PG
Festuca pratensis		Meadow fescue	Poaceae - Grass Family	I	C	PG
Glyceria grandis		Tall mannagrass	Poaceae - Grass Family	N	W	PG
Glyceria striata		Fowl mannagrass	Poaceae - Grass Family	N	W	PG
Hesperostipa comata	*Stipa comata*	Needle-and-thread	Poaceae - Grass Family	N	C	PG
Koeleria macrantha	*Koeleria pyramidata*	Junegrass	Poaceae – Grass Family	N	C	PG
Lophopyrum elongatum	*Agropyron elongatum*	Tall wheatgrass	Poaceae - Grass Family	I	C	PG
Muhlenbergia filiformis		Pull-up muhly	Poaceae - Grass Family	N	W	AG
Muhlenbergia montana		Mountain muhly	Poaceae - Grass Family	N	W	PG
Panicum virgatum		Switchgrass	Poaceae - Grass Family	N	W	PG
Elymus canadensis		Canada wild rye	Poaceae - Grass Family	N	C	PG
Pascopyrum smithii	*Agropyron smithii*	Western wheatgrass	Poaceae - Grass Family	N	C	PG
Phleum pratense		Common Timothy	Poaceae - Grass Family	I	C	PG
Poa compressa		Canada bluegrass	Poaceae - Grass Family	I	C	PG
Poa fendleriana		Muttongrass	Poaceae - Grass Family	N	C	PG
Poa pratensis		Kentucky bluegrass	Poaceae - Grass Family	I	C	PG
Schizachyrium scoparium	*Andropogon scoparius*	Little bluestem	Poaceae - Grass Family	N	W	PG
Sorghastrum nutans		Indian-grass	Poaceae - Grass Family	N	W	PG
Spartina pectinata		Prairie cordgrass	Poaceae - Grass Family	N	W	PG
Sporobolus airoides		Alkaline sacatone	Poaceae - Grass Family	N	W	PG
Sporobolus cryptandrus		Sand dropseed	Poaceae - Grass Family	N	W	PG

Table 6. Riparian Fringe Wetland

Plant Species List NREL National Wind Technology Center						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Rumex crispus		Curly dock	Polygonaceae - Buckwheat Family	N	NA	PF
Clematis ligusticifolia		Virgin's bower	Ranunculaceae - Buttercup Family	N	NA	V
Agrimonia striata		Agripmony	Rosaceae - Rose Family	N	NA	PF
Geum macrophyllum		Large-leaved avens	Rosaceae - Rose Family	N	NA	PF
Padus virginiana	*Prunus virginiana*	Chokecherry	Rosaceae - Rose Family	N	NA	S
Potentilla hippiana		Wooly cinquefoil	Rosaceae - Rose Family	N	NA	PF
Potentilla recta		Sulfur cinquefoil	Rosaceae - Rose Family	I	NA	PF
Rosa sayi	*Rosa acicularis*	Prickly wild rose	Rosaceae - Rose Family	N	NA	S
Galium aparine		Catchweed bedstraw	Rubiaceae - Madder Family	I	NA	AF
Populus deltoides		Plains cottonwood	Salicaceae - Willow Family	N	NA	T
Salix alba var. vitellina		Golden osier	Salicaceae - Willow Family	I	NA	T
Salix amygdaloides		Peach-leaf willow	Salicaceae - Willow Family	N	NA	T
Salix exigua		Sandbar willow	Salicaceae - Willow Family	N	NA	S
Salix fragilis		Crack willow	Salicaceae - Willow Family	I	NA	T
Verbascum blattaria		Moth mullein	Scrophulariaceae - Figwort Family	I	NA	BF
Verbascum thapsus		Common mullein	Scrophulariaceae - Figwort Family	I	NA	BF
Mimulus glabratus		Monkeflower	Scropulariaceae - Figwort Family	N	NA	PF
Veronica peregrina		Purslane speedwell	Scropulariaceae - Figwort Family	N	NA	AF
Typha angustifolia		Narrow-leaved cattail	Typhaceae - Cattail Family	N	NA	PF
Typha latifolia		Common cattail	Typhaceae - Cattail Family	N	NA	PF

Table 7. Groundwater Seep Wetland

Plant Species List NREL National Wind Technology Center						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Apocynum cannabinum		Indian hemp	Apocynaceae - Dogbane Family	N	NA	PF
Asclepias speciosa		Showy milkweed	Asclepiadaceae - Milkweed Family	N	NA	PF
Arnica fulgens		Arnica	Asteraceae - Sunflower Family	N	NA	PF
Acosta diffusa	*Centaurea diffusa*	Diffuse knapweed	Asteraceae - Sunflower Family	I	NA	BF/PF
Aster adscendens	*Aster chilensis*	Aster	Asteraceae - Sunflower Family	N	NA	PF
Breea arvensis	*Cirsium arvense*	Canada thistle	Asteraceae - Sunflower Family	I	NA	PF
Carduus nutans		Musk thistle	Asteraceae - Sunflower Family	I	NA	BF
Helianthus annuus		Common sunflower	Asteraceae - Sunflower Family	N	NA	AF
Solidago serotinoides		Goldenrod	Asteraceae - Sunflower Family	N	NA	PF
Xanthium strumarium		Cocklebur	Asteraceae - Sunflower Family	I	NA	AF
Cynoglossum officinale		Houndstongue	Boraginaceae - Borage Family	I	NA	BF
Symphoricarpos occidentalis		Western snowberry	Caprifoliaceae - Honeysuckle Family	N	NA	S
Bassia sieversiana	*Kochia scoparia*	Kochia	Chenopodiaceae - Goosefoot Family	I	NA	AF
Carex languinosa		Sedge	Cyperaceae - Sedge Family	N	NA	PG
Carex nebrascensis		Nebraska sedge	Cyperaceae - Sedge Family	N	NA	PG
Carex utriculata	*Carex rostrata*	Sedge	Cyperaceae - Sedge Family	N	NA	PG
Dipsacus fullonum	*Dipsacus sylvestris*	Common teasel	Dipsacaceae - Teasel Family	I	NA	BF
Hippochaete laevigata	*Equisetum laevigatum*	Smooth scouring rush	Equisetaceae - Horsetail Family	N	NA	AF
Amorpha fruticosa		False indigo	Fabaceae - Pea Family	N	NA	S
Glycyrrhiza lepidota		American licorice	Fabaceae - Pea Family	N	NA	PF
Melilotus albus		White sweetclover	Fabaceae - Pea Family	I	NA	BF
Melilotus officinalis		Yellow sweetclover	Fabaceae - Pea Family	I	NA	BF
Hypericum perforatum		St. Johnswort	Hypericaceae - St. Johnswort family	I	NA	PF
Iris missouriensis		Wild iris	Iridaceae - Iris Family	N	NA	PF
Juncus balticus		Baltic rush	Juncaceae - Rush Family	N	NA	PG
Juncus effusus		Rush	Juncaceae - Rush Family	N	NA	PG
Marrubium vulgare		Horehound	Lamiaceae - Mint Family	I	NA	PF
Mentha arvensis		Fieldmint	Lamiaceae - Mint Family	N	NA	PF
Oenothera villosa		Common evening-primrose	Onagraceae - Evening-primrose Family	N	NA	PF
Plantago lanceolata		English plantain	Plantaginaceae - Plantain Family	I	NA	PF
Agrostis gigantea	*Agrostis alba*	Redtop	Poaceae - Grass Family	I	C	PG
Bromopis inermis	*Bromus inermis*	Smooth bromegrass	Poaceae - Grass Family	I	C	PG
Critesion jubatum	*Hordeum jubatum*	Foxtail barley	Poaceae - Grass Family	N	C	PG
Dactylis glomerata		Orchard grass	Poaceae - Grass Family	I	C	PG
Nasselaa viridula	*Stipa viridula*	Green needlegrass	Poaceae - Grass Family	N	C	PG
Panicum capillare		Witchgrass	Poaceae - Grass Family	N	W	AG
Panicum virgatum		Switchgrass	Poaceae - Grass Family	N	W	PG
Pascopyrum smithii	*Agropyron smithii*	Western wheatgrass	Poaceae - Grass Family	N	C	PG
Poa compressa		Canada bluegrass	Poaceae - Grass Family	I	C	PG
Poa pratensis		Kentucky bluegrass	Poaceae - Grass Family	I	C	PG
Spartina pectinata		Prairie cordgrass	Poaceae - Grass Family	N	W	PG

Table 7. Groundwater Seep Wetland

Plant Species List NREL National Wind Technology Center						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Geum macrophyllum		Large-leaved avens	Rosaceae - Rose Family	N	NA	PF
Prunus americana		Wild plum	Rosaceae - Rose Family	N	NA	S
Rosa sayi	*Rosa acicularis*	Prickly wild rose	Rosaceae - Rose Family	N	NA	S
Rosa woodsii		Woods rose	Rosaceae - Rose Family	N	NA	S
Salix exigua		Sandbar willow	Salicaceae - Willow Family	N	NA	S
Verbascum blattaria		Moth mullein	Scrophulariaceae - Figwort Family	I	NA	BF
Verbascum thapsus		Common mullein	Scrophulariaceae - Figwort Family	I	NA	BF
Typha angustifolia		Narrow-leaved cattail	Typhaceae - Cattail Family	N	NA	PF
Typha latifolia		Common cattail	Typhaceae - Cattail Family	N	NA	PF

Table 8. Seasonal Pond

Plant Species List NREL National Wind Technology Center						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Achillea lanulosa		Yarrow	Asteraceae - Sunflower Family	N	NA	PF
Acosta diffusa	*Centaurea diffusa*	Diffuse knapweed	Asteraceae – Sunflower Family	I	NA	BF/PF
Ambrosia psilostachya		Western ragweed	Asteraceae - Sunflower Family	N	NA	PF
Aster porteri		White aster	Asteraceae - Sunflower Family	N	NA	PF
Breea arvensis	*Cirsium arvense*	Canada thistle	Asteraceae - Sunflower Family	I	NA	PF
Conyza canadensis		Horseweed	Asteraceae – Sunflower Family	N	NA	AF
Erigeron divergens		Spreading fleabane	Asteraceae – Sunflower Family	N	NA	BF
Grindelia squarrosa		Curlycup gumweed	Asteraceae – Sunflower Family	N	NA	BF
Helianthus annuus		Common sunflower	Asteraceae – Sunflower Family	N	NA	AF
Lactuca serriola		Prickly lettuce	Asteraceae – Sunflower Family	I	NA	BF
Oligosporus campestris	*Artemisia campestris*	Western sagewort	Asteraceae – Sunflower Family	N	NA	BF
Xanthium strumarium		Cocklebur	Asteraceae – Sunflower Family	I	NA	AF
Alyssum minus		Alyssum	Brassicaceae – Mustard Family	I	NA	AF
Descurainia sp.		Tansy mustard	Brassicaceae – Mustard Family	I	NA	AF/BF
Neolepia campestre	*Lepidium campestre*	Fieldcress	Brassicaceae – Mustard Family	I	NA	BF
Sisymbrium altissimum		Tumbling mustard	Brassicaceae – Mustard Family	I	NA	AF
Thlaspi arvense		Fanweed	Brassicaceae – Mustard Family	I	NA	AF
Calochortus gunnisonii		Mariposa lily	Calochortaceae – Mariposa Family	N	NA	PF
Carex nebrascensis		Nebraska sedge	Cyperaceae – Sedge Family	N	NA	PG
Carex utriculata	*Carex rostrata*	Sedge	Cyperaceae – Sedge Family	N	NA	PG
Eleocharis palustris		Spike-rush	Cyperaceae – Sedge Family	N	NA	PG
Dalea purpurea	*Petalostemon purpurea*	Purple prairie clover	Fabaceae – Pea Family	N	NA	PF
Glycyrrhiza lepidota		American licorice	Fabaceae – Pea Family	N	NA	PF
Erodium cicutarium		Filaree	Geraniaceae – Geranium Family	I	NA	AF
Juncus balticus		Baltic rush	Juncaceae – Rush Family	N	NA	PG
Juncus effusus		Rush	Juncaceae – Rush Family	N	NA	PG
Agropyron cristatum		Crested wheatgrass	Poaceae – Grass Family	I	C	PG
Anisantha tectorum	*Bromus tectorum*	Cheatgrass	Poaceae – Grass Family	I	C	AG
Bromopsis inermis	*Bromus inermis*	Smooth brome	Poaceae – Grass Family	I	C	PG
Critesion jubatum	*Hordeum jubatum*	Foxtail barley	Poaceae – Grass Family	N	C	PG
Distichlis spicata		Salt-grass	Poaceae – Grass Family	N	W	PG
Koeleria macrantha	*Koeleria pyramidata*	Junegrass	Poaceae – Grass Family	N	C	PG
Pascopyrum smithii	*Agropyron smithii*	Western wheatgrass	Poaceae – Grass Family	N	C	PG
Poa compressa		Canada bluegrass	Poaceae – Grass Family	I	C	PG
Poa pratensis		Kentucky bluegrass	Poaceae – Grass Family	I	C	PG
Persicaria 21aculate	*Polygonum persicaria*	Lady's thumb	Polygonaceae – Buckwheat Family	I	NA	AF
Persicaria pennsylvanica	*Polygonum pennsylcanicum*	Pennsylvania smartweed	Polygonaceae – Buckwheat Family	N	NA	PF
Rumex crispus		Curly dock	Polygonaceae – Buckwheat Family	N	NA	PF
Agrimonia striata		Agrimony	Rosaceae - Rose Family	N	NA	PF

Table 8. Seasonal Pond

Plant Species List NREL National Wind Technology Center						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Verbascum blattaria		Moth mullein	Scrophulariaceae - Figwort Family	I	NA	BF
Typha angustifolia		Narrow-leaved cattail	Typhaceae - Cattail Family	N	NA	PF
Typha latifolia		Common cattail	Typhaceae - Cattail Family	N	NA	PF

Table 9. Disturbed

Plant Species List NREL National Wind Technology Center						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Yucca glauca		Yucca	Agavaceae - Agave Family	N	NA	SU
Paronychia jamesii		James' nailwort	Alsinaceae - Chickweed Family	N	NA	PF
Amaranthus retroflexus		Redroot pigweed	Amaranthaceae - Amaranth Family	I	NA	AF
Lomatium orientale		Lomatium	Apiaceae - Parsley Family	N	NA	PF
Apocynum cannabinum		Indian hemp	Apocynaceae - Dogbane Family	N	NA	PF
Asclepias speciosa		Showy milkweed	Asclepiadaceae - Milkweed Family	N	NA	PF
Achillea lanulosa		Yarrow	Asteraceae - Sunflower Family	N	NA	PF
Acosta diffusa	*Centaurea diffusa*	Diffuse knapweed	Asteraceae - Sunflower Family	I	NA	BF/PF
Ambrosia psilostachya		Western ragweed	Asteraceae - Sunflower Family	N	NA	PF
Artemisia frigida		Fringed sagebrush	Asteraceae - Sunflower Family	N	NA	SS
Artemisia ludoviciana		Prairie sagewort	Asteraceae - Sunflower Family	N	NA	PF
Aster ericoides		White aster	Asteraceae - Sunflower Family	N	NA	PF
Breea arvensis	*Cirsium arvense*	Canada thistle	Asteraceae - Sunflower Family	I	NA	PF
Carduus nutans		Musk thistle	Asteraceae - Sunflower Family	I	NA	BF
Centaurea maculosa		Spotted knapweed	Asteraceae - Sunflower Family	I	NA	PF
Cichorium intybus		Chicory	Asteraceae - Sunflower Family	I	NA	PF
Conyza canadensis		Horseweed	Asteraceae - Sunflower Family	N	NA	AF
Dyssodia papposa		Fetid marigold	Asteraceae - Sunflower Family	N	NA	PF
Erigeron divergens		Spreading fleabane	Asteraceae - Sunflower Family	N	NA	BF
Grindelia squarrosa		Curlycup gumweed	Asteraceae - Sunflower Family	N	NA	BF
Gutierrezia sarothrae		Broom snakeweed	Asteraceae - Sunflower Family	N	NA	SS
Helianthus annuus		Common sunflower	Asteraceae - Sunflower Family	N	NA	AF
Lactuca serriola		Prickly lettuce	Asteraceae - Sunflower Family	I	NA	BF
Liatris punctata		Dotted gayfeather	Asteraceae - Sunflower Family	N	NA	PF
Ratibida columnifera		Prairie coneflower	Asteraceae - Sunflower Family	N	NA	PF
Solidago spathulata		Goldenrod	Asteraceae - Sunflower Family	N	NA	PF
Sonchus arvensis		Field sow thistle	Asteraceae - Sunflower Family	I	NA	PF
Taraxacum officinale		Common dandelion	Asteraceae - Sunflower Family	I	NA	PF
Xanthium strumarium		Cocklebur	Asteraceae - Sunflower Family	I	NA	AF
Lithospermum incisum		Narrowleaf gromwell	Boraginaceae - Borage Family	N	NA	PF
Alyssum alyssoides		Pale alyssum	Brassicaceae - Mustard Family	I	NA	AF
Cardaria draba		Whitetop	Brassicaceae - Mustard Family	I	NA	PF
Sisymbrium altissimum		Tumbling mustard	Brassicaceae - Mustard Family	I	NA	AF
Bassia sieversiana	*Kochia scoparia*	Kochia	Chenopodiaceae - Goosefoot Family	I	NA	AF
Chenopodium murale		Nettleleaf goosefoot	Chenopodiaceae - Goosefoot Family	I	NA	AF
Kochia scoparia	*Bassia sieversiana*	Summer cypress	Chenopodiaceae - Goosefoot Family	I	NA	AF
Salsola australis	*Salsola iberica*	Russian-thistle	Chenopodiaceae - Goosefoot Family	I	NA	AF
Salsola iberica		Russian-thistle	Chenopodiaceae - Goosefoot Family	I	NA	AF
Teloxys botrys		Woordseed	Chenopodiaceae - Goosefoot Family	I	NA	AF
Convolvulus arvensis		Field bindweed	Convolvulaceae - Morning Glory Family	I	NA	PF
Carex brevior		Sedge	Cyperaceae - Sedge Family	N	NA	PG
Chamaesyce	*Euphorbia*	Ridgeseed spurge	Euphorbiaceae - Spurge Family	I	NA	AF

Table 9. Disturbed

Plant Species List NREL National Wind Technology Center						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
glyptosperma	*glyptosperma*					
Euphorbia esula		Leafy spurge	Euphorbiaceae - Spurge Family	I	NA	PF
Tithymalus brachyceras		Spurge	Euphorbiaceae - Spurge Family	N	NA	PF
Astragalus cicer		Cicer milkvetch	Fabaceae - Pea Family	I	NA	PF
Medicago sativa		Alfalfa	Fabaceae - Pea Family	I	NA	PF
Melilotus albus		White sweetclover	Fabaceae - Pea Family	I	NA	BF
Melilotus officinalis		Yellow sweetclover	Fabaceae - Pea Family	I	NA	BF
Oxytropis lambertii		Lambert locoweed	Fabaceae - Pea Family	N	NA	PF
Psoralidium tenuiflora		Slimflower scurfpea	Fabaceae - Pea Family	N	NA	PF
Trifolium pratense		Red clover	Fabaceae - Pea Family	I	NA	PF
Hypericum perforatum		St. Johnswort	Hypericaceae - St. Johnswort family	I	NA	PF
Juncus longistylis		Rush	Juncaceae - Rush Family	N	NA	PG
Leucocrinum montanum		Sand lily	Liliaceae - Lily Family	N	NA	PF
Linum lewisii		Perennial flax	Linaceaea - Flax Family	N	NA	PF
Calylophus serrulatus		Shrubby evening-primrose	Onagraceae - Evening-primrose Family	N	NA	SS
Gaura parviflora		Smallflower gaura	Onagraceae - Evening-primrose Family	N	NA	AF
Oxalis dillenii		Woodsorrel	Oxalidaceae - Woodsorrel Family	N	NA	PF
Plantago lanceolata		English plantain	Plantaginaceae - Plantain Family	I	NA	PF
Plantago major		Common plantain	Plantaginaceae - Plantain Family	I	NA	PF
Agropyron cristatum		Crested wheatgrass	Poaceae - Grass Family	I	C	PG
Andropogon gerardii		Big bluestem	Poaceae - Grass Family	N	W	PG
Anisantha tectorum	*Bromus tectorum*	Cheatgrass	Poaceae - Grass Family	I	C	AG
Aristida purpurea		Three-awn	Poaceae - Grass Family	N	W	PG
Bouteloua curtipendula		Side-oats grama	Poaceae - Grass Family	N	W	PG
Bromopis inermis	*Bromus inermis*	Smooth bromegrass	Poaceae - Grass Family	I	C	PG
Buchloë dactyloides		Buffalograss	Poaceae - Grass Family	N	W	PG
Chondrosum gracile	*Bouteloua gracilis*	Blue grama	Poaceae - Grass Family	N	W	PG
Critesion jubatum	*Hordeum jubatum*	Foxtail barley	Poaceae - Grass Family	N	C	PG
Dactylis glomerata		Orchard grass	Poaceae - Grass Family	I	C	PG
Echinochloa crusgalli		Barnyard grass	Poaceae - Grass Family	I	W	AG
Elymus elymoides	*Sitanion hystrix*	Bottletail squirreltail	Poaceae - Grass Family	N	C	PG
Elymus trachycaulus	*Agropyron caninum*	Slender wheatgrass	Poaceae - Grass Family	N	C	PG
Elytrigia dasystachyum	*Agropyron dasystachyum*	Thickspike wheatgrass	Poaceae - Grass Family	N	C	PG
Eragrostis cilianensis		Stinkgrass	Poaceae - Grass Family	I	W	AG
Festuca ovina		Sheep fescue	Poaceae - Grass Family	N	C	PG
Hesperostipa comata	*Stipa comata*	Needle-and-thread	Poaceae - Grass Family	N	C	PG
Koeleria macrantha	*Koeleria pyramidata*	Junegrass	Poaceae - Grass Family	N	C	PG
Lophopyrum elongatum	*Agropyron elongatum*	Tall wheatgrass	Poaceae - Grass Family	I	C	PG
Muhlenbergia montana		Mountain muhly	Poaceae - Grass Family	N	W	PG
Panicum capillare		Witchgrass	Poaceae - Grass Family	N	W	AG
Panicum virgatum		Switchgrass	Poaceae - Grass Family	N	W	PG

Table 9. Disturbed

Plant Species List NREL National Wind Technology Center						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Pascopyrum smithii	*Agropyron smithii*	Western wheatgrass	Poaceae - Grass Family	N	C	PG
Poa compressa		Canada bluegrass	Poaceae - Grass Family	I	C	PG
Poa fendleriana		Muttongrass	Poaceae - Grass Family	N	C	PG
Poa pratensis		Kentucky bluegrass	Poaceae - Grass Family	I	C	PG
Schizachyrium scoparium	*Andropogon scoparius*	Little bluestem	Poaceae - Grass Family	N	W	PG
Setaria viridis		Green floxtail	Poaceae - Grass Family	I	W	AG
Sporobolus cryptandrus		Sand dropseed	Poaceae - Grass Family	N	W	PG
Thinopyrum intermedium	*Agropyrum intermedium*	Intermediate wheatgrass	Poaceae – Grass Family	I	C	PG
Triticum aestivum		Wheat	Poaceae - Grass Family	I	C	AG
Rumex crispus		Curly dock	Polygonaceae – Buckwheat Family	N	NA	PF
Potentilla hippiana		Wooly cinquefoil	Rosaceae - Rose Family	N	NA	P
Rosa arkansana		Prairie rose	Rosaceae - Rose Family	N	NA	S
Commandra umbellata		Bastard-toadflax	Santalaceae - Sandelwood Family	N	NA	PF
Verbascum blattaria		Moth mullein	Scrophulariaceae - Figwort Family	I	NA	BF
Verbascum thapsus		Common mullein	Scrophulariaceae - Figwort Family	I	NA	BF
Leiostemon ambiguum			Scropulariaceae - Figwort Family	N	NA	PF
Physalis virginiana		Virginia ground-cherry	Solanaceae - Nightshade Family	I	NA	PF
Solanum rostratum		Buffalobur	Solanaceae - Nightshade Family	N	NA	AF
Verbena bracteata		Prostrate verbena	Verbebaceae - Verbena Family	N	NA	PF
Viola nuttallii		Yellow prairie violet	Violaceae - Violet Family	N	NA	PF

APPENDIX C

Plant Community and Other Photos

Photo 1. Looking southwest from Row 3 at the xeric mixed grassland community. August 5, 2010.

Photo 2. Looking northwest at the mesic mixed grassland community. The solar array is visible to the northeast. October 21, 2010.

Photo 3. Looking southwest at the ponderosa pine woodland in the distance. August 5, 2010.


Photo 4. Looking south-southwest at the upland shrubland. August 5, 2010.

Photo 5. Looking northwest across PE-2. This area has experienced a general drying trend over the last decade. Dominants in this photo include smooth brome and mullein. Evidence of baltic rush can be found by combing through prior years' vegetation. Baltic rush can persist for years after a disturbance to it's water source. August 5, 2010.

Photo 6. Looking west-northwest at the western end of RF-1 which consists of a shallow swale. August 5, 2010.

Photo 7. West of the ponderosa pine woodlands, looking east at the groundwater seep (GS-1) wetland in the distance. A hawthorn tree at it's south end grows along the property boundary fence. This area no longer supports cattails. May 9, 2011.

Photo 8. Looking at the northwest portion of the groundwater seep (GS-2) in the northeast portion of the site with common teasel in the foreground and cattails in the background. A pond beyond the northern site boundary is visible in the distance. August 5, 2010.

Photo 9. Looking northwest at the seasonal pond west of the ponderosa pine woodland. August 5, 2010.

Other Photos

Photo 10. Looking southwest at an isolated group of hawthorn trees occurring along the western site boundary in the distance. May 9, 2011.

APPENDIX D

Listing of Mammals, Reptiles, Amphibians, and Terrestrial Arthropods Observed During All Surveys Combined

Appendix D. Listing of Mammals, Reptiles, Amphibians, and Terrestrial Arthropods Observed During All Surveys Combined, National Renewable Energy Laboratory National Wind Technology Center, 2010 – 2011

Common Name	Scientific Name	Vegetation Community Code*
Mammals		
Thirteen-lined ground squirrel (burrows only)	*Spermophilus tridecemlineatus*	XMG
Deer Mouse	*Peromyscus maniculatus*	XMG, RFW, XMG/PPW
Mexican Woodrat	*Neotoma mexicana*	XMG/PPW
Prairie Vole	*Microtus ochrogaster*	RFW
Meadow Vole	*Microtus pennsylvanicus*	RFW
Western Harvest Mouse	*Reithrodontomys megalotis*	XMG
Desert cottontail	*Sylvilagus audubonii*	BRS
Masked Shrew	*Sorex cinereus*	RFW
Myotis bats** (from acoustical monitoring report, Appendix E)	*Myotis* sp.	XMG/PPW
Big brown bat (from acoustical monitoring report, Appendix E)	*Eptesicus fuscus*	XMG/PPW
Fringed myotis (from acoustical monitoring report, Appendix E)	*Myotis thysanodes*	XMG/PPW
Silver-haired bat (from acoustical monitoring report, Appendix E)	*Lasionycteris noctivagans*	XMG/PPW
Hoary bat (from acoustical monitoring report, Appendix E)	*Lasiurus cinereus*	XMG/PPW
Eastern red bat (from acoustical monitoring report, Appendix E)	*Lasiurus borealis*	XMG/PPW
Coyote (scat only)	*Canis latrans*	XMG
American elk	*Cervus canadensis*	XMG
Mule deer (beds)	*Odocoileus hemionus*	RFW
Amphibians		
Boreal chorus frog	*Pseudacris maculata*	RFW
Woodhouse's toad (deceased)	*Bufo woodhousii*	XMG
Reptiles		
Bull snake (observed on road during orientation)	*Pituophis catenifer*	XMG
Terrestrial Arthropods		
Checkered white	*Pontia protodice*	RFW
Western white	*Pontia occidentalis*	XMG
Cabbage white	*Pieris rapae*	RFW

Common Name	Scientific Name	Vegetation Community Code*
Orange sulphur	*Colias eurytheme*	XMG
Dainty sulphur	*Nathalis iole*	XMG
Gray hairstreak	*Strymon melinus*	RFW
Aphrodite fritillary	*Speyeria aphrodite*	RFW
Common wood nymph	*Cercyonis pegala*	RFW

*Vegetation community code: XMG= Xeric mixed grassland, RFW=Riparian fringe wWetland, PEW=Palustrine emergent wetland, BRS=Building/road/structure, SP=Seasonal pond, PPW=Ponderosa pine woodland.

**Included in this group may be one or more of the following species: western small-footed myotis, western long-eared myotis, little brown myotis, and long-legged myotis.

APPENDIX E

Bat Acoustical Surveys at the National Renewable Energy Laboratory, National Wind Technology Center, Jefferson County, Colorado, May 6, 2011

Bat Acoustical Surveys at the National Renewable Energy Laboratory, National Wind Technology Center

Jefferson County, Colorado

May 5, 2011

Prepared for

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Prepared by

Walsh
an ecology and environment company

TABLE OF CONTENTS

TABLES

FIGURES

LIST OF ACRONYMS

CDOW	Colorado Division of Wildlife
CF	compact flash
NWTC	NREL's National Wind Technology Center
Mic	microphone
Walsh	Walsh Environmental Scientists and Engineers

EXECUTIVE SUMMARY

An acoustical bat use survey was conducted at the NWTC from July 6, 2010 to November 7, 2010, using a passive acoustical method with AnaBat Systems Bat Detectors (Titley Electronics). The purpose of this survey was to obtain information about use by bats within the Project area.

All data were collected from one bat detector was mounted on a fence post within the conservation easement in the northwest portion of the site. Bat activity was determined by the number of bat passes (number of echolocation calls recorded with ≥ 2 chirps) per detector night. Species composition, temporal distribution (by month), and peak activity levels were analyzed.

A total of 12,425 bat passes was recorded during the survey period for an index of activity of 99.40 bat passes per detector night. Of the 12,425 total bat passes, 8,772 passes could be identified to species (70.18 identified bat passes per detector night).

Species identified included big brown bat, eastern red bat, fringed myotis, hoary bat, silver-haired bat, and Myotis bat group (which may include western small-footed myotis, western long-eared myotis, little brown myotis, and long-legged myotis).

Most bats were detected in July (3,952 total bat passes) and August (5,058 total bat passes). The Myotis bat group was most the most frequently detected (4,373 identified bat passes).

There were no peaks of activity during the monitoring period, but rather constant fluctuation.

No Federally- or state-listed threatened, endangered, or candidate species or species of special concern were identified during surveys (USFWS 2010, CDOW 2010).

INTRODUCTION

Walsh Environmental Scientists and Engineers, LLC (Walsh) was retained by the National Renewable Energy Laboratory (NREL) to conduct acoustic bat surveys at the National Wind Technology Center (NWTC). This effort involved using passive acoustical detectors that recorded bat echolocation calls from July to November 2010. This report presents the results of these surveys.

NWTC is located on approximately 320 acres in Jefferson County, Colorado, on State Highway 128 between the cities of Boulder and Golden, Colorado adjacent to the eastern foothills of the Rocky Mountains. The legal description of the current boundary is: T2N, R70W, portions of Sections 3 and 4.

The site is largely composed of Xeric mixed grassland. The bat monitoring unit was located in a draw within a conservation easement in the western portion of the site. There is a small stand of ponderosa pines directly east of the unit, a small ephemeral pond a few hundred yards south, and a larger, long-lasting pond one-half mile south (Figure 1).

METHODS

Field Work

Bat echolocation calls were recorded from July 6 to November 7, 2010, using an AnaBat SD2 ultrasonic detector from Titley Electronics, Ballina, Australia. One AnaBat detector was installed on a fencepost within the conservation easement at roughly 0.5 meters above the ground. It is recognized that attenuation of bat calls occurs at roughly 30 meters from the unit, indicating that the detector was able to capture calls about 30 meters above the ground.

Data collection methods followed Kunz et al. (2007). Call recording was conducted during crepuscular and nocturnal hours (about one hour before sunset to one hour after sunrise) to capture peak times of bat activity (Reynolds 2006). All files recorded during the survey period were saved to 1 gigabyte compact flash (CF) cards that were collected at two- to three-week intervals and downloaded to a computer using Titley's CF card reader software.

Walsh
Environmental Scientists and Engineers, LLC
an ecology and environment company

- Anabat Location
- NWTC Boundary
- Ponderosa Pine Woodland
- Conservation Area

National Hydrography Dataset
- Artificial Path
- Canal Ditch
- Pipeline
- Intermittent Stream/River
- Perennial Stream/River

1:18,000
0 0.25 0.5 1 Miles
N
1 in = 1,500 feet

Figure 1. AnaBat Detector Location
NREL National Wind Technology Center
Jefferson County, CO
May 3, 2011 | 900758.0001.020

2011\304\1\Projects\900758.0001.010_nrel_nwtc\map_mxd\anabat_location.mxd

Data Management and Analysis

Data gathered from the AnaBat detector were analyzed using Analook software. A preliminary analysis was run to separate extraneous noise files (which may include noise created by weather, radio or microwaves, insects, birds, etc.) from bat echolocation call files. The number of bat calls could then be determined and reported using the metric "bat pass." A bat pass is an accepted measure of bat activity defined as an echolocation sequence of at least two echolocations pulses, or chirps, with a minimum pulse duration of 10 milliseconds within each sequence, separated by more than one second (Gannon et al. 2003, Kunz et al. 2007). Bat call files were further identified and segregated into species groups to show species composition of bats on the site. A number of calculated variables are derived from the bat pass data and are described below.

Bat passes were identified to species or species group when possible, and this subset of bat passes is termed "identified bat pass." Identified bat passes included all bat passes that had five or more clear echolocation calls, or chirps. Myotis bats are a group whose individual species' calls are difficult to distinguish. These calls are therefore lumped as Myotis bats, and may include one or more of the following species known to occur along the Front Range of Colorado: western small-footed myotis (*Myotis ciliolabrum*), western long-eared myotis (*Myotis evotis*), little brown myotis (*Myotis lucifugus*), and long-legged myotis (*Myotis volans*). The fringed myotis (*Myotis thysanodes*) is an exception as its calls are distinct.

An index of relative bat activity, or activity index, was calculated as the number of bat passes per detector night (the number of nights the detector was recording data). Additionally, an activity index was determined per species by using the number of identified bat passes for each species per detector night. Other metrics calculated from the data include temporal distribution of bat activity by month and peak activity.

Two important assumptions are required for these data analyses that may not be completely supported:

> 1) Each bat pass accounts for a single bat recorded only once by the AnaBat detector. One bat pass may actually contain more than one individual bat echolocating, or alternatively, multiple bat passes may be the same bat circling around and echolocating. However, recognition of individuals cannot be determined using AnaBat detectors, so the analysis must be conducted with one bat pass equivalent to one bat.
>
> 2) All species are equally well detected by AnaBat detectors. Different species of bats echolocation calls attenuate at differing distances, with some species of bats whose calls attenuate at shorter distances being recorded less often than those whose calls carry further. For example, Townsend's big-eared bat (*Corynorhinus townsendii*) has a weak call that attenuates quickly and is not as readily detected as many other species (Piaggio 2005). Furthermore, behavioral differences may result in certain species being recorded more often than others. Since there is no appropriate way to correct for these differences, detection equality must be assumed (Gannon et al. 2003).

During data analysis, any special status species, i.e., Federally- or state-listed threatened, endangered, or candidate species, or species of special concern were noted (USFWS 2010, CDOW 2010).

RESULTS

Detector Nights

One AnaBat detector recorded data for 125 detector nights, every night from July 6 to November 7, 2010 (Table 1).

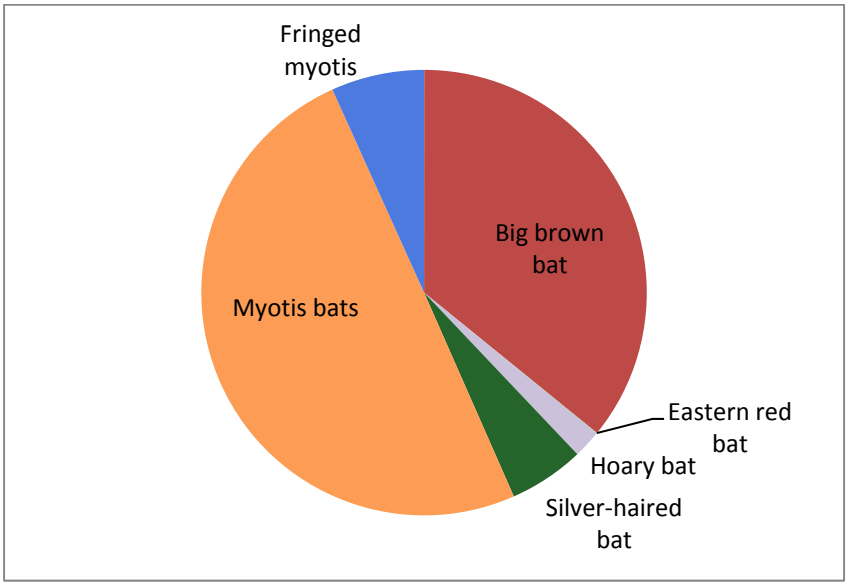
Table 1. Detector Nights, NWTC, Jefferson County, Colorado 2010.

Month	Detector Nights
July	26
August	31
September	30
October	31
November	7
Total	**125**

Bat Passes and Species Composition

A total of 12,425 bat passes were recorded during the survey period. Of those, 8,772 were identified to species. Species composition is summarized in Figure 2 and included 50 percent Myotis bats (*Myotis* sp.) (4,373 identified bat passes), 36 percent big brown bat (*Eptesicus fuscus*) (3,145 passes), 7 percent fringed myotis (592 passes) (*Myotis thysanodes*), 5 percent silver-haired bat (*Lasionycteris noctivagans*) (481 passes), 2 percent hoary bat (*Lasiurus cinereus*) (179 passes), and less than 1 percent eastern red bat (*Lasiurus borealis)* (2 passes).

Figure 2. Bat Species Composition by Identified Bat Passes, NWTC, Jefferson County, Colorado 2010.



Activity Index

There are two indices of bat activity: total bat passes, which includes all echolocation calls with two or more chirps, and identified bat passes, which is limited to those with five or more chirps (see Methods). The overall activity index recorded at the AnaBat detector was 99.40 total bat passes per detector night and 70.18 identified bat passes per detector night (Table 1). The species of bat with the highest activity index is the Myotis bat group (34.98 bat passes per detector night). Big brown bat also had comparatively high levels of activity (25.15 bat passes per detector night). Fringed myotis, silver-haired bat, and hoary bat had comparatively moderate levels of activity, between 1.43 to 4.74 identified bat passes per detector night. Eastern red bat had a comparatively low level of activity (0.02 identified bat passes per detector night) (Table 2).

Table 2. Identified Bat Passes and Index of Activity, NWTC, Jefferson County, Colorado 2010.

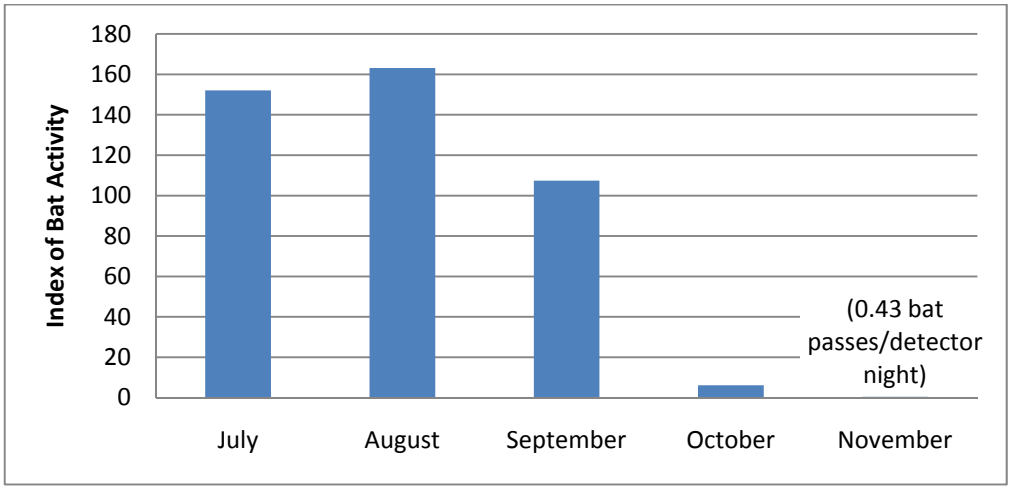
Common Name	Scientific Name	Number Identified	Index of Activity (Number Identified/Detector Nights)
Myotis bats*	*Myotis* sp.	4,373	34.98
Big brown bat	*Eptesicus fuscus*	3,145	25.15
Fringed myotis	*Myotis thysanodes*	592	4.74
Silver-haired bat	*Lasionycteris noctivagans*	481	3.85
Hoary bat	*Lasiurus cinereus*	179	1.43
Eastern red bat	*Lasiurus borealis*	2	0.02
Total Identified Bat Passes		**8,772**	**70.18**
Total Bat Passes		**12,425**	**99.40**

*Included in this group may be one or more of the following species: western small-footed myotis, western long-eared myotis, little brown myotis, and long-legged myotis.

Temporal Distribution

Total bat activity was highest in July (3,952 bat passes) and August (5,058 bat passes) with an activity index of 152.04 and 163.16 total bat passes per detector night, respectively. September was also a month of high bat activity (3,221 bat passes) with an activity indices of 107.37 total bat passes per detector night. October and November had relatively low levels of bat activity (190 and 3 bat passes) with activity indices of 6.13 and 0.43 total bat passes per detector night, respectively (Figure 3, Table 3).

Figure 3. Index of Bat Activity by Month, NWTC, Jefferson County, Colorado 2010.



Note: Index of bat activity is determined by number of bat passes per detector night for that month; detector nights are shown in Table 1.

Identified bat passes were also highest in July (3162) and August (3,299 bat passes) with an activity index of 121.62 and 106.42 identified bat passes per detector night, respectively. Bat activity was moderate in September, lower in October, and very low in November.

Big brown bats, Myotis bats, and hoary bats experienced their highest activity in July and August (Table 3), with hoary bats active at much lower frequencies than the other two species/groups. Fringed myotis were active in July, August and September; silver-haired bats were most active in September but maintained a presence in July and August as well. Eastern red bats had very low activity, though were present in July and August.

Table 3. Temporal Distribution of Bat Activity, NWTC, Jefferson County, Colorado 2010.

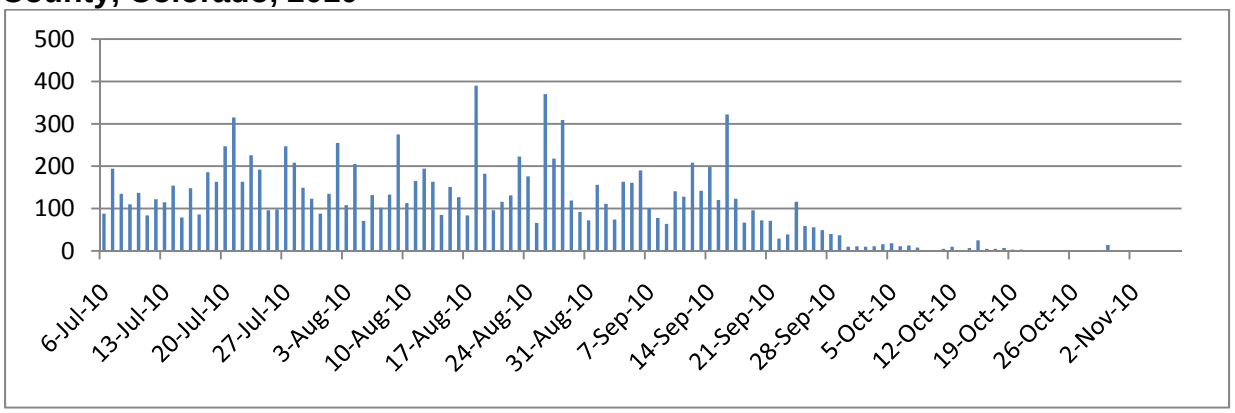
Species	July	Aug	Sept	Oct	Nov
Big brown bat	58.15	39.97	12.37	0.68	0.14
Eastern red bat	0.04	0.03	0.00	0.00	0.00
Fringed myotis	6.38	6.74	7.13	0.10	0.00
Hoary bat	2.53	3.03	0.63	0.00	0.00
Myotis bats	51.19	52.06	46.13	1.42	0.00
Silver-haired bat	3.31	4.55	6.37	1.97	0.29
Total Identified Bat Passes	**121.62**	**106.41**	**72.63**	**4.16**	**0.43**
Total Bat Passes	**152.04**	**163.16**	**107.16**	**6.13**	**0.43**

Note: Bat activity determined by number of identified bat passes per detector night for that month.

Peak Activity Levels

The level of bat activity fluctuates consistently from the beginning of monitoring in July through the end of September, when levels drop off (Figure 4). Although there are no true peaks of activity, which would be indicated by a fairly steady rise to a high point in activity, there are several spikes in activity that can be seen on July 21 (315 bat passes), August 18 (390 bat passes), August 26 (370 bat passes), August 28 (309 bat passes) and September16 (322 bat passes).

Figure 4. Peak Activity Levels, by Total Bat Passes, NWTC, Jefferson County, Colorado, 2010



Special Status Species

No Federally-listed threatened, endangered or candidate bat species listed by the Endangered Species Act are known to occur in Colorado (USFWS 2010). No state-listed threatened or endangered species or species of special concern were identified during surveys (CDOW 2010).

DISCUSSION

Detector Nights

The AnaBat detector ran every night without obvious problems from July 6, 2010 to November 7, 2010.

Bat Passes and Species Composition

The Myotis bat group was the most commonly detected group during monitoring with 4,373 identified bat passes, or nearly half of all identified bats. Since it is very difficult to differentiate echolocation calls of the species in this group, they were not identified to species. The species of Myotis that are known to inhabit this region include western small-footed myotis, western long-eared myotis, little brown myotis, and long-legged myotis. The Myotis group may be made up of any of these species. Since this group was detected throughout July, August, and September, they are most likely resident bats. Big brown bats were the second most commonly detected group with 3,144 identified bat passes. Their presence throughout July, August, and September also shows that they are most likely resident bats.

Of the 18 species of bats documented in Colorado (Armstrong et al. 1994; Fitzgerald et al. 1994), a minimum of 6 species and up to 9 species were identified on site (depending on how many Myotis species are present in the Myotis bat group). Several calls recorded may have been pallid bat calls (*Antrozous pallidus*), but due to the unlikely event that this species would occur along

the foothills, and that aspects of pallid bat calls look very similar to either big brown bats or little brown myotis, these calls were not identified as pallid bats. Although Colorado bat populations and distribution have not been thoroughly studied, these results are consistent with what is generally known about the bat populations within the state (Adams 2003, Armstrong et al. 1994).

Activity Index

Total bat passes for the survey period was 99.40 per detector night. Although data may not be perfectly comparable with monitoring done at wind farms, this level of activity is much higher than what has been found for projects in this and other regions of the U.S (Table 4). It is not known why the levels of activity on this site are so high. Several hypotheses include:

1) The Ponderosa pines, shrubs, and grasses in the draw where the AnaBat unit was located provide good foraging for bats, as well as potential roosting sites in the trees;

2) The large pond on the Lafarge mining property (Spicer) 0.5 mile to the south of the AnaBat unit is the best quality and closest water source to bat roosts, and this water source is available through the summer, when smaller water sources will become dry;

3) The rocky ridgeline of the foothills, roughly two miles to the west, provides good roosting habitat, a limiting factor for bats; and

4) Vacant buildings on Lafarge's property may provide good roosting habitat for big and little brown bats.

Table 4. Baseline Bat Activity at NWTC Compared with Wind Energy Facilities.

Wind Energy Facility	Bat Activity (total bat passes/detector night)	Reference
Colorado Highlands, CO	0.23	Walsh 2010
Top of the World, WY	0.58	Rintz and Kimberly 2009
Dunlap Ranch, WY	1.67	Johnson et al. 2009
Campbell Hill, WY	2.03	Taylor et al. 2008
Buffalo Mountain, TN	23.70	Fiedler 2004
Mountaineer, WV	38.30	Arnett et al. 2005
NWTC, CO	99.40	This report

Temporal Distribution

For all species combined, the highest number of bat passes was recorded in July and August. This suggests that the majority of recorded bat passes are from local, resident bats. Bat passes recorded in late August, September, and October may be related to fall migration. This coincides with other studies that have found high levels of bat activity in the late summer and early fall (Erickson et al. 2002, Cryan 2003, Kunz et al. 2007).

Big brown bats appear to be resident, as they are most active in July and August. Myotis bats, active July through September on site, may delay migration until later in September. Fringed myotis is also likely resident, with activity from July through September and their known presence in the general vicinity (Rick Adams, personal communication, March 11, 2011). Silver-haired bats show some resident activity with a presence in July and August; the higher activity in September is indicative of their migratory behavior. Hoary bats are solitary and seldom abundant, suitably reflected in their low abundance in July and August. The eastern red bat was present in July and August but very infrequently and is uncommon in Colorado.

Peak Activity levels

Bat activity fluctuated from July to September and then decreased until the end of the monitoring period with no true peaks of activity. This, again, suggests that most of the bat activity captured during the summer was of resident bats. The fluctuation of activity levels, as well as the spikes of activity, may be due to weather or other factors that influence the activity of bats.

Special Status Species

No special status species were identified during acoustical bat surveys. Townsend's big-eared bat, the only state-listed bat species, is known to occur near this area (Adams 2003). Maternity colonies have been identified and are protected at Harmon and Mallory caves on City of Boulder Open Space and Mountain Parks land roughly 5 miles to the north/northwest (http://www.bouldercolorado.gov/files/openspace/closure_documents/MalloryHarmonCave_WhiteNoseSyndrome.pdf).

RECOMMENDATIONS

Walsh recommends several additional surveys which will help to better understand bat movement and activity at NWTC.

- Continued passive acoustical monitoring of bats from April 1 to July 6 to complete a full year of monitoring.
- Continued monitoring in subsequent years to substantiate patterns seen in this study as well as provide year-to-year comparisons.
- Additional passive acoustical monitoring at different locations and heights to see the movement of bats through the site
- Mist netting surveys can better identify which species are using the site
- Putting radio-tags on some bats can show where they are roosting.

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