Ecological Condition Report

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Filoha Meadows Nature Preserve
Pitkin County, Colorado

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1.0 Introduction

Filoha Meadows Nature Preserve (~190 acres), located in the scenic Crystal River Valley two miles north of Redstone, Colorado, is one of the most biologically diverse properties in the Pitkin County Open Space and Trails (PCOST) system (Figure 1). The property includes mature riparian areas along the Crystal River, a beaver pond/wetland fen complex, mineral laden hot springs that support rare plant communities, sagebrush shrublands, Gambel oak woodlands, pinyon juniper woodlands, and agricultural meadows. The rare and unique plant communities and the wildlife that are supported by these plant communities are unparalleled in the Crystal River Valley. At the same time, some areas are degraded by non-native pasture grasses and noxious weeds (PCOST, 2008).

Intensive survey work at Filoha for preparation of the Management Plan was conducted in 2004-2007. Other than continued avian surveys, however, little survey or monitoring has been done since that time. The purpose of this report is to summarize the results of the field work conducted in 2017. Specifically, we detail the results of the rapid riparian and wetland habitat assessment, provide a vascular plant species list for the Preserve, map and describe noxious weeds, and describe the state of the important wildlife habitat at Filoha. Finally, we provide recommendations for future monitoring and protection of ecologically sensitive areas.

2.0 Methods

2.1 Vegetation

Riparian and wetland habitat assessments, noxious weed surveys, and a floristic inventory were conducted on July 5, July 6, and September 26, 2017, by Rea Orthner of Peak Ecological Services, LLC. Ms. Orthner has a M.S. degree in botany from the University of Colorado in Boulder and has completed numerous riparian habitat assessments, floristic inventories and rare plant surveys in western Colorado over the last 20 years. A qualitative riparian habitat assessment was conducted by walking the riparian areas and determining the extent to which the vegetation is in functional condition (i.e. canopy cover, species diversity, riparian plant reproduction). In addition, all vascular plant species encountered were recorded in order to provide a comprehensive plant species list for Filoha (Appendix A). Finally, notes were taken on noxious weeds when encountered and large noxious weed infestations were mapped (Figure 1).

2.2 Wildlife

A rapid wildlife habitat assessment was conducted on August 28 2017, by Jonathan Lowsky of Colorado Wildlife Science, LLC (CWS). Mr. Lowsky has a M.S. degree in wildlife biology from Colorado State University and has completed numerous wildlife habitat assessments in the Roaring Fork watershed and western Colorado over the last 25 years. CWS conducted pedestrian surveys of the area to review the important biotic and abiotic wildlife habitat at Filoha. These subjective surveys, in combination with 17 years' experience monitoring wildlife on the property, were used to develop an assessment of the habitat categorized by plant community and prominent abiotic features (e.g., cliffs and talus). In addition, the list of vertebrate species known or suspected to occur at Filoha developed for the 2008 Management Plan (PCOST, 2008) has been updated (Appendix B).

In most areas, vegetation provides the main structure of wildlife habitat. Typically, it is the complexity of that vegetation that drives species richness (Tews et al., 2004; Culbert et al., 2013). More complex, heterogeneous habitats provide more niches and microhabitats for a higher number of specialized species. Plants provide much of this heterogeneity via their diverse and complex growth forms. This variation in physical structure in turn shapes a range of micro-environments relevant to other organisms. Thus, plants are important ecosystem engineers that generate habitat niches, such as light patches in canopies and understory, and more complex vegetation structure utilized by other organisms;

for example birds, reptiles and small mammals (Wiens and Rotenberry, 1981; Blair, 1996; Falck et al., 2003; Garden et al., 2007). Plant communities that provide both horizontal (variation of structure across a horizontal space) and vertical (variation in structure across a vertical space) vegetation structure typically support more species and greater densities of individuals as some taxa, e.g. birds or bees, may depend more on strong changes in horizontal structures (e.g. trees for nesting and open area for foraging) than other taxa (Tews et al., 2004). Altogether, measures of vegetation structure can serve as valuable indicators of species diversity and richness, which can then be used to determine management actions.

3.0 Results

3.1 Vegetation

3.1.1 Riparian Areas

Filoha Meadows Nature Preserve supports a well-developed wetland/riparian area that occurs to the west and southwest of the beaver pond/fen complex. This area is dominated by narrowleaf cottonwood (*Populus angustifolia*) and blue spruce (*Picea pungens*) with thinleaf alder (*Alnus incana* subsp. *tenuifolia*), and best fits the Narrowleaf Cottonwood - Blue Spruce / Thinleaf Alder Woodland as described by the Colorado Natural Heritage Program (CNHP, 2003). Other common plants observed include shrubs such as Woods' rose (*Rosa woodsii*) and dogwood (*Cornus sericea*), and herbaceous plants including starry false Solomon's seal (*Maianthemum stellatum*), roundleaf wintergreen (*Pyrola rotundifolia*), field horsetail (*Equisetum hyemale*), goldenrod (*Solidago cf. missouriensis*). Non-native pasture grasses are also common in some areas and include orchardgrass (*Dactylis glomerata*), timothy (*Phleum pratense*) and smooth brome (*Bromus inermis*).

Photo 1. Riparian Restoration Site A (9/26/17).

Other riparian areas at Filoha are in degraded condition and some areas may warrant restoration. There are three areas which appear to be good candidates for riparian restoration activities. See Figure 1. Restoration Site A (4.6 acres) is located south of the beaver pond/fen complex. This area occurs on a low terrace above the Crystal River and was converted to agricultural pastureland or for crop production in the mid 1950's (PCOST, 2008). The site is now dominated by non-native agricultural grasses, weeds, and the occasional regenerating blue spruce and narrowleaf cottonwood. In addition, the site is bordered by the Wilke Ditch, which diverts 1.2 cfs from the Crystal River. According to the 2008 Filoha Management Plan, "The management goal for this ditch [Wilke Ditch] is to improve the condition and exercise the water rights. The water from the ditch will be used to restore native vegetation on the property and enhance the wetlands. If feasible, this water right could also be dedicated for instream flow protection once the restoration allows" (PCOST, 2008; p. 6).

Restoration Site B, 0.7 acres in size, is located north of the beaver pond/fen complex on an outside bend of the Crystal River. Bank erosion is occurring at this location and should be stabilized prior to restoring the riparian habitat.

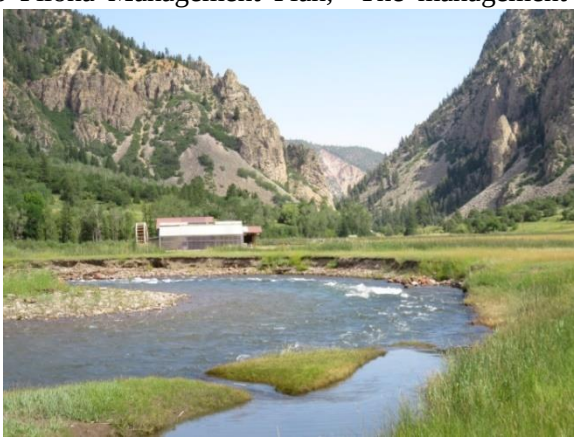


Photo 2. Eroding bank of the Crystal River at Riparian Restoration Site B (9/26/17).

Restoration Area C, located along the Crystal River north of the "hot springs" wetland meadows and across the Crystal River from Penny Hot Springs, may also benefit from riparian restoration. While woody riparian vegetation was not likely present in the hot springs meadows, the area north of the meadows should be further investigated to determine if additional riparian trees and shrubs could be planted there.

3.1.2 Beaver Pond/Fen Complex

During the initial riparian habitat assessment in early July 2017, it was determined that the beaver pond wetland complex may support Histosol soils and thus qualify as a fen. A fen is defined as a groundwater-fed wetland with saturated organic soils, commonly known as peat (Mitsch and Gosselink, 2000). Regulatory agencies such as the U.S. Army Corps of Engineers (USACE) have required fens to meet the formal criteria established for organic soils (Histosols) in the USDA soil taxonomy (USACE, 2017). The criteria include the duration of saturated conditions, organic carbon content, and a minimum thickness of 40 cm (16 in) of peat in the upper 80 cm (32 in) of soil (USDA, 1994). Fens are rare and ecologically significant wetlands in Colorado and the Rocky Mountains and are colloquially known as “old-growth” wetlands because they can be thousands of years old. They are ancient ecosystems potentially 8,000 to 12,000 years old. Even though they occupy a small percentage of the landscape, they provide important headwater quality functions, including carbon storage, water storage, wildlife habitat, and biodiversity.

On September 26, 2017, David Buscher, a certified professional soil scientist of Buscher Soil and Environmental Consulting, Inc., evaluated the soils of this wetland area. A total of four (4) soil pits were hand dug and the soils were described as per type (i.e. organic or mineral), the depth of organic soil layers, and redox features. In addition, notes were taken on the groundwater levels encountered and dominant plant species. The results of the soil sampling of the beaver pond wetland complex indicate that the area does contain Histosol soils to depths greater than 16 inches and thus is considered a fen. Specifically, two of the soils analyzed in the wetland contained a peat layer 21 inches thick. Water levels were also observed either at the surface or within the upper 12 inches of the soil surface at the time of assessment in late September, hence the hydrological functioning of the fen appears to be intact. See Table 1.

The vegetation of the beaver pond/fen complex is dominated by beaked sedge (*Carex utriculata*), a common peat forming sedge of the Rocky Mountains. Numerous other common native plants were observed including creeping spikerush (*Eleocharis palustris*), Baltic rush (*Juncus arcticus* subsp. *ater*), three-square bulrush (*Schoenoplectus americanus*), inland sedge (*Carex interior*), golden sedge (*Carex aurea*), field mint (*Mentha arvensis*), and Norton’s Saint Johnswort (*Hypericum scouleri* subsp. *nortoniae*). Shrubs which occur in portions of this wetland complex include diamondleaf willow (*Salix planifolia*), sandbar willow (*Salix exigua*) bog birch (*Betula glandulosa*), river birch (*Betula fontinalis*), and thinleaf alder. Less desirable plants include broadleaf cattail (*Typha latifolia*), which can form dense monocultures and outcompete other plants, redtop (*Agrostis gigantea*), a non-native pasture grass, and noxious weeds such as Canada thistle (*Cirsium* arvense) and oxeye daisy (*Leucanthemum vulgare*).

Photo 3. Beaver Pond/Fen Wetland Complex (9/26/17).

Table 1. Soil Sampling Results. Beaver Pond / Fen Complex	
ID No.	**Notes**
1	Mineral soil. Dominated by *Carex utriculata, Agrostis gigantea, Typha latifolia*. GPS #RO502
2	Histosol, 0-21 inches hemic/sapric with minor gray clay loam mixed in below 10 inches, probably due to mixing by beavers, >21 inches gray clay loam, water table at surface. GPS #188. Dominated by *Carex utriculata, Agrostis gigantea, Typha latifolia*.
3	Histosol, 0-21 inches hemic, below 9 inches gray clay loam mixed in, probably due to mixing by beavers, water table at 4 inches.. GPS #189. Dominated by *Scirpus acutus, Schoenoplectus americanus, Carex utriculata, Hypericum scouleri* subsp. *nortoniae*).
4	Hemic 0-5 inches over gray clay loam with some hemic material mixed in, water table at 16 inches. Not a Histosol or Histic epipedon. GPS #190.
Notes: Date of field observation: September 26, 2017	

3.1.3 Floristics

A total of 147 vascular plant species were observed at the Filoha Meadows Nature Preserve. These include eight species of trees, 27 shrubs/subshrubs, 32 perennial graminoids, 58 perennial forbs, two fern allies, 18 annual/biennial forbs, and two species of annual graminoids. Of the total, 39 or 27% are non-native and 17 species are Colorado State listed noxious weeds (see Section 3.2.3).

As described in EM Ecological (2007), three species of vascular plants currently tracked by the CNHP occur in the wetland meadows in the vicinity of the hot springs. These include beaked spikerush (*Eleocharis rostellata*), giant helleborine orchid (*Epipactis gigantea*), and canyon bog orchid (*Platanthera tescamnis, syn=Platanthera sparsiflora*). See Table 2. No long term demographic monitoring has occurred for these species, and it is unknown if the populations are stable. However, the dry spring of 2017 did appear to negatively affect the flowering phenology of *Epipactis gigantea* (L. Tasker, personal communication). Noxious weed populations in the vicinity of the rare plants appear to be their greatest threat. Both Canada thistle and oxeye daisy occur intermixed with portions of the giant hellobrine and canyon bog orchid populations, and may compete with these rare plants for nutrients, light, and water. If left unchecked, the weeds could cause long term adverse effects to population viability. Test plots investigating the use of biocontrols, mechanical control, and careful use of a selective herbicide such as Milestone is recommended. See Section 4.0.

Photo 4. *Epipactis gigantea* in the hot spring meadows (7/5/17).

Table 2. Rare Plants Tracked by the Colorado Natural Heritage Program			
Scientific Name	**Common Name**	**Family**	**CNHP Rank[1,2]**
Eleocharis rostellata	Beaked spikerush	Cyperaceae	G3/S2[3]
Epipactis gigantea	Giant helleborine; stream orchid	Orchidaceae	G4/S1S2
Platanthera tescamnis (=syn P. sparsiflora var. *sparsiflora*	Canyon bog orchid;	Orchidaceae	G4G5T4?/ S3
Source: EM Ecological 2007 *Notes:* [1]Ranking current as of February 2017. See http://www.cnhp.colostate.edu/download/list.asp [2]See http://www.cnhp.colostate.edu/about/heritage.asp for a description of the ranking criteria [3]Ranked at the community level only			

3.1.4 Noxious Weeds

Seventeen (17) species of noxious weeds were documented during the 2017 ecological assessment or were previously reported to be present at Filoha (EM Ecological, 2007). See Table 3.

Photo 5. Canada thistle invading rare plant habitat (9/26/2017).

The Colorado Noxious Weed Act directs the Department of Agriculture to develop and implement management plans for all List A and List B noxious weed species. There are no List A Noxious Weeds Filoha Meadows Nature Preserve. However, there are ten List B species, seven of which (tamarisk, toadflax, sulphur cinquefoil, common tansy, plumeless thistle, musk thistle, and bull thistle) are slated for elimination. The other three species (Canada thistle, oxeye daisy, and houndstongue) are slated for suppression. There are also seven List C species at Filoha, which should also be controlled. Of particular concern is the List C species, cheatgrass, as well as Japanese brome (*Bromus japonicus*), another invasive annual grass that occupies the same ecological niche.

Table 3. Colorado Listed Noxious Weeds. Filoha Meadows Nature Preserve

Scientific Name	Common Name	Family	Noxious Weed List	Management Status[4]
Trees/Shrubs				
Tamarix parviflora[1,2]	Tamarisk; Salt cedar	Tamaricaceae	B	Eliminate by 2019
Perennial Forbs				
Cichorum intybus	Chicory	Asteraceae	C	N/A
Cirsium arvense (=Breea)	Canada thistle	Asteraceae	B	Suppression
Convolvulus arvensis	Field bindweed	Convolvulaceae	C	N/A
Leucanthemum vulgare	Oxeye daisy	Asteraceae	B	Suppression
Linaria vulgaris[2]	Butter and eggs, toadflax	Plantaginaceae	B	Eliminate by 2021
Potentilla recta[2]	Sulphur cinquefoil	Rosaceae	B	Elimination[3]
Tanacetum vulgare[2]	Common tansy	Asteraceae	B	Eliminate by 2016
Annual/Biennial Forbs				
Arctium minus[2]	Lesser burdock	Asteraceae	C	N/A
Carduus acanthoides	Plumeless thistle	Asteraceae	B	Eliminate by 2018
Carduus nutans subsp. macrolepis	Musk thistle (Nodding plumeless thistle)	Asteraceae	B	Eliminate by 2022
Cirsium vulgare	Bull thistle	Asteraceae	B	Eliminate by 2020
Cynoglossum officinale	Houndstongue	Boraginaceae	B	Suppression
Erodium cicutarium	Redstem stork's bill	Geraniaceae	C	N/A
Sonchus arvensis	Field sowthistle	Asteraceae	C	N/A
Verbascum thapsus	Mullein	Scrophulariaceae	C	N/A

Table 3. Colorado Listed Noxious Weeds. Filoha Meadows Nature Preserve				
Scientific Name	**Common Name**	**Family**	**Noxious Weed List**	**Management Status[4]**
Annual Graminoids				
Anisantha tectorum[5]	Cheatgrass	Poaceae	C	N/A

Notes: Common reed (*Phragmites australis*) is also reported for Filoha (EM Ecological, 2007), however it is the native ecotype, and therefore not a noxious weed at this location.

[1] Although tamarisk was previously removed from the site, it should remain on the list to ensure monitoring for new populations occurs.

[2] Reported by EM Ecological, 2007 and not directly observed by the author.

[3] *Potentilla recta* occurs outside of the Pitkin County containment area, therefore elimination is the management strategy.

[4] Source: https://www.colorado.gov/pacific/agconservation/county-weed-programs; and List B Management Plan Web Database for Pitkin County (updated Apr-01-2017).

"Elimination" means the removal or destruction of all emerged, growing plants of a population of List A or List B species designated for eradication by the Commissioner. It is the first step in achieving Eradication and is succeeded by efforts to detect and destroy newly emerged plants arising from seed, reproductive propagule, or remaining root stock for the duration of the seed longevity for the particular species.

"Suppression" means reducing the vigor of noxious weed populations within an infested region, decreasing the propensity of noxious weed species to spread to surrounding lands, and mitigating the negative effects of noxious weed populations on infested lands. Suppression efforts may employ a wide variety of integrated management techniques.

[5]Japanese brome (*Bromus japonicus*), although not a Colorado listed noxious weed, is another invasive annual grass species that occupies the same ecological niche as cheatgrass. It should be controlled along with cheatgrass.

3.2 Wildlife

3.2.1 Riparian Areas

The importance of riparian habitat to wildlife is greatly disproportionate to its limited acreage. Although riparian systems occupy no more than 3% of the Colorado landscape (Kingery, 1998), 75% of the bird species in the American west use riparian areas during some part of their life cycle (Howe, 1996), and in Colorado, approximately 80% of all wildlife use a riparian area at some point in their life cycle (Johonson and Jones, 1977). As described in Section 3.1.1, the quality of the riparian habitat at Filoha varies from high quality to degraded. The Narrowleaf Cottonwood - Blue Spruce / Thinleaf Alder Woodland on the southeast end of the property (Figure 1) has a high level of structural and compositional diversity relative to the adjacent uplands. The presence of low shrubs (e.g., common juniper [*Juniperus communis*]), large shrubs (e.g., thinleaf alder), and large trees (e.g., narrowleaf cottonwood), as well as snags and downed woody material results in a multi-layered canopy with high vertical and horizontal habitat diversity. It is important to note that Rocky Mountain elk (*Cervus elaphus nelsoni*) are suspected to use this area for limited calving and rearing.

Photo 6. Spotted calf observed during bird monitoring at Filoha.

In comparison, the riparian areas on the property to the east and north of this area are degraded and relatively devoid of structural diversity due to an absence of woody

vegetation. One of these areas identified as a potential restoration site in Figure 1, Site A, is, to some extent, beginning to recover from past clearing efforts to improve agricultural production. Here, trees such as blue spruce and narrowleaf cottonwood are recolonizing the riparian zone. Restoration of this area in combination with a restoration effort at Site B, and potentially site C, would substantially increase the acreage of this important habitat type at Filoha. Wildlife that would benefit include many species of songbird (e.g., cordilleran flycatcher [*Empidonax occidentalis*], Lewis's woodpecker [*Melanerpes lewis*], warbling vireo [*Vireo gilvus*], yellow warbler [*Setophaga petechial*]), elk, raptors and owls (e.g., Cooper's hawk [*Accipiter cooperii*], northern saw-whet owl [*Aegolius acadicus*]), and a plethora of small mammals (e.g, long-tailed vole [*Microtus longicaudus*], masked shrew [*Sorex cinereus*]).

3.1.2 Beaver Pond/Fen Complex

In contrast to the riparian woodland, the beaver pond/fen complex provides horizontal and vertical habitat diversity at more of a micro scale but, nonetheless, is quite important to a specialized suite of species. The interspersion of open water, emergent vegetation, beaked sedge dominated graminoid wetlands, and upland meadows with the occasional small tree (e.g., bog birch, thinleaf alder) or shrub (e.g., willows) provides important habitat for songbirds and wading birds dependent on such habitat, such as red-winged blackbird, sora, and Wilson's snipe; waterfowl such as cinnamon teal and gadwall; and small mammals such as American water shrew (*Sorex palustris*), muskrats (*Ondatra zibethicus*), and western jumping mice (*Zapus princeps*). North American beaver (*Castor canadensis*) are, of course, present and are the engineers of much of the habitat complexity in this ecological community. The combination of beaver damming and foraging activity increases habitat heterogeneity, increases the number of species of herbaceous plants in the riparian zone, and substantially increases amphibian, mammal, and songbird species richness (Olsen and Hubert, 1994; Schulte and Müller-Schwarze, 1999; Wright et al., 2002; Cooke and Zack, 2008).

3.1.3 Aspen Forest

As described in the 2008 Management Plan, Filoha encompasses a small portion of an extensive aspen stand in the extreme southern portion of the property (Figure 2). Healthy aspen stands with diverse understories support some of the highest levels of vertebrate diversity in the Southern Rocky Mountains. Because aspen is seral and is sometimes mixed with conifer trees, the importance of aspen-dominated woodlands to birds and other wildlife far exceeds the areal extent of the stands themselves (DeByle et al., 1985). The large numbers of elk that continue to use the property throughout the year are limiting regeneration of aspen and heavily impacting the development of understory shrubs and herbaceous plants. Because of elk forage pressure, in combination with other factors, this stand is in poor condition and does not support the vertebrate species richness as healthier stands. Birds strongly associated with aspen habitat such as broad-tailed hummingbirds (*Selasphorus platycercus*), dusky grouse (*Dendragapus obscurus*), flammulated owls (*Otus flammeolus*), northern goshawks (*Accipiter gentilis*), red-naped sapsuckers (*Sphyrapicus nuchalis*), violet-green swallows (*Tachycineta thalassina*), and warbling vireos, and mammals such as black bears (*Ursus americanus*), least chipmunk (*Tamias minimus*), and southern red-backed vole (*Myodes gapperi*) would benefit from management of this stand to limit the effects of elk on regeneration and understory development. In addition, mechanical treatment of the aspen to encourage vegetative reproduction could be effective and result in rejuvenation of this important habitat type. Successful vegetative regeneration of aspen is dependent on three key components: hormonal stimulation, growth environment and protection of resulting suckers (Shepperd, 2004). To induce the proper hormonal stimulation for sucker production, mechanical treatments can be used to interrupt the auxin flow from stem to roots. The preferred environment for regeneration is achieved by the removal of competing vegetation to provide for warm soil conditions that will stimulate growth. For example, in a replicated study comparing bulldozing with chainsaw felling, Shepperd (1996) found that portions of clones where aspen was tipped over with a bulldozer produced significantly more sprouts than portions felled with a chainsaw. This type of treatment, in combination with physical wildlife barriers (i.e., fencing) can be added to guard against over-browsing by livestock and wild ungulates.

3.1.4 Montane Shrubland

Although Filoha is adjacent to hundreds of acres of Gambel oak dominated montane shrublands, this habitat type occupies only a small portion of the property on the northerly facing slopes on the eastern boundary (Figure 2). The dominant shrub species in this community, Gambel oak (*Quercus gambelii*), is arguably the most important shrub for wildlife in the montane zone of western Colorado. It provides both vertical and horizontal heterogeneity, potentially increasing species diversity by increasing the number of available habitats (Brown, 1958; Kruse, 1992; Pendleton et al., 1992; Pearson et al., 1996; Rosenstock, 1998). For example, Gambel oak provide cavities for roosting bats and increases species composition and diversity of bird communities by providing additional nesting and foraging substrates and cavities (Rosenstock, 1998). In addition to enhancing habitat for many small birds, the Gambel oak dominated shrublands provide valuable food and cover for deer, elk, rabbits, turkeys, grouse, and squirrels (Pendleton et al., 1992). A variety of wildlife including chipmunks (*Tamias* spp.), elk, mule deer (*Odocoileus hemionus hemionus*), and red squirrels (*Tamiasciurus hudsonicus*) browse on twigs, foliage, and acorn mast, and use the dense shrubby nature of the oak for cover. Along with oak, many of the other common shrubs in the montane shrubland community such as serviceberry (*Amelanchier alnifolia*) and chokecherry (*Prunus virginiana*) provide important forage for birds, black bears, and small mammals.

Photo 7. Lazuli bunting in mature montane shrublands at Filoha.

Much of the Gambel oak on and adjacent to the property is of a single age class and over-mature or decadent (i.e., old and degenerate growth indicating a general lack of vigor and vitality). The age of Gambel oak stands corresponds to ecological habitat for many wildlife species. Old decadent stands, containing large amounts of dead crown and hollow boles and limbs, present fire concerns and produce fewer acorns and less palatable leaves. Under natural conditions, Gambel oak stands experience relatively frequent disturbance from fires that result in ecologically healthy and productive multi-aged stands. In coordination with PCOST, the Aspen-Sopris District of the White River National Forest (WRNF) initiated a wildlife habitat improvement project in 2011 that included WRNF lands adjacent to Filoha. White River National Forest personnel are improving aspen forest and montane shrublands via a combination of prescribed burning and mechanical mastication. The purpose of this initiative is to improve wildlife browse and habitat for bighorn sheep, mule deer, elk, and a variety of other native wildlife that inhabit fire-adapted vegetation communities such as Gambel oak dominated shrublands.

3.1.5 Pinyon-Juniper Woodland

Pinyon (*Pinus edulis*) and juniper (*Juniperus* spp.; hereafter, "pinyon-juniper") dominated woodland occupies substantial acreage at the north end of Filoha. Pinyon-juniper habitat supports one of the largest nesting bird species list of any upland vegetation type in western Colorado (Colorado Partners in Flight, 2000). The avian species richness in pinyon-juniper ecological communities is due, in part, to the fact that it occurs at such a broad range of elevations (approximately 4,500 - 8,500 feet) (Balda and Masters, 1980). This habitat type at Filoha also provides important year-round habitat for mule deer and winter habitat for bighorn sheep and elk. Some of the animals at Filoha, such as rock squirrels (*Otospermophilus variegatus*), are found primarily in the pinyon-juniper woodlands.

Photo 8. Pinyon-juniper encroachment.

The pinyon-juniper woodland at Filoha is in excellent condition and, largely due to its location on steep, rocky slopes, it is relatively intact with few invasive species. The management challenge, however, is that since major agricultural operations at Filoha subsided over the past 20-30 years, pinyon-juniper has expanded from the rocky areas into the old hay fields. Without research into historical documents and photography, it is difficult to determine whether this is a recolonization of its former extent or if it is encroaching on areas where it did not occur in the past. That being said, Filoha is one of the most important winter refuges for the Avalanche Creek bighorn sheep herd, which were recommended as a Management Indicator Species (MIS) in the 2008 Management Plan. The juxtaposition of the old hayfields, although anthropogenic, with the cliffs and mineral hot springs provides outstanding bighorn sheep habitat. The open hayfields offer nutritious forage with clear sightlines for predator detection in proximity to escape cover. Not only does the continued encroachment of the pinyon-juniper reduce the acreage of high quality forage, it also reduces the 360 degree sightlines. PCOST has conducted pinyon-juniper thinning at Filoha for this purpose, but this thinning must be a continuous effort in order to maintain the effectiveness of the sheep habitat.

3.1.6 Grassland

The plant community with the greatest area at Filoha is non-native grassland (i.e., old hayfield). It is likely that given a normal disturbance regime, grasslands would occupy some proportion of the total cover on the property, but would be substantially lower. In addition, the dominant species would be native grasses and forbs rather than the introduced pasture grasses that dominate the grassland now. Such grasses have low to moderate forage value for wildlife. Monitoring data suggests that this habitat type on Filoha supports the lowest species richness of all of the habitats found on the property. The upland grasslands provide very low structural diversity, both horizontal and vertical, for avian foraging, nesting, and perching (Rotenberry and Wiens, 1980; Wiens and Rotenberry, 1981) or hiding or thermal cover for larger mammals such as elk or mule deer. That being said, when one considers the landscape scale interspersion of the grasslands at Filoha with the extensive Gambel oak dominated montane shrublands, aspen forest, and cliff/rock habitat on the property and adjacent WRNF lands, this results in outstanding year round habitat for elk and winter habitat for Rocky Mountain bighorn sheep. The major threats to these anthropogenic grassland habitats at Filoha are pinyon-juniper encroachment and the persistent and expanding cheatgrass (*Anisantha tectorum*) and/or Japanese brome (*Bromus japonicus*) infestation.

Photo 9. Band of elk cows and yearlings in the old hayfields at Filoha.

3.1.7 Abiotic Habitat

Photo 10. The interspersion of cliff/rock habitat with water and grassland habitat at Filoha results in excellent bighorn sheep winter habitat.

The most important abiotic habitat features at Filoha other than the surface water (i.e., Crystal River, ponds) are the cliffs, rock outcrops, and talus. See Figure 2. Cliffs and rock outcrops occupy a small percentage of the land base, but they are disproportionately important as wildlife habitat. The uniqueness of this habitat often results in entirely different communities during the breeding season compared with adjacent habitats, increasing overall species richness and diversity (Hester and Grenier, 2005). Cliffs and rock outcrops benefit birds and mammals directly by providing shelter and breeding sites, and indirectly by providing diverse vegetation structure. Many of the wildlife species that use these habitats at Filoha are highly specialized and are often dependent upon cliffs, rock outcrops, or talus for foraging or predator avoidance. The stability and persistence of cliffs and rock formations encourage the repeated use of specific areas as breeding habitat. Raptors that nest on cliffs and rocky outcrops include peregrine falcon (*Falco peregrinus*), prairie falcon (*F. mexicanus*), golden eagle (*Aquila chrysaetos*), and turkey vulture (*Cathartes aura*). Bighorn sheep feed on the vegetation found on Filoha's cliffs, rock outcrops, and talus and also use these habitats to escape predators such as mountain lions.

Although the avifauna of the cliff/rock habitat is small compared to other habitats, these species are highly specialized. Birds that use cliffs for nesting may be more susceptible to loss of nesting habitat than many other species because they rely entirely on cliffs (e.g., white-throated swifts [*Aeronautes saxatalis*]) as nest sites (Kingery 1998). Thus, the number of suitable nest sites is finite and essentially non-renewable. All suitable nest sites in some areas may be used, making any disruption of a nest site by humans result in a direct reduction in the population.

Another abiotic habitat type adjacent to, but potentially affected by management actions, is the abandoned Van Sycle mine at Elephant Mountain, which is located within 200 meters of Filoha's western boundary. Mining activity resulted in surface access to a series of thermal caves. The caves are now home to one of the largest all female colonies of Townsend's big-eared bats (*Corynorhinus townsendii*) which are ranked S2 (imperiled) by CNHP (CNHP, 2017), Species of Greatest Conservation Need (SGCN) by Colorado Parks & Wildlife (CPW, 2017), and Sensitive by the U.S. Forest Service Region 2, (USDA Forest Service, 2017).

It is important to note that there is an historic peregrine falcon nesting area on cliffs within ½ mile of Filoha near the Three Sisters waterfalls. Although the birds nest on WRNF lands, Filoha meets all of the criteria for high quality peregrine hunting habitat. Formerly listed as Endangered, peregrines were delisted from the Federal Threatened and Endangered Species list in 1999. They are now listed only as a State of Colorado Species of Special Concern, which is not a statutory listing.

Conflicts related to the wildlife that depend on these abiotic habitat features include recreation such as rock climbing, mining, road construction, hiking, mountain bike and equestrian trails, and residential development (Knight and Cole, 1995). All these activities can have a negative impact, whether they are conducted at the base or the top of a cliff, rocky ledge, or small rocky out thrust. Currently, the integrity of the cliff/rock habitats at and adjacent to Filoha is relatively intact with little disturbance, but the sensitivity of the species that depend on these habitats requires special attention by managers.

4.0 Conclusion and Recommendations

4.1 Vegetation

Filoha Meadows Nature Preserve harbors unique plant communities and healthy riparian habitats along the Crystal River. However, the site also has a long history of anthropogenic impacts and hence non-native plant species, including agricultural meadows (old hay pastures), occupy significant portions of the area. In order to preserve and enhance the ecological integrity of Filoha, the following vegetation recommendations should be implemented.

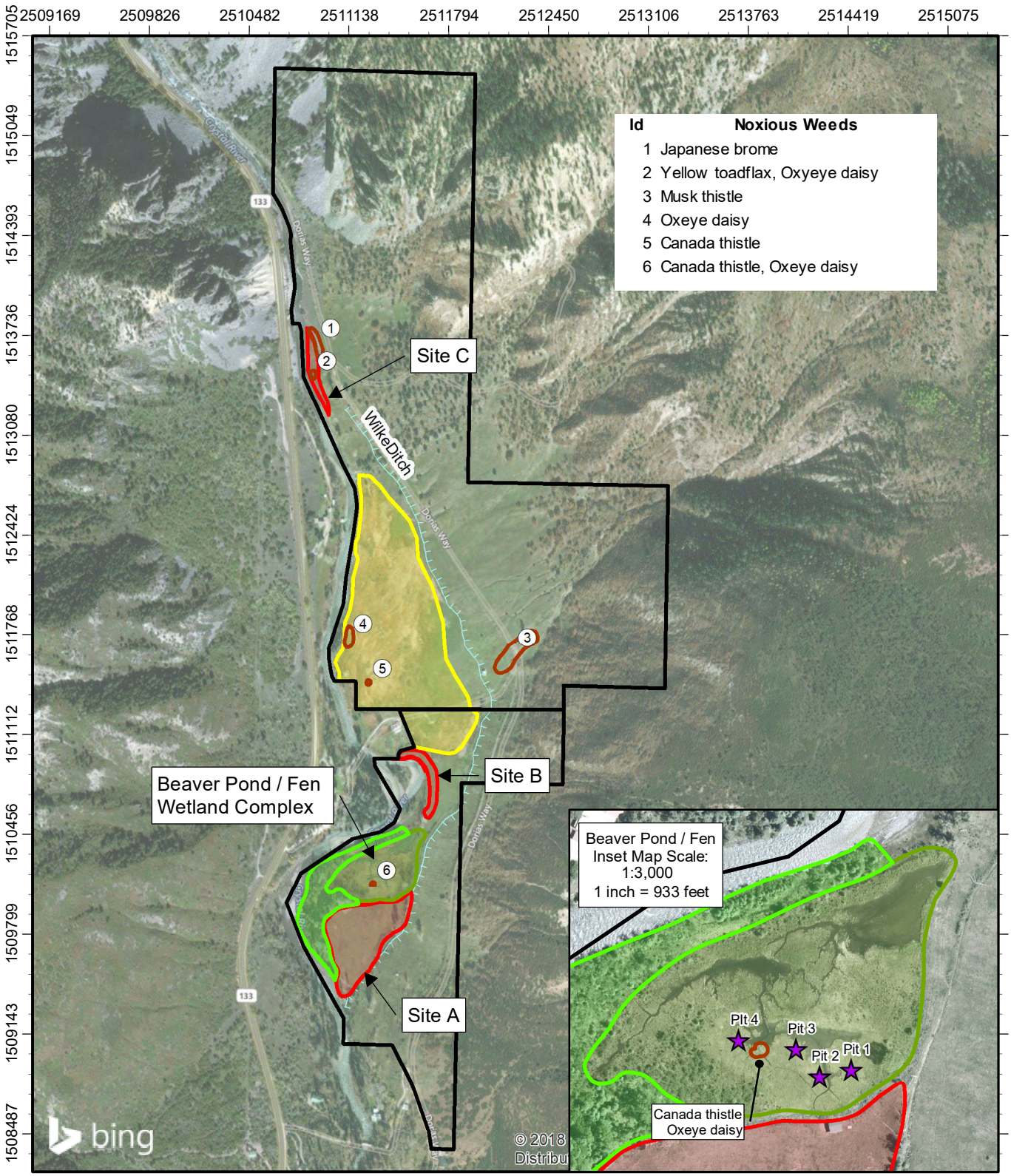
- Develop and implement riparian restoration plans for the 4.6 acre agricultural meadow (Site A) and the outside bend of the Crystal River, which is exhibiting signs of bank erosion (Site B, 0.7 acre). Investigate the potential for additional riparian restoration north of the Hot Springs Meadow and across the Crystal River from Penny Hot Springs (Site C).
- To our knowledge the maximum extent of *Epipactis gigantea* and *Platanthera tescamnis* has not been mapped at Filoha. Consider mapping these rare plant locations (similar to the *Eleocharis rostellata* mapping – EM Ecological, 2007; Figure 1) so that these populations can be easily identified on a map and protection measures and/or buffers can be established. In addition, initiate a long-term demographic monitoring study of these rare plant populations to help understand whether the populations are stable.
- Develop and implement an experimental noxious weed control plan in the vicinity of *Epipactis gigantea* and *Platanthera tescamnis*. Investigate the use of biocontrols (i.e. the host-specific pathogenic rust fungus (*Puccinia punctiformis*) for Canada thistle), mechanical control (hand pulling), and careful use of selective herbicide such as Milestone, an aminopyralid. Test plots are highly recommended in order to establish the most effective method and timing of controlling the noxious weeds without detriment to the rare plants or rare and unique insects (*i.e.* fireflies) or pollinators. Any noxious weed control work in the vicinity of the rare plants (generally located in the hot springs fed wet meadow), should be conducted by a qualified botanist or plant ecologist (with appropriate pesticide applicator license) to ensure no adverse effects occur.
- Revisit tamarisk removal locations to ensure none of these invasive riparian plants become re-established. See Table 3, Note 1.
- Outside of the rare plant population areas, we recommend control of noxious weeds with an emphasis on List B species and those slated for eradication by the Pitkin County Weed Management Plan (Table 2). In addition we recommend the control of the invasive grasses cheatgrass and Japanese brome. Weed control with herbicides should be completed by licensed professional pesticide applicators. Communication with PCOST staff or a qualified botanist/ecologist is strongly encouraged to ensure that no drift occurs that might impact rare plant communities. Limited spot-spraying with backpack type equipment is preferred over truck mounted or boom spraying.
- Set up and monitor quantitative vegetation transects in the same locations as EM Ecological (2007). We recommend using the point-intercept method along 50-meter-long transects with 100 first hits along each transect.
- Continue floristic inventory work at Filoha, especially in areas not previously surveyed.
- Map the vegetation types of the project site and qualitatively describe the vegetation composition.

4.2 Wildlife

The wildlife habitat at Filoha varies from excellent with little disturbance to highly disturbed. That being said, the function of the existing habitat is relatively high but, given the sensitive nature of the species that depend on many of the habitat features at Filoha, the integrity of that function remains somewhat precarious. The major issues related to habitat effectiveness at Filoha are:

1. Human disturbance – The current management plan restricts human activity at Filoha to research and management activities in combination with a limited number of guided educational programs with seasonal restrictions. As long as this level of activity is not exceeded, human disturbance should remain minimal. Any increase in recreational use would likely have substantial consequences for sensitive species such as bighorn sheep, elk, and songbirds.
    a. Recommended management actions: Continue current restrictions on recreation and educational groups.
2. Pinyon-juniper encroachment – As described above, the Avalanche Creek bighorn sheep herd is one of the greatest conservation concerns in the Crystal River watershed. Protecting the effectiveness of habitat important to the persistence of this herd should be a priority for managers.
    a. Recommended management actions: Continue mechanical pinyon-juniper removal efforts to improve bighorn sheep forage areas with substantial predator detection sightlines. The treatments should be limited to areas below (west of) the rocky slopes and cliffs where grasses historically dominated.
3. Riparian habitat – Given the importance of high quality riparian habitat to most of the wildlife species that occur or have the potential to occur at Filoha, protection of existing riparian habitat and restoration of disturbed riparian areas would likely have the greatest impact on habitat conditions for the greatest number of species than any other management action.
    a. Recommended management actions: Follow riparian restoration plan guidance described in vegetation recommendations above.
4. Cheatgrass/Japanese brome control – As these invasive annual grasses begin to dominate an area, they alter the native plant communities and displace native plants, thus impacting wildlife. In addition, the window of palatability is substantially narrower than native perennial grasses, causing a significant cost in forage quality and quantity for grazers such as bighorn sheep and elk.
    a. Recommended management actions: Continue and expand efforts to control cheatgrass. Prevent cheatgrass and Japanese brome from spreading to bighorn sheep grazing area and elk winter concentration area.
5. Insects – Fireflies of genus *Photuris* or *Photinus* occur at Filoha. According to Whitney Cranshaw, Colorado State University Entomologist, light emitting fireflies have never been common in the western United States and are particularly rare in Colorado (2008, personal communication). Given this unique occurrence in the Roaring Fork watershed, invertebrate sampling of the hot springs wetlands could reveal additional invertebrate species that are rare or of conservation concern.

5.0 Figures



BASE: Bing Maps Aerial Imagery
GRID: UTM NAD83 Z13

Figure 1. Ecological Assessment Map
Riparian Areas, Wetlands, and Noxious Weeds
Filoha Meadows Nature Preserve Open Space
Piktin County, Colorado

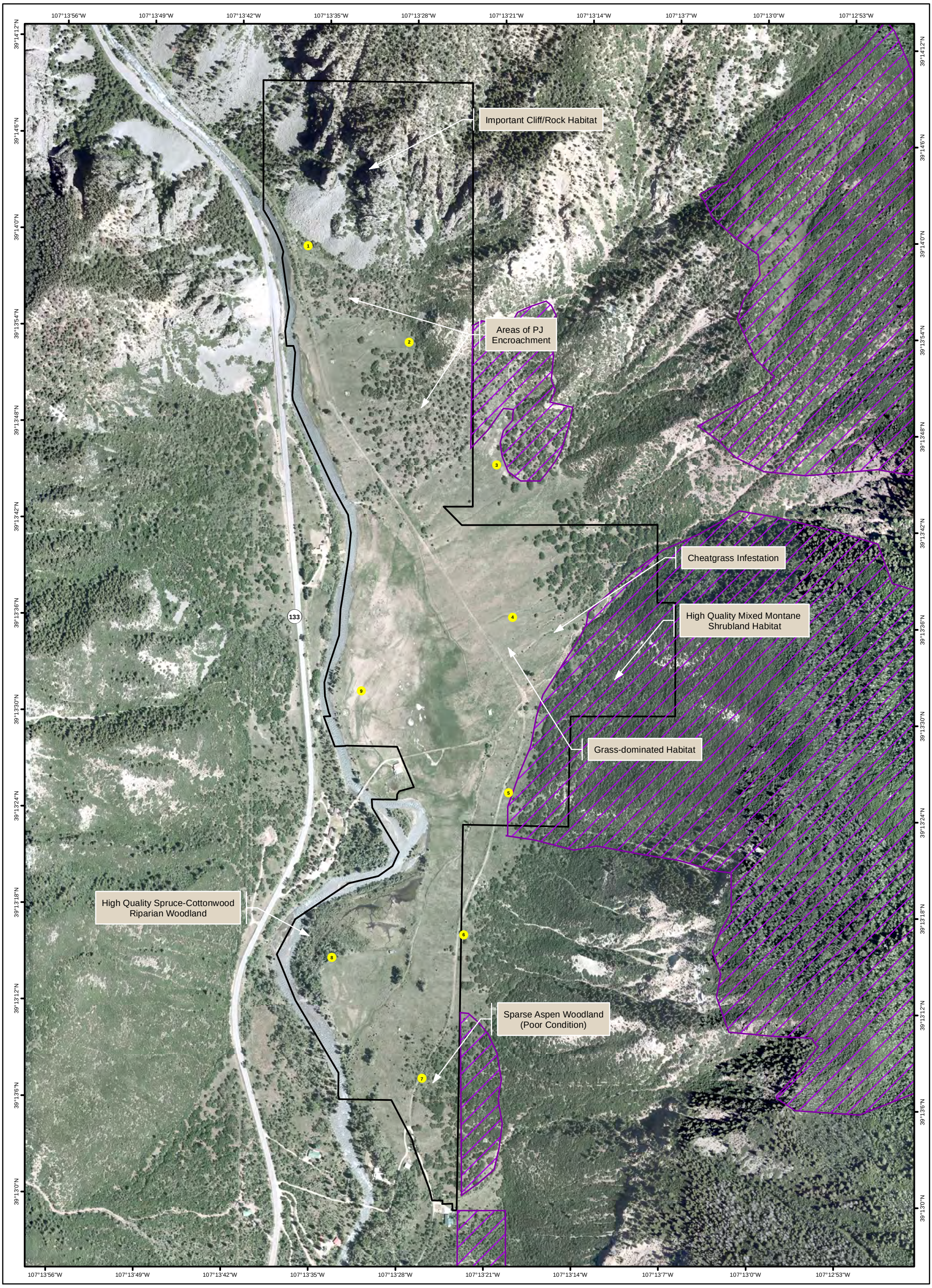
Legend

- Open Space Boundary
- Mapped Noxious Weed Populations
- Beaver Pond / Fen Wetland Complex
- Riparian Habitat
- Hot Springs Meadow (with rare orchids)
- Proposed Riparian Restoration Sites

N

Scale: 1:11,200
1 inch = 933 feet
Date: February 2018

Peak Ecological Services, LLC
301 Boulder Canyon Drive
Nederland, CO 80466
info@peakecological.com



Filoha Meadows Nature Preserve

Pitkin County, CO

Wildlife Habitat Assessment

Figure 2. Avian Monitoring Points, WRNF Treatment Areas, & Habitat Features of Interest

Legend:

- Property Boundary
- WRNF Habitat Treatment Area
- 5 Avian Monitoring Point

N

0 50 100 200 Meters

1:6,542

NOTE: Boundaries are approximate.

Base Layer Source:
Pitkin County GIS
2014 Digital Orthophotos

COLORADO WILDLIFE SCIENCE LLC
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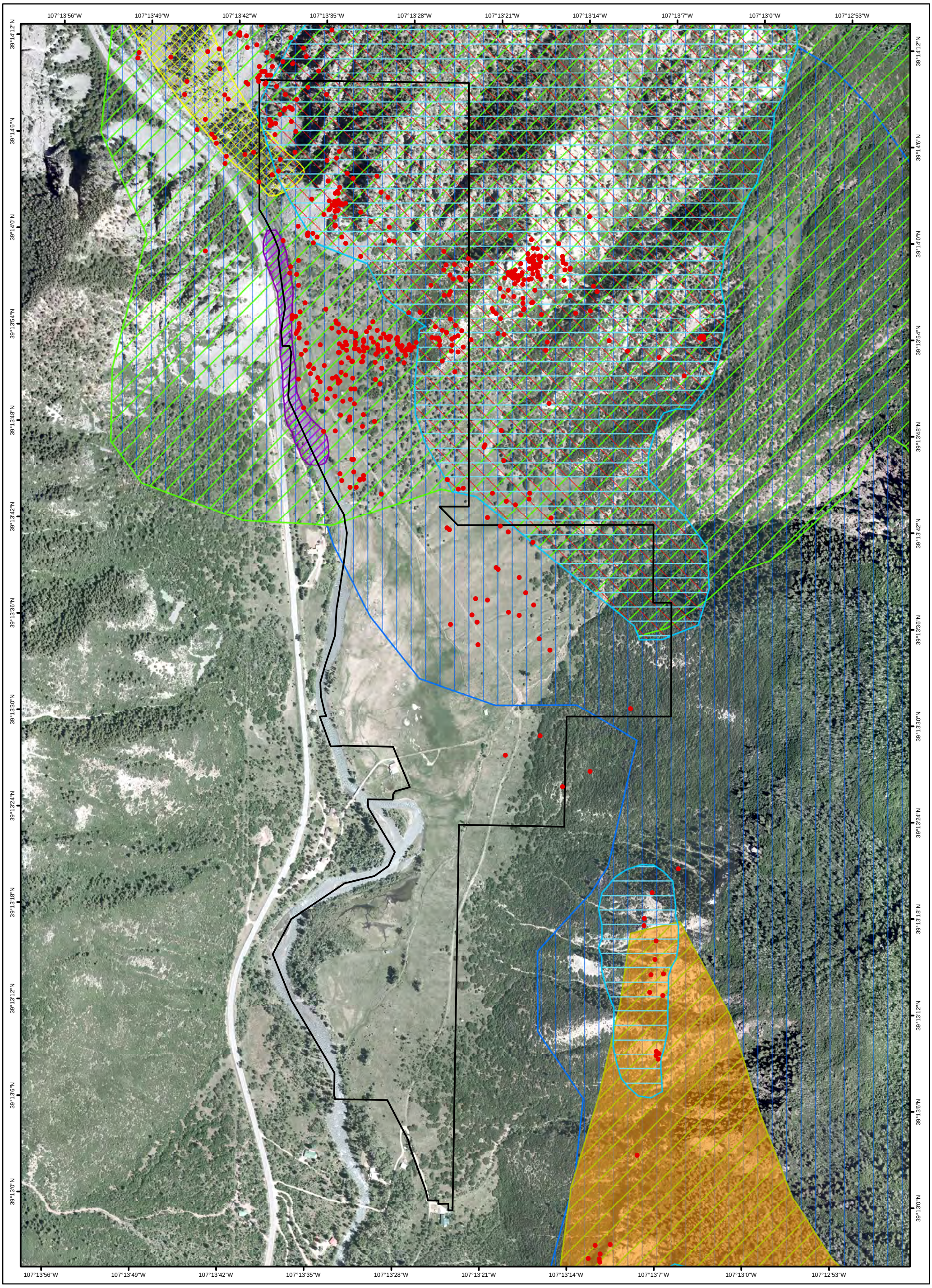

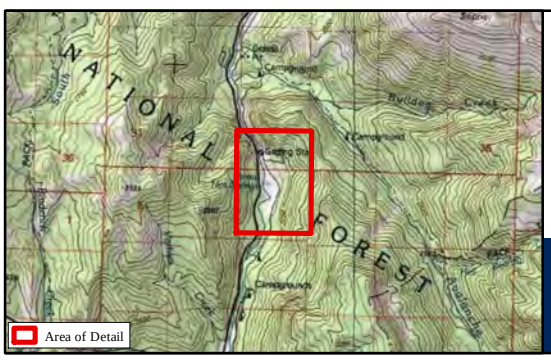

Filoha Meadows Nature Preserve

Pitkin County, CO

Wildlife Habitat Assessment

Figure 3. CPW Mapped Bighorn Sheep Habitat

Legend:

- Property Boundary
- Winter Range
- Severe Winter Range
- Winter Concentration Area
- Production Area
- Migration Corridor
- Summer Range
- Mineral Lick
- CPW Telemetry Location

N

0 50 100 200 Meters

1:6,542

NOTE: Boundaries are approximate.

Base Layer Source:
Pitkin County GIS
2014 Digital Orthophotos

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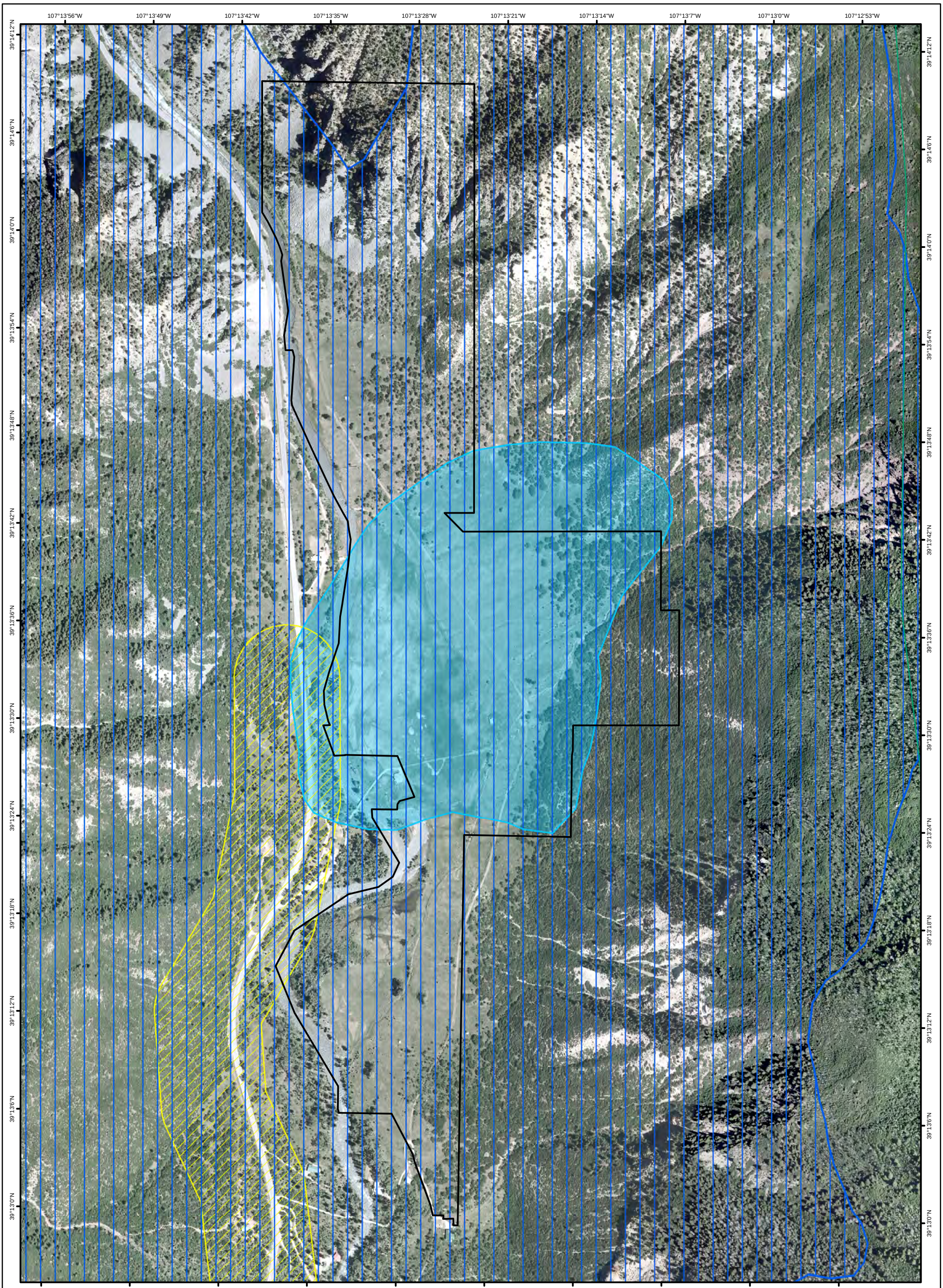

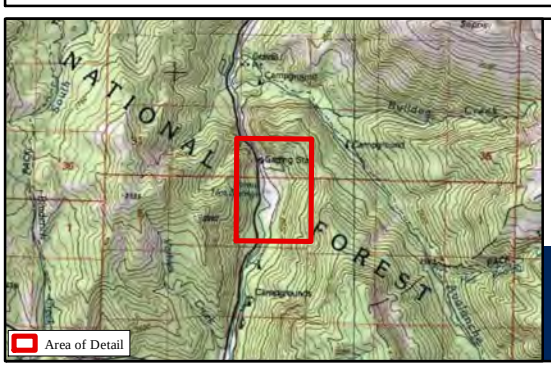

Filoha Meadows Nature Preserve

Pitkin County, CO

Wildlife Habitat Assessment

Figure 4. CPW Mapped Elk Habitat

Legend:

- Property Boundary
- Winter Range
- Severe Winter Range
- Winter Concentration Area
- Production Area
- Highway Crossing Area
- Summer Range

N

0 50 100 200 Meters

1:6,542

NOTE: Boundaries are approximate.

Base Layer Source:
Pitkin County GIS
2014 Digital Orthophotos

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Appendix A

Filoha Meadows Nature Preserve - 2017 Vascular Plant Species List

Scientific Name	Common Name	Family	Origin	C-Value	Voucher	Photo
Trees						
Acer negundo (=Negundo aceroides)	Box elder	Sapindaceae	N	7	☐	☐
Juniperus osteosperma (=Sabina)	Utah juniper	Cupressaceae	N	5	☐	☐
Juniperus scopulorum (=Sabina)	Rocky Mountain juniper	Cupressaceae	N	5	☐	☐
Picea pungens	Blue spruce	Pinaceae	N	6	☐	☐
Pinus ponderosa subsp. scopulorum	Ponderosa pine	Pinaceae	N	5	☐	☐
Populus angustifolia	Narrowleaf cottonwood	Salicaceae	N	5	☐	☐
Populus tremuloides	Quaking aspen	Salicaceae	N	5	☐	☐
Pseudotsuga menziesii	Douglas-fir	Pinaceae	N	5	☐	☐
Shrubs/Subshrubs						
Acer glabrum	Rocky Mountain maple	Sapindaceae	N	7	☐	☐
Alnus incana subsp. tenuifolia	Thinleaf alder	Betulaceae	N	6	☐	☐
Amelanchier alnifolia	Serviceberry	Rosaceae	N	6	☐	☐
Artemisia tridentata var. vaseyana	Mountain big sagebrush	Asteraceae	N	5	☐	☐
Betula glandulosa	Bog birch	Betulaceae	N	9	☐	☐
Betula occidentalis (=B. fontinalis)	River birch	Betulaceae	N	8	☐	☐
Ceanothus fendleri	Fendler's ceanothus, buckbrush	Rhamnaceae	N	7	☐	☐
Chrysothamnus viscidiflorus	Sticky rabbitbrush	Asteraceae	N	5	☐	☐
Cornus sericea subsp. sericea	Redosier dogwood	Cornaceae	N	7	☐	☐
Crataegus rivularis	River hawthorn	Rosaceae	N	6	☐	☐
Distegia involucrata	Twinberry honeysuckle	Caprifoliaceae	N	7	☐	☐
Ericameria nauseosa (=Chrysothamnus)	Rubber rabbitbrush	Asteraceae	N	3	☐	☐
Holodiscus discolor	Oceanspray	Rosaceae	N	8	☐	☐
Juniperus communis subsp. alpina	Common juniper	Cupressaceae	N	6	☐	☐
Mahonia repens	Oregon grape	Berberidaceae	N	5	☐	☐
Paxistima myrsinites	Mountain lover	Celastraceae	N	7	☐	☐
Potentilla fruticosa (=Pentaphylloides floribunda)	Shrubby cinquefoil	Rosaceae	N	4	☐	☐
Prunus virginiana var. melanocarpa	Chokecherry	Rosaceae	N	4	☐	☐

Appendix A

Scientific Name	Common Name	Family	Origin	C-Value	Voucher Photo	
Quercus gambelii	Gambel oak	Fagaceae	N	5	☐	☐
Rhus aromatica subsp. trilobata	Skunkbush sumac	Anacardiaceae	N	5	☐	☐
Ribes inerme	Whitestem gooseberry	Grossulariaceae	N	5	☐	☐
Rosa woodsii	Woods' rose	Rosaceae	N	5	☐	☐
Salix exigua	Sanbar willow, coyote	Asteraceae	N	3	☐	☐
Salix monticola	Mountain willow	Salicaceae	N	6	☐	☐
Salix planifolia	Planeleaf willow	Salicaceae	N	7	☐	☐
Symphoricarpos rotundifolius (=S. oreophilus)	Roundleaf snowberry	Caprifoliaceae	N	5	☐	☐
Tamarix parviflora	Tamarisk, Salt Cedar	Tamaricaceae	I B	0	☐	☐
Perennial Graminoids						
Agrostis gigantea	Redtop	Poaceae	I	0	☐	☐
Bromus inermis	Smooth brome	Poaceae	I	0	☐	☐
Calamagrostis stricta	Slimstem reedgrass	Poaceae	N	7	☑	☐
Carex aurea	Golden sedge	Cyperaceae	N	7	☑	☐
Carex geyeri	Elk sedge	Cyperaceae	N	6	☐	☐
Carex interior	Inland sedge	Cyperaceae	N	7	☑	☐
Carex pellita (=C. lanuginosa)	Woolly sedge	Cyperaceae	N	6	☑	☐
Carex praegracilis	Clustered field sedge	Cyperaceae	N	5	☑	☐
Carex utriculata	Beaked sedge	Cyperaceae	N	5	☐	☐
Dactylis glomerata	Orchardgrass	Poaceae	I	0	☐	☐
Deschampsia cespitosa	Tufted hairgrass	Poaceae	N	4	☐	☐
Distichlis stricta (=D. spicata)	Saltgrass	Poaceae	N	4	☐	☐
Eleocharis palustris	Creeping spikerush	Cyperaceae	N	3	☐	☐
Eleocharis rostellata	Beaked spikerush	Cyperaceae	N	6	☑	☐
Glyceria striata	Fowl mannagrass	Poaceae	N	6	☐	☐
Hesperostipa comata	Needle and thread grass	Poaceae	N	6	☐	☐
Hordeum jubatum	Foxtail barley	Poaceae	N	2	☐	☐
Juncus arcticus var. balticus (=J. balticus)	Arctic rush	Juncaceae	N	4	☐	☐
Juncus ensifolius (=J. saximontanus)	Swordleaf rush	Juncaceae	N	6	☑	☐
Juncus longistylis	Longstyle rush	Juncaceae	N	6	☑	☐

Appendix A

Scientific Name	Common Name	Family	Origin	C-Value	Voucher Photo	
Juncus nodosus	Knotted rush	Juncaceae	N	6	☑	☐
Muhlenbergia asperifolia	Scratchgrass muhly	Poaceae	N	4	☑	☐
Pascopyrum smithii	Western wheatgrass	Poaceae	N	5	☐	☐
Phalaris arundinacea	Reed canarygrass	Poaceae	I	0	☐	☐
Phleum pratense	Timothy	Poaceae	I	0	☐	☐
Phragmites australis	Common reed	Poaceae	N	3	☐	☐
Poa palustris	Fowl bluegrass	Poaceae	N	6	☑	☐
Poa pratensis	Kentucky bluegrass	Poaceae	I	0	☐	☐
Schedonorus pratensis (=Festuca)	Meadow fescue	Poaceae	I	0	☑	☐
Schoenoplectus acutus	Hardstem bulrush	Cyperaceae	N	3	☐	☐
Schoenoplectus americanus (=Scirpus)	Olney's three-square bulrush	Cyperaceae	N	4	☑	☐
Triglochin palustris	Marsh arrowgrass	Juncaginaceae	N	7	☑	☐
Perennial Forbs						
Achillea lanulosa	Yarrow	Asteraceae	N	4	☐	☐
Allium acuminatum	Tapertip onion	Alliaceae	N	8	☐	☐
Allium geyeri	Geyer's onion	Alliaceae	N	5	☐	☐
Anaphalis margaritacea	Pearly everlasting	Asteraceae	N	4	☐	☐
Artemisia frigida	Fringed sage, prairie sagewort	Asteraceae	N	4	☐	☐
Asclepias speciosa	Showy milkweed	Asclepiadaceae	N	3	☐	☐
Calochortus gunnisonii	Mariposa lily	Liliaceae	N	7	☐	☐
Castilleja linariifolia	Wyoming Indian paintbrush	Orobanchaceae	N	6	☐	☐
Cichorium intybus	Chicory	Asteraceae	I C	0	☐	☐
Cirsium arvense (=Breea)	Canada thistle	Asteraceae	I B	0	☐	☐
Clematis ligusticifolia	Western white clematis	Ranunculaceae	N	4	☐	☐
Convolvulus arvensis	Field bindweed	Convolvulaceae	I C	0	☐	☐
Epipactis gigantea	Giant helleborine, Stream orchid	Orchidaceae	N	9	☐	☑
Erigeron speciosus	Aspen fleabane	Asteraceae	N	5	☐	☐
Frasera speciosa	Monument plant, Elkweed	Gentianaceae	N	6	☐	☐

Appendix A

Scientific Name	Common Name	Family	Origin	C-Value	Voucher Photo	
Galium boreale (=G. septentrionale)	Northern bedstraw	Rubiaceae	N	6	☐	☐
Gentiana affinis (=Pneumonanthe)	Rocky Mountain gentian	Gentianaceae	N	8	☐	☐
Geranium richardsonii	Richardson's geranium	Geraniaceae	N	6	☐	☐
Geum macrophyllum var. perincisum	Largeleaf avens	Rosaceae	N	6	☐	☐
Glycyrrhiza lepidota	Wild licorice	Fabaceae	N	3	☐	☐
Grindelia squarrosa	Curlycup gumweed	Asteraceae	N	1	☐	☐
Helianthus nuttallii	Nuttall's sunflower	Asteraceae	N	3	☑	☑
Heterotheca villosa	Hairy false goldenaster	Asteraceae	N	3	☐	☐
Hippuris vulgaris	Common mare's-tail	Hippuridaceae	N	6	☐	☐
Hypericum scouleri susp. nortoniae (=H. formosum)	Norton's St. John's-wort	Clusiaceae	N	7	☑	☑
Ipomopsis aggregata	Scarlet gilia	Polemoniaceae	N	5	☐	☐
Leucanthemum vulgare	Oxeye daisy	Asteraceae	I B	0	☐	☐
Linaria vulgaris	Butter and eggs, toadflax	Plantaginaceae	I B	0	☐	☐
Maianthemum stellatum	Starry false Solomon's seal	Ruscaceae	N	7	☐	☐
Medicago lupulina	Black medic	Fabaceae	I	0	☐	☐
Medicago sativa	Alfalfa	Fabaceae	I	0	☐	☐
Monarda fistulosa var. menthifolia	Wild bergamot	Lamiaceae	N	6	☐	☐
Oenothera villosa subsp. strigosa	Hairy evening primrose	Onagraceae	N	4	☐	☐
Orobanche fasciculata (=Aphyllon)	Clustered broomrape	Orobanchaceae	N	5	☐	☐
Packera pseudaurea	Falsegold groundsel	Asteraceae	N	7	☑	☐
Penstemon caespitosus	Mat penstemon	Plantaginaceae	N	7	☐	☐
Penstemon strictus	Rocky Mountain penstemon	Plantaginaceae	N	5	☐	☐
Plantago lanceolata	Narrowleaf plantain	Plantaginaceae	I	0	☐	☐
Plantago major	Common plantain	Plantaginaceae	I	0	☐	☐
Platanthera aquilonis	Northern green orchid	Orchidaceae	N	7	☑	☑
Platanthera tescamnis (=Limnorchis sparsiflora, L. ensifolia)	Canyon bog orchid	Orchidaceae	N	9	☑	☑
Potentilla hippiana	Woolly cinquefoil	Rosaceae	N	5	☐	☐
Potentilla recta	Sulphur cinquefoil	Rosaceae	I B	0	☐	☐
Pseudognaphalium stramineum	Winged cudweed	Asteraceae	N	4	☑	☑

Appendix A

Scientific Name	Common Name	Family	Origin	C-Value	Voucher Photo	
Pyrola rotundifolia subsp. asarifolia	Roundleaf wintergreen	Pyrolaceae	N	8	☐	☐
Rumex triangulivalvis (=R. salicifolius)	Willow dock	Polygonaceae	N	4	☐	☐
Sidalcea candida	White checkermallow	Malvaceae	N	5	☐	☐
Sidalcea neomexicana	Rocky Mountain checker-bloom	Malvaceae	N	5	☐	☐
Sisyrinchium montanum	Rocky Mountain blue-eyed grass	Iridaceae	N	6	☐	☐
Solidago velutina subsp. sparsiflora	Three-nerve goldenrod	Asteraceae	N	6	☑	☐
Spiranthes romanzoffiana	Hooded lady's tresses	Orchidaceae	N	7	☐	☐
Symphyotrichum laeve var. geyeri (=Aster)	Smooth blue aster	Asteraceae	N	6	☑	☐
Tanacetum vulgare	Common tansy	Asteraceae	I B	0	☐	☐
Taraxacum officinale	Dandelion	Asteraceae	I	0	☐	☐
Thalictrum fendleri	Fendler's meadow-rue	Ranunculaceae	N	6	☐	☐
Trifolium pratense	Red clover	Fabaceae	I	0	☐	☐
Typha latifolia	Broadleaf cattail	Typhaceae	N	2	☐	☐
Valeriana edulis	Tobacco root; Edible valerian	Valerianaceae	N	7	☐	☐
Ferns and Fern Allies						
Equisetum arvense	Field horsetail	Equisetaceae	N	4	☐	☐
Equisetum laevigatum (=Hippochaete)	Smooth horsetail	Equisetaceae	N	4	☑	☐
Annual/Biennial Forbs						
Alyssum alyssoides	Pale madwort	Brassicaceae	I	0	☐	☐
Arctium minus	Lesser burdock	Asteraceae	I C	0	☐	☐
Atriplex heterosperma	Twoscale saltbush	Chenopodiaceae	I	0	☑	☐
Atriplex subspicata	Saline saltbush	Chenopodiaceae	N	3	☑	☐
Carduus acanthoides	Plumeless thistle	Asteraceae	I B	0	☐	☐
Carduus nutans subsp. macrolepis	Musk thistle (Nodding plumeless thistle)	Asteraceae	I B	0	☐	☐
Cirsium vulgare	Bull thistle	Asteraceae	I B	0	☐	☑
Cynoglossum officinale	Houndstongue	Boraginaceae	I B	0	☐	☐
Erodium cicutarium	Redstem stork's bill	Geraniaceae	I C	0	☐	☐

Appendix A

Scientific Name	Common Name	Family	Origin	C-Value	Voucher	Photo
Lepidium campestre (=Neolepia)	Field pepperweed	Brassicaceae	I	0	☐	☐
Lepidium perfoliatum	Clasping pepperweed	Brassicaceae	I	0	☐	☐
Melilotus albus	White sweetclover	Fabaceae	I	0	☐	☐
Melilotus officinale	Yellow sweetclover	Fabaceae	I	0	☐	☐
Mentha arvensis	Wild mint	Lamiaceae	N	4	☐	☐
Sisymbrium altissimum	Tumble mustard	Brassicaceae	I	0	☐	☐
Sonchus arvensis	Field sowthistle	Asteraceae	I C	0	☐	☐
Tragopogon dubius subsp. major	Western salsify	Asteraceae	I	0	☐	☐
Verbascum thapsus	Mullein	Scrophulariaceae	I C	0	☐	☐
Annual Graminoids						
Anisantha tectorum	Cheatgrass	Poaceae	I C	0	☐	☐
Bromus japonicus	Japanese brome	Poaceae	I	0	☐	☐

Source: Field reconnaissance by R.Orthner in 2017 and EM Ecological (2007). Notes: Nomenclature generally follows Flora of Colorado (Ackerfield 2015) with Weber and Wittmann (2012) synonyms in parantheses. Origin: N=Native; I=Introduced, I+A,B,C,W = Colorado Listed Noxious Weed and Rank. C-Value from Rocchio (2007), where 0 (non-native species); 1-3 (commonly found in non-natural areas), 4-6 (equally found n natural and non-natural areas); 7-9 (obligate to natural areas but can sustain some habitat degredation); 10 (obligate to high quality natural areas (relatively unaltered from pre-European settlement). Voucher / Photo: checkmark indicates whether a voucher and/or photograph were taken, respectively.

Appendix B. Vertebrates Known or Suspected to Occur on Filoha Meadows Nature Preserve

Birds are listed in Table B1, the mammals are listed in Table B2, and the amphibians and reptiles are listed in Table B3.

Table B1: Birds		
	Common Name	**Latin Name**
1	American coot	*Fulica americana*
2	American dipper	*Cinclus mexicanus*
3	American kestrel	*Falco sparverius*
4	American peregrine falcon	*Falco peregrinus anatum*
5	American robin	*Turdus migratorius*
6	Bald eagle	*Haliaeetus leucocephalus*
7	Bank swallow	*Riparia riparia*
8	Barn swallow	*Hirundo rustica*
9	Belted kingfisher	*Ceryle alcyon*
10	Black-billed magpie	*Pica hudsonia*
11	Black-capped chickadee	*Poecile atricapillus*
12	Black-headed grosbeak	*Pheucticus melanocephalus*
13	Dusky grouse	*Dendragapus obscurus*
14	Blue-gray gnatcatcher	*Polioptila caerulea*
15	Blue-winged teal	*Anas discors*
16	Broad-tailed hummingbird	*Selasphorus platycercus*
17	Brown creeper	*Certhia americana*
18	Brown-headed cowbird	*Molothrus ater*
19	Bushtit	*Psaltriparus minimus*
20	Canada goose	*Branta canadensis*
21	Canyon wren	*Catherpes mexicanus*
22	Cedar waxwing	*Bombycilla cedrorum*
23	Chipping sparrow	*Spizella passerina*
24	Cinnamon teal	*Anas cyanoptera*
25	Common merganser	*Mergus merganser*
26	Common nighthawk	*Chordeiles minor*
27	Common poorwill	*Phalenoptilus nuttallii*
28	Common raven	*Corvus corax*
29	Cooper's hawk	*Accipiter cooperii*
30	Cordilleran flycatcher	*Empidonax occidentalis*
31	Dark-eyed junco	*Junco hyemalis*
32	Downy woodpecker	*Picoides pubescens*
33	Dusky flycatcher	*Empidonax oberholseri*
34	Evening grosbeak	*Coccothraustes vespertinus*
35	Flammulated owl	*Otus flammeolus*
36	Fox sparrow	*Passerella iliaca*
37	Gadwall	Anas strepera

Table B1: Birds		
	Common Name	**Latin Name**
38	Golden eagle	*Aquila chrysaetos*
39	Great blue heron	*Ardea herodias*
40	Great-horned owl	*Bubo virginianus*
41	Green-tailed towhee	*Pipilo chlorurus*
42	Green-winged teal	*Anas crecca*
43	Hairy woodpecker	*Picoides villosus*
44	House finch	*Carpodacus mexicanus*
45	House wren	*Troglodytes aedon*
46	Lazuli bunting	*Passerina amoena*
47	Lewis' woodpecker	*Melanerpes lewis*
48	Lincoln's sparrow	*Melospiza lincolnii*
49	Long-eared owl	*Asio otus*
50	MacGillivray's warbler	*Oporornis tolmiei*
51	Mallard	*Anas platyrynchus*
52	Mountain bluebird	*Sialia currucoides*
53	Mountain chickadee	*Poecile gambeli*
54	Mourning dove	*Zenaida macroura*
55	Northern flicker	*Colaptes auratus*
56	Northern harrier	*Circus cyaneus*
57	Northern goshawk	*Accipiter gentilis*
58	Northern pygmy owl	*Glaucidium gnoma*
59	Northern rough-winged swallow	*Stelgidopteryx serripennis*
60	Northern saw-whet owl	*Aegolius acadicus*
61	Orange-crowned warbler	*Vermivora celata*
62	Pinyon jay	*Gymnorhinus cyanocephalus*
63	Plumbeous vireo	*Vireo plumbeus*
64	Prairie falcon	*Falco mexicanus*
65	Pygmy nuthatch	*Sitta pygmaea*
66	Red-naped sapsucker	*Sphyrapicus nuchalis*
67	Red-tailed hawk	*Buteo jamaicensis*
68	Red-winged blackbird	*Agelaius phoeniceus*
69	Rock wren	*Salpinctes obsoletus*
70	Ruby-crowned kinglet	*Regulus calendula*
71	Sharp-shinned hawk	*Accipiter striatus*
72	Song sparrow	*Melospiza melodia*
73	Sora	*Porzana carolina*
74	Spotted sandpiper	*Actitus macularis*
75	Spotted towhee	*Pipilo maculatus*
76	Steller's jay	*Cyanocitta stelleri*
77	Townsend's solitaire	*Myadestes townsendi*
78	Tree swallow	*Tachycineta bicolor*
79	Turkey vulture	*Cathartes aura*
80	Vesper sparrow	*Pooecetes gramineus*

Table B1: Birds		
	Common Name	**Latin Name**
81	Violet-green swallow	*Tachycineta thalassina*
82	Virginia rail	*Rallus limicola*
83	Warbling vireo	*Vireo gilvus*
84	Western meadowlark	*Sturnella neglecta*
85	Western screech-owl	*Otus kennicottii*
86	Western scrub jay	*Aphelocoma californica*
87	Western tanager	*Piranga ludoviciana*
88	Western wood-pewee	*Contopus sordidulus*
89	White-breasted nuthatch	*Sitta carolinensis*
90	White-crowned sparrow	*Zonotrichia leucophrys*
91	White-throated swift	*Aeronautes saxatalis*
92	Wild turkey	*Meleagris gallopavo*
93	Wilson's snipe	*Gallinago delicata*
94	Wilson’s warbler	*Cardellina pusilla*
95	Yellow warbler	*Setophaga petechia*
96	Yellow-rumped warbler	*Setophaga coronata*

Table B2. Mammals		
	Common Name	**Latin Name**
1	American badger	*Taxidea taxus*
2	American beaver	*Castor canadensis*
3	American red squirrel	*Tamiasciurus hudsonicus*
4	American water shrew	*Sorex palustris*
5	Big brown bat	*Eptesicus fuscus*
6	Black bear	*Ursus americanus*
7	Bobcat	*Lynx rufus*
8	Bushy-tailed woodrat	*Neotoma cinerea*
9	Common muskrat	*Ondatra zibethicus*
10	Coyote	*Canis latrans*
11	Deer mouse	*Peromyscus maniculatus*
12	Dwarf shrew	*Sorex nanus*
13	Ermine (or short-tailed weasel)	*Mustela erminea*
14	Fringed myotis	*Myotis thysanodes*
15	Golden-mantled ground squirrel	*Spermophilus lateralis*
16	Hoary bat	*Lasiurus cinereus*
17	Least chipmunk	*Tamias minimus*
18	Little brown myotis	*Myotis lucifugus*
19	Long-legged myotis	*Myotis volans*
20	Long-tailed vole	*Microtus longicaudus*
21	Long-tailed weasel	*Mustela frenata*

Table B2. Mammals		
	Common Name	**Latin Name**
22	Masked shrew	*Sorex cinereus*
23	Montane shrew	*Sorex monticolus*
24	Montane vole	*Microtus montanus*
25	Mountain lion	*Felis concolor*
26	Mule deer	*Odocoileus hemionus hemionus*
27	North American moose	*Alces americanus*
28	Northern pocket gopher	*Thomomys talpoides meritus*
29	Mountain cottontail	*Sylvilagus nuttallii*
30	Red fox	*Vulpes vulpes*
31	Rock squirrel	*Spermophilus variegatus*
32	Silver-haired bat	*Lasionycteris noctivagans*
32	Striped skunk	*Mephitis mephitis*
33	Southern red-backed vole	*Clethrionomys gapperi*
34	Townsend's big-eared bat	*Corynorhinus townsendii pallescens*
35	Uinta chipmunk	*Tamias umbrinus*
36	Rocky Mountain bighorn sheep	*Ovis canadensis canadensis*
37	Rocky Mountain elk	*Cervus elaphus nelsoni*
38	Water shrew	*Sorex palustris*
39	Western jumping mouse	*Zapus princeps*
40	Wyoming ground squirrel	*Spermophilus elegans*
41	Yellow-bellied marmot	*Marmota flaviventris*

Table B3. Amphibians and Reptiles		
	Common Name	**Latin Name**
1	Bullsnake (or Gopher snake)	*Pituophis catenipher*
2	Northern leopard frog	*Rana pipiens*
3	Tiger salamander	*Ambystoma tigrinum*
4	Western chorus frog	*Pseudacris triseriata*
5	Western terrestrial garter snake	*Thamnophis elegans*