Silt River Preserve

Ecological Assessment and Recommendations Report

March 2021

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ASPEN VALLEY LAND TRUST

Contents

1.0 Introduction

The purpose of this document is to present a comprehensive analysis of the existing ecological communities and their current condition within Silt River Preserve property to assist in the development of the Property Master Plan. DHM Design Ecological Services staff have completed a comprehensive site analysis to evaluate existing ecological conditions, opportunities, and constraints as they relate to current and future management of the property. The information included in this report is intended to guide decisions for restoration, recreational and agricultural use on the property. The Town of Silt and Aspen Valley Land Trust envision the Master Planning and development of the property to harmonize the relationship between recreation, agriculture and ecological function with a minimal and passive approach. This ecological evaluation takes into consideration this overarching goal and describes the natural resources that are present on the property including vegetation types, plant communities, aquatic resources and wildlife habitat. Detailed recommendations by resource type can be found in *Appendix 3 – Restoration Activities Table*.

2.0 Methods

2.1 Desktop Analysis

To initiate the property analysis, DHM Design Ecological Services staff completed a comprehensive desktop analysis to assess and evaluate existing data for the property. The desktop review includes all data and information provided to date by AVLT and the Town of Silt. In addition, DHM conducted a further refined review of available resource data for the property that would best support the master plan vision. This analysis provides the most available resource data to date including but not limited to:

- 2010 Baseline Documentation Report (2010)
- AVLT Yearly Conservation Easement Monitoring Reports (2011-2019)
- Silt River Preserve Deed of Conservation Easement
- GOCO Resilient Communities Program Grant Application (2020)
- Silt River Preserve Management Plan
- South Side Conservation District Noxious Vegetation Mapping (2018)
- Still Water Ranch Wetland Permit Application (2006)
- National Vegetation Classification Standard, Version 2 (2008)
- USDA NRCS Geospatial Data Gateway (2020)
- U.S. Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPAC)
- Upper Colorado River Endangered Fish Recovery Program (Documents and Publications)
- National Wetlands Inventory (NWI) Wetland Mapper (USFWS) 2020
- NRCS Web Soils Mapper (2020)
- Google Earth Imagery
- Natural Resources Conservation Service (NRCS) National Agriculture Imagery Program
  (NAIP) aerial photographs.

2.2 Field Survey

DHM Design Ecological Services staff completed detailed pedestrian surveys of the property on February 10 and an additional follow up site visit March 12, 2021. DHM surveyed the entire property to assess and map existing ecological conditions and evaluate opportunities and constraints for future management of the property. GPS data was collected in ArcGIS Collector on a handheld mobile device connected to an external GNSS receiver. The average accuracy for data collection was 8 -14 inches.

2.3 Data Processing and Mapping

GIS data was processed in ArcPro version 2.4.0 and mapping digitization for property features was completed at a 1:500 scale using high resolution aerial imagery available through ESRI databases, Google Earth and NAIP.

3.0 Existing Conditions

3.1 Location

Silt River Preserve is located on the southern bank of the Colorado River in Garfield County, approximately 2.25 miles south of the Town of Silt (0.6 air miles) (figure 1). Access to the property is located off of County Road 346, approximately 2 miles south of Interstate 70. The legal description for the property is included below:

County, State: Garfield County, Colorado

Legal Description: Section: E ½ of Section 9 and W ½ of Section 10, Township: 6 S, Range: 92

Garfield County Parcel Number: 217909400733

Latitude and Longitude: 39 32’ 12.65” N;

107 39’ 44.30” W

U.S. Geological Survey (USGS) 7.5 Minute Quadrangle: Silt, CO 2019

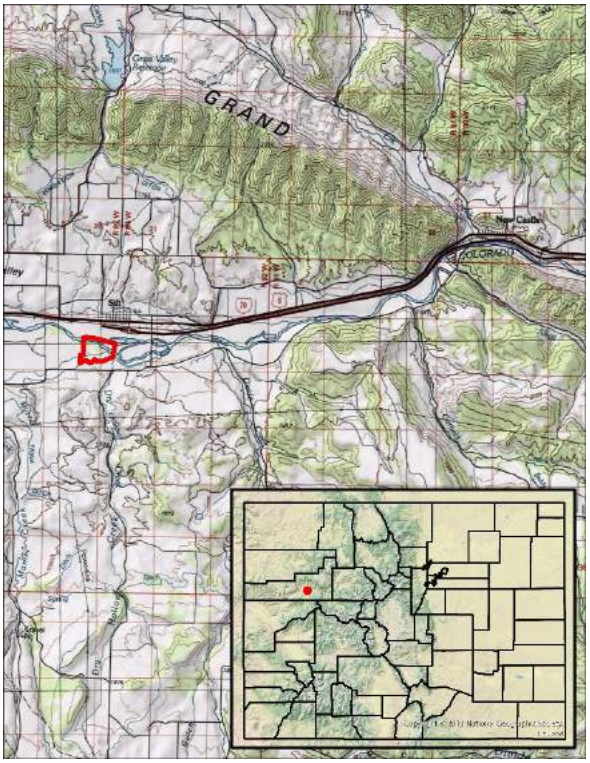

Figure 1 - Project location map

3.2 Landform, Elevation and Size

Silt River Preserve is a 132-acre parcel situated at approximately 5,410 ft of elevation consisting of relatively flat topography, in the gently terraced floodplain of the Colorado River.

3.3 Soils

The soil types on site are predominantly loamy soils that range from a sandy to clayey loam texture. They are well drained to poorly drained with the more poorly drained soils being found in the riparian woodland adjacent to the Colorado River. A total of five (5) mapped NRCS soil map units (MU) are located within Silt River Preserve and are shown in *Appendix 5 – NRCS Soil Survey Report*, along with more detailed soil descriptions. It is recommended that soil analysis is completed prior to restoration efforts to fully understand the composition and state of the soils in the area. Soil units include:

- **3** Arvada loam, 1 to 6 percent slopes (35.3%)
- **27** Halaquepts, nearly level (5.1%)
- **65** Torrifluvents, nearly level (23.7%)
- **72** Wann sandy loam, 1 to 3 percent slopes (25.6%)
- **73** Water (10.3%)

3.4 Hydrology

The Colorado River is the primary hydrological feature within the Preserve. This section of the Colorado River is located within the Dry Hollow Creek – Colorado River watershed which is approximately 31,424.86 acres. Additional stream segment data for the Colorado River is included in Table 1 below.

Table 1 - Stream Segment Data (NHDP V2)

For the stream segment	Value
Stream Name	Colorado River
Stream Order	6
Stream Level	4
Mean annual flow volume (estimate)	3,920.49 cfs
Mean annual flow velocity (estimate)	2.96 fps
Stream Length	0.63 miles

The Colorado River runs east to west along the northern and eastern portion of the Preserve. For a portion of the property, the river in this section is channelized with two (2) distinct channels, a northern and southern channel. The northern channel contains the majority of the water during low flow periods. The southern channel contains year-round flow and is more active during a higher flow. At highwater, there is an overflow channel that is activated and floods large portion of the riparian corridor. These two channels reconnect on the property and form a single channel downstream of the island. Other Hydrological features on the property include two (2) canals. These are discussed in the water rights section.

Figure 2 – Secondary side channel located at Northern end of property.

3.5 Ecological Setting

Silt River Preserve is located in the Warm Central Desertic Basin (34B) Major Land Resource Area (MLRA) and is situated in the Colorado River valley at the northern foot of Battlement Mesa in Western Colorado. The location of the property is on the far eastern extent of the Colorado Plateau and is considered to be in a semiarid climatic zone. The ecology and vegetation of the warm central desertic basin is strongly influenced by the hydrology of the major river systems that arise from the surrounding high elevation mountains. Specific to the Silt River Preserve, the hydrology of the site is influenced by the seasonal high flows and flooding from the Colorado River and artificially induced water tables from the irrigation ditches that bisect the property. The floodplains and Riparian areas are often dominated by large cottonwoods and a diversity of shrub species that are adapted for the more mesic site conditions with regular to periodic flooding. As the topology transitions from the floodplain to the upland communities, the conditions become more xeric; low growing shrubs, forbs and grasses that are more suited to the dryer conditions are dominant.

The current ecological condition of the Preserve is a result of past disturbances. Conversion of the land to agricultural use for grazing and crop production has heavily impacted the site. Many introduced species are now dominant to co-dominant species within the property.

3.6 Vegetation

3.6.1 Vegetative Communities

From a broad ecological perspective, the land encompassing Silt River Preserve can be categorized as a riparian/floodplain community type with transitional upland communities. These broader categories are primarily distinguishable by land form and positioning in relation to the Colorado River. Additionally, historic land uses, including intensive agricultural use, establishment of irrigation ditches and aggregate mining activities have drastically altered the vegetation and associated communities from their native, natural state.

To better define the site ecology and guide restoration and management needs for the property, the site has been delineated into a more descriptive and accurate set of niche ecological communities based upon defining vegetative and hydrologic characteristics. A total of five (5) vegetative communities and four (4) wetland types have been identified within the Silt River Preserve in accordance with the United States National Vegetation Classification (NVC, 2020) and Cowardin wetland classification system. These communities are listed below and shown in *Appendix 1 – Existing Conditions Maps.*

Vegetative Communities

- Western Interion Riparian Forest and Woodland
- Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland
- Great Basin-Intermountain Ruderal Dry Shrubland and Grassland
- Western Cool Temperate Pasture and Hayland – Western North American Ruderal Grassland & Shrubland
- Western Cool Temperate Close Grown Crops

Western Interior Riparian Forest and Woodland

This vegetative community is the dominant community found throughout the riparian corridor and lower floodplain of the Colorado River. It is distinguishable by the presence of large, mature cottonwood trees, with a more open understory composition. The canopy species of these forested areas are comprised of Rio Grande cottonwoods (*Populus deltoides wislizenii*) and narrowleaf cottonwoods (*Populus angustifolia*), with Siberian elm (*Ulmus pumila*) starting to co-dominate in areas. Periodic flooding is imperative in propagating natural ecological succession of these cottonwood stands, allowing for establishment of new growth in areas of scouring and deposition with adequate hydrology. Conditionally, this community appears to trending towards later seral – to climax stages of succession, with a lack of vertical or age class diversity among the cottonwood species. Current water regimes and increased drought conditions may be contributing towards this, or it may be function of changing river morphology in the area.

Figure 3 - Mature Rio Grande cottonwoods in western interior riparian forest and woodland.

The understory vegetation consists of scattered shrubs and occasional thickets with a graminoid and forb layer of a more ruderal composition. The understory vegetation is indictive of disturbances from previous land use and external influences from adjacent properties with noted high densities of noxious vegetation and non-native species.

Common shrub species include three-leaf sumac (*Rhus trilobata*), silver buffaloberry (*Shepherdia argentea*), coyote willow (*Salix exigua*), and river hawthorn (*Cratageus rivularis*). Invasive Russian olive (*Eleagnus angustifolia*) and salt cedar (*Tamarisk* spp.) establishment has been reduced over the years through concentrated removal efforts, but the species are still present a significant part of the overall vegetative characteristic of this community.

Common graminoid species include: saltgrass (*Distichlis spicata*), smooth brome (*Bromus inermis*), barnyard grass (*Echinocloa crus-galli*), redtop (*Agrostis gigantea*), rabbitfoot (*Polygonum monspeliensis*), reed canary grass (*Phalaris arundinacea*), Spikerush (*Eliocharis spp.*), Arctic rush (*Juncus arcticus*), and horsetail (*Equisetum* spp.).

Common forb species include: common cocklebur (Xanathium strumarium), wild licorice (*Glycyrrhiza lepidota*), fleabane (*Erigeron* spp.), Ironweed (*Bassia hyssopifolia*), and Western white clematis (*Clematis ligusticifolia*) with high densities of noxious and nuisance vegetation consisting of: Russian knapweed (*Acroptilon repens*), kochia (*Bassia scoparia*), curly dock (*Rumex crispus*), Canada thistle (*Cirsium arvense)*, bull thistle (*Cirsium vulgare)*, common tansy (*Tanacetum vulgare*), oxeye daisy (*Leucanthemum vulgare)* and hoary cress (*Lepidium draba*).

Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland

This vegetative community is primarily found along the backchannel portion of the Colorado River, on the upper benches outside of the active channel movement. They are situated above the wetland communities, where adequate hydrology is present, but not regularly inundated and are distinguishable by the dominance of mid to tall shrub species establishment. Three leaf sumac (*Rhus trilobata*) is the prominent shrub species throughout, with silver buffaloberry (*Shepherdia argentea*) becoming codominant in some locations. other observed native shrub species found throughout this community include: river hawthorn (*Cratageus rivularis*), honeysuckle (*Lonicera* spp.), and red osier dogwood (*Cornus sericea*). Coyote willow (*Salix exigua*) is commonly found along the margins with the scrub shrub wetland boundaries. Non-native invasive shrub species include (*Eleagnus angustifolia*) and salt cedar (*Tamarisk* spp.).

Figure 4 - Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland existing on property.

Within the dense shrub dominated stands, the scattered understory vegetation consists largely of graminoid species, with smooth brome (*Bromus inermis)* and reed canary grass (*Phalaris arundinacea)* dominating. Dense populations of noxious forb species, including Canada thistle (*Cirsium arvense)* and bull thistle (*Cirsium vulgare*) have also been observed in more open areas of this community.

Great Basin-Intermountain Ruderal Dry Shrubland and Grassland

This vegetative community occupies the more xeric, upland areas that not been completely converted to pasture or hayland. These areas contain remnants of a shrubland community, but are dominated by non-native vegetation or have high coverage of disturbed, bare soils. Common shrubs that are indictive of this community are big sagebrush (*Artemisia tridentata*), rubber rabbitbrush (*Ericameria nauseosa*) and greasewood (*Sarcobatus vermiculatus*). Throughout a large portion of this community, the forb and graminoid layer has been highly disturbed with expansive areas of bare ground. When present, the forb and graminoid composition is dominated by non-native species. Common graminoid species include: crested wheatgrass (*Agropyron cristatum*), cheatgrass (*Bromus tectorum*), and some native western wheatgrass (*Pascopyrum smithii*).

Figure 5 - Great Basin-Intermountain Ruderal Dry Shrubland and Grassland

Common forb species include: Russian knapweed (*Acroptilon repens*), kochia (*Bassia scoparia*), Scotch thistle (*Onopordum acanthium*), Russian thistle (*Salsola tragus*) and various annual mustard species. the succulent species Prickly pear cactus (*Oputia* sp.) and Claret cup (*Echinocereus triglochidiatus*).

Western Cool Temperate Pasture and Hayland – Western North American Ruderal Grassland & Shrubland

Historically, the property has been used as pasture for domestic livestock and hay production. Prior to the 1960's, this was the primary use for the property. In more recent time, the irrigation and maintenance of the property fallen into neglect, resulting in deterioration of much of the land and the opportunity for noxious and non-native weedy vegetation to establish. In 2010, Aspen Valley Land Trust purchased the property and put it into a conservation easement. Recently, new irrigation infrastructure has been installed on the southern pasture/hayfields and these areas have been actively restored to contain a more sustainable composition of pasture/hayland species. While the large pasture in the middle of the property has remained in a more ruderal state, consisting of a highly disturbed condition of bare soils and continued establishment of weedy species. Common species graminoid found within this area consist of remnant pasture grasses, including blue bunch wheatgrass, western wheatgrass, crested wheatgrass and smoot brome. In the more mesic areas, patches of saltgrass dominate. Common forb species include: Russian knapweed, kochia, field bindweed, scotch thistle, curlycup gumweed, purple aster and Russian thistle.

Figure 6 - Western Cool Temperate Pasture and Hayland – Western North American Ruderal Grassland & Shrubland on the property.

Western Cool Temperate Close Grown Crops

This vegetative community is located within the 3.5 acre fenced in area operated by Highwater Farms on the southeast side of the property. This area has been developed for the production of various produce and is managed for the growth of organic vegetables.

3.6.2 Wetlands

Four (4) wetland types consisting of approximately 11.49 acres were identified and rapidly delineated during the field assessment at Silt River Preserve. The dominant wetland type observed was the seasonally flooded palustrine scrub shrub wetlands (PSS1C), accounting for approximately 42% (4.82 acres) of the wetlands identified. The wetland types are listed in *Table 2* below and shown in *Appendix 1 – Existing Conditions Maps*.

Table 2 - Silt River Preserve Wetland Types

Cowardin Type	Acres
PEM1C – Palustrine Emergent, Persistent, Seasonally Flooded	2.64
PEM1K – Palustrine emergent, Persistent, Artificially Flooded	1.02
PSS1C - Palustrine Scrub Shrub, Broad-leaved Deciduous, Seasonally Flooded	4.82
PUBFx – Palustrine Unconsolidated Bottom, Semi permanently Flooded, Excavated	3.01
Wetlands Total	***11.49***

PEM1C – Palustrine Emergent, Persistent, Seasonally Flooded (2.64 acres)

These emergent wetlands are located along the irrigation ditches and drainages where the hydrology is directly correlated with flow and water levels within the channels. Common vegetative species include softstem bullrush (*Schoenoplectues tabernaemontani*), reed canary grass (*Phalaris arundinaceae*) and cattails (*Typha* spp.)

PEM1K – Palustrine emergent, Persistent, Artificially Flooded (1.02 acres)

This emergent wetland is distinguishable from the seasonally flooded emergent wetlands by its species composition, location and source of hydrology. This wetland is located in a slight swale north of the Last Chance Ditch where a ditch has been cut to drain the ditch when needed. The hydrology for this wetland is reliant on the overflow and drainage of the Last Chance Ditch which results in the flooding of the lower swale area. The vegetation in this area is sparse, but consist of reed canary grass (*Phalaris arundinace)* and curly dock (*Rumex crispus*).

PSS1C - Palustrine Scrub Shrub, Broad-leaved Deciduous, Seasonally Flooded (4.82 acres)

These scrub shrub wetlands occur along the banks of the side channel of the Colorado River where the hydrology is directly correlated with seasonal flooding and inundation of high-water events with the spring runoff. The distinguishing characteristic is the high-density canopy cover of coyote willow (Salix exigua) and minimal tree cover. The graminoid and herbaceous forbs understory is composed primarily of reed canary grass (*Phalaris arundinaceae)* and redtop (*Agrotsis gigantica*).

Figure 7 - Palustrine Scrub Shrub, Broad-leaved Deciduous, Seasonally Flooded wetland area.

Figure 8 - Palustrine Unconsolidated Bottom, Semi permanently Flooded, Excavated pond.

PUBFx – Palustrine Unconsolidated Bottom, Semi permanently Flooded, Excavated (3.01 acres)

A total of three (3) freshwater ponds exists on the property which are remnants from the past aggregate mining activities. These ponds are seasonally inundated, and have established, high densities of hydrophytic emergent vegetation. Given the transformation of these ponds, they may be considered emergent wetlands with current water regime in the arid west. With more consistent drought conditions, these ponds have experienced shorter time periods of inundation. Common vegetative species include softstem bullrush (*Schoenoplectues tabernaemontani*), reed canary grass (*Phalaris arundinaceae*), three-square bulrush (scirpus americanus) and cattails (*Typha* spp.).

3.8 Wildlife

The Riparian Ecosystem of the Colorado River and the associated wetland systems of Silt River Preserve supports a diversity of wildlife, providing critical habitat for many species. In addition to onsite observations, the Colorado Parks and Wildlife (CPW) Species Activity Map (SAM) and the USFS Information for Planning and Consultation (IPaC) was used to determine potential species that could inhabit Silt Preserve within the planning area. Wildlife species associated with CPW's SAM data are included in *Table 2* below and mapping is included in *Appendix 3 – Supporting Maps*. Notable mapped CPW habitat within Silt River Preserve includes active bald eagle and blue heron nesting sites and various other important habitats for a diversity of species, as listed in *Table 2*. Other wildlife utilization on the property includes mule deer and elk. According to Travis ByBee, the district wildlife manager for CPW, there is a group of 10-15 mule deer that utilize the property year-round. During winter, more mule deer tend to utilize the property and up to 100 head have been observed on the property in any given winter (ByBee - personal communication, 2021). Seasonal closures for these species and potentially others should be considered as part of the overall property management plan. It is recommended that consultation with CPW occur prior to any development of the property. In addition to the species listed above, and shown in table 3 below, the preserve is likely to provide habitat to a number of other species, including: northern leopard frogs, coyote, fox, bobcat, beaver, badger, striped skunk, raccoon, cottontail, jackrabbit, porcupine, long-tailed weasel, squirrels, chipmunks, mice, voles, and shrews.

Table 3 -Colorado Parks and Wildlife Species Activity Map Species List for Silt River Preserve

Mammals			**Reptiles**	
Species	**Habitat Utilization**		**Species**	**Habitat Utilization**
Black Bear (*Ursus americanus)*	Overall Range		Bull Snake (*Pituophis catenifer sayi)*	Overall Range
Brazilian Free-tailed Bat (*Tadarida brasiliensis*)	Overall Range		Common Sagebrush Lizard (*Sceloporus graciosus*)	Overall Range
Elk (*Cervus canadensis*)	Overall Range Winter Range Winter Concentration Severe Winter Range		Common Side-blotched Lizard (*Uta stansburiana*)	Overall Range

Mountain Lion (*Puma concolor*)	Overall Range Human Conflict Area	Eastern Collared Lizard (*Crotaphytus collaris)*	Overall Range
Mammals		**Reptiles**	
Species	**Habitat Utilization**	**Species**	**Habitat Utilization**
Mule Deer (*Odocoileus hemionus*)	Overall Range Winter Range Winter Concentration Severe Winter Range Resident Population	Hernandez's Short-horned Lizard (*Phrynosoma hernandesi)*	Overall Range
River Otter (*Lontra canadensis*)	Overall Range Winter Range	Milksnake *(Lampropeltis triangulum*)	Overall Range
Birds		North American Racer (*Coluber constrictor*)	Overall Range
Species	**Habitat Utilization**	Ornate Tree Lizard (*Urosaurus ornatus*)	Overall Range
Bald Eagle (*Haliaeetus leucocephalus*)	Active Nest Site Roost Site Summer Forage Winter Forage Winter Range	Plateau Striped Whiptail (*Cnemidophorus septemvittatus*)	Overall Range
Canada Geese (*Branta canadensis*)	Brood Concentration Foraging Area Production Area Winter Concentration Winter Range	Prairie Lizard (*Sceloporus undulatus*)	Overall Range
Great Blue Heron (*Ardea herodias*)	Nesting Area Foraging Area	Smooth Greensnake (*Opheodrys vernalis*)	Overall Range
Birds		**Reptiles**	
Greater Sage Grouse (*Centrocercus urophasianus*)	Historic Habitat	Striped whipsnake (*Masticophis taeniatus*)	Overall Range
Osprey (*Pandion haliaetus*)	Foraging Area	Terrestrial Gatersnake (*Thamnophis elegans*)	Overall Range
Wild Turkey (*Meleagris gallopavo*)	Overall Range Winter Range Winter Concentration Area Production Area Roose Site	Tiger Whiptail (*Aspidoscelis tigris*)	Overall Range

U.S. Fish and Wildlife IpAC data was accessed to determine what potential Threatened and Endangered Species (T&E) species and habitat could exist on the property. *Table 4* includes a list of T&E species with the potential to occur within the preserve. In review of preferred habitat for Mexican Spotted Owl's, it is deemed unlikely that they would inhabit the preserve.

The vegetative communities within the preserve are not suitable for the Mexican Spotted Owl, as they prefer pine-oak forests or mixed conifer forests dominated by Douglas-fir and pine species. Suitable habitat for the Yellow-billed Cuckoo may exist on the property, but the bird is quite rare in the west, and though occurrence of this species unlikely, it should be considered in management efforts. If impacts to potential habitat are likely to occur, it is recommended that a consultation with USFWS take place prior to any impact to the riparian corridor.

In addition to T&E species, A review of USFWS migratory birds of concern (MBOC) was completed and is shown in Table 5. There is suitable habitat for all species listed, with two active bald eagles nest located on site. During the site visit, a mating pair of bald eagles were observed and many of the mature cottonwoods have evidence of woodpecker activity. Prior to any site development, Colorado Parks and Wildlife recommended buffer zones and seasonal restrictions for Colorado raptors (2020) should be consulted to understand species specific recommendations and potential seasonal closures. Swainson's and red-tailed hawks were observed during the site inventory.

Birds	
Species	**Status**
Mexican Spotted Owl (*Strix occidentalis lucida*)	Threatened
Yellow-billed Cuckoo (*Coccyzus americanus*)	Threatened
Fishes	
Species	**Status**
Bonytail (*Gila elegans*)	Endangered
Colorado Pikeminnow (*Ptychocheilus lucius*)	Endangered
Humpback Chub (*Gila cypha*)	Endangered
Razorback Sucker (*Xyrauchen texanus*)	Endangered

Table 4 - USFS Threatened and Endangered Species

Species	**Breeding Season**
Bald Eagle (*Haliaeetus leucocephalus*)	Dec 1 - Aug 31
Golden Eagle (*Aquila chrysaetos*)	Jan 1 -Aug 31
Gray Vireo (*Vireo vicinior*)	May 10 - Aug 20
Lewis's Woodpecker (*Melanerpes lewis*)	Apr 20 - Sep 30
Pinyon Jay (*Gymnorhinus cyanocephalus*)	Feb 15 - July 15
Rufous Hummingbird (*Selasphorus rufus*)	Breeds Elsewhere

3.8.1 Fisheries

The Colorado River between New Castle and Silt is an excellent trout fishery. The Silt River Preserve is near the upper end of the fisheries transition zone, where the water temperature generally begins to increase. Additionally, the section of river within the Preserve is just upstream of critical habitat zones for native species. Ongoing efforts in the region include the removal of small mouth bass (*Micropterus dolomieu*) and northern pike (*Esox lucius*), and removal of non-native suckering species to protect the endemic blue head sucker (*Catostomus discobolus*), roundtail chub (*Gila robusta*), and flannel mouth sucker (*Catostomus latipinnis*). Hofer rainbow trout and cutthroat trout are stocked for sport fishing nearby, due to their resistance to the parasite (*Myxobolus cerebralis*) which causes whirling disease.

3.9 Noxious Vegetation

A total of fourteen (14) species classified as noxious weeds in Colorado were observed within Silt River Preserve (*Table 6*). Detailed mapping was not completed at the time of the survey, but comprehensive mapping provided by South Side Conservation District have been provided for reference and are included in *Appendix 4 – Supporting Documentation.* Additionally, many non-native weedy species have been observed on site, including: Kochia, Russian thistle, curly dock, reed canary grass, and various annual mustard species. These species are known to be

aggressive and are considered to be an ecological threat in grasslands, pastures, wet meadows and disturbed areas along waterways. Therefore, these species are included in management recommendations. Specific mitigation activities have been identified and are included in *Appendix 3 – Restoration Activities Table*.

Table 6 - Noxious Weed Species Observed at Silt River Preserve

Scientific Name	*Common Name*	*[1] State List Status*	*Life Cycle*
Acroptilon repens	Russian knapweed	B	Perennial
Bromus tectorum	Cheatgrass	C	Annual
Carduus nutans	Musk thistle	B	Biennial
Cirsium arvense	Canada thistle	B	Perennial
Cirsium vulgare	Bull thistle	B	Biennial
Convolvulus arvensis	Field bindweed	C	Perennial
Cynoglossum officinale	Houndstongue	B	Biennial
Elaeagnus angustifolia	Russian olive	B	Woody perennial
Lepidium draba	Hoary cress	B	Perennial
Leucanthemum vulgare	Oxeye daisy	B	Perennial
Onopordum acanthium	Scotch thistle	B	biennial
Tamarisk spp.	Salt cedar	B	Woody Perennial
Tanacetum vulgare	Common tansy	B	Perennial
Ulmus pumila	Siberian elm	Watch List	Woody perennial

The suppression and eradication of noxious vegetation within Silt River Preserve will be essential throughout all restoration and management activities for the site. Continued control of noxious and weedy vegetation should resume in the spring of 2021, with focused and intensive treatments occurring prior to restoration activities. Long term management of noxious vegetation will be necessary to restoration and maintenance of the ecological integrity of the site, and it is recommended that a comprehensive adaptive management plan be developed implementing chemical, mechanical, cultural and biological controls. In the fall of 2021, goat grazing was utilized throughout the preserve to manage vegetation on site. The use of goats provides many benefits in managing vegetation, but should be utilized as a targeted effort. Goats are not selective grazers, and while they have a positive impact on nuisance vegetation, they can also have negative impacts on established native vegetation. The continued utilization of goats should be prioritized for highly disturbed areas that will be actively re-seeded and planted. Following restoration efforts, goats should be no longer utilized in those area and more selective control efforts (mechanical, chemical and selective biological control) should be used.

In general, management efforts for existing noxious vegetation should be implemented based upon prevalence throughout the site and the target plants life cycle (annual, biennial, perennial and woody perennial species). Given the current conditions, the priority species for management, and the species that will be the most inhibiting to restoration activities, are Russian knapweed, Canada thistle, scotch thistle, reed canary grass and Siberian elm. The management of other species will also be important, and should not be neglected at expense of treating the more prevalent species. It is important to treat species before they become more wide spread, and the management of these species will be easier if managed no matter the size or extent of infestation. Persistent efforts, with timely treatments throughout the growing season – ideally spring, summer, and fall – should be utilized for the property, following the generalized management strategies.

3.9.1 Biennial Species

The biennial forb species found on site consist of bull thistle, musk thistle, Scotch thistle, and houndstongue. These species reproduce solely by seed and are considered aggressive due to their high seed production rates. The key to control for these species is to suppress seed production and to eliminate the seed bank. Targeting first year plant growth in the early rosette stage, and second year plant growth as it starts to bolt in the late spring/early summer with repeated applications of herbicide or mechanical control are strategies to manage these species. Specifically, management efforts for these species will utilize a hybrid option of mechanical and chemical treatments, targeting spring and fall rosettes with chemical spot spray treatments and mechanical removal of bolting to flowering plants in the summer months.

3.9.2 Perennial Species

The perennial, state listed noxious vegetation species found on site consist of Canada thistle, Russian knapweed, hoary cress, oxeye daisy, common tansy, and field bindweed. In general, these species are deep-rooted perennial forbs that have a tendency to form large colonies connected by a common root system. These root systems are often extensive, reaching depths of up to 20 feet and spreading up to 15 feet laterally. They have the ability to reproduce by rhizomes and via seed, therefore it is essential to both suppress seed production and systematically kill the below ground root systems. Using a combination of chemical, mechanical and cultural treatments, the key to control of these species is to continually stress the plants to diminish their energy reserves deplete their rhizomatous root systems beneath the ground.

3.9.3 Woody Species

The woody noxious vegetation species found on site include Siberian elm, Russian olive and salt cedar. It is evident that in the past, efforts have been made to control and suppress the growth and establishment of Russian olive and salt cedar. Efforts to eradicate these species should be part of the restoration efforts of the site. Siberian elm has become prevalent across the site and should be prioritized for removal. As there are numerous well established elm trees on site, the removal of these trees should be planned through a well-developed management plan over the course of a 3-5-year period. Planting and establishment of native trees, specifically in areas around the ponds on site, need to be part of this plan. Currently, despite their noxious tendencies the mature elm trees provide benefits that should not be immediately removed. Younger saplings, suckers, and lager trees with surrounding native woody vegetation should be immediately prioritized for removal. As more native tree species establish, the larger Siberian elm should be removed. Removal of tree species should take place annually in the fall months, with cut stump, girdling, or drill and fill efforts used for trees >1” diameter, and foliar treatments for trees <1” in diameter.

3.10 Water Rights

Water rights for the property are delivered by the Rising Sun Ditch, a large irrigation canal that traverses the southern boundary of the property. This includes 2.44 cfs of pre-compact water rights and a total of 4.3 cfs for irrigation (*Table* 6). The conservation easement over the property ensures that the water rights will forever remain attached to the property. The Preserve does not have a water right in the Last Chance Ditch. Property management should consider exploring a lease to use this overflow water for restoration activities.

In order to change the use of water on the Preserve to better fit the current and future use of the property, three actions can be taken:

1. Establish a relationship with a water attorney to potentially change a portion of the water rights to storage and/or piscatorial use while maintaining irrigation capacity.
2. Begin detailed recording of water use annually.
3. Establish base ground water conditions near the ponds to determine how the ditch system impacts pond levels and restoration potential.

Specific restoration water rights have been identified and are included in *Appendix 3 – Restoration Activities Table*.

Table 7 - Silt River Preserve Water Rights

Priority	Decree/Case No.	Total Amount Decreed	Amount Decreed for Property	Adjudication Date	Appropriation Date	Decreed Uses
16	CA 89	3.33 cfs	0.69 cfs	5-5-1888	12-5-1883	Irrigation
89	CA 89	8.5 cfs	1.75 cfs	5-5-1888	12-1-1886	Irrigation
226	CA 4954	9 cfs	1.86 cfs	7-9-1965	4-15-1953	Irrigation

4.0 Restoration Opportunities

The expansive extent and limited development of Silt River Preserve allows for numerous restoration opportunities to re-establish a high-quality riparian and transitional upland interface ecological community in close proximity to the Town of Silt. Additionally, the variety of habitat types and diversity of wildlife present at or in close proximity to the Preserve present unique opportunities to conduct restoration with specific species and habitat interventions. All recommendations are summarized in *Appendix 3 – Restoration Activities Table*.

Based upon current site conditions, areas have been identified for restoration utilizing the following types of interventions:

1. **Creation** – Identifying and re-establishing areas that are heavily degraded but have the opportunity, due to location, and surrounding vegetation for full restoration activities resulting in the creation of a new wetland, riparian or upland area.
2. **Enhancement** - The restoration of partially functioning uplands, wetlands and riparian areas. This can include noxious weed elimination, planting, seeding, and other restoration techniques.
3. **Preservation** - The protection of intact and functioning upland, wetland or riparian areas through ecologic and landscape planning. Installation of habitat enhancing elements as recommended by wildlife agencies.

It is recommended that restoration activities are focused on short, medium, and long-range planning activities and that established restoration goals are identified to provide a base for monitoring success. Through restoration, the goal is to return a large portion of the property to its proper ecological setting prior to anthropogenic influences. Due to the large scale of the site and the scope of potential restoration activities, there is the opportunity to study different means and methods for accomplishing restoration goals. Additionally, there are diverse opportunities to engage the local community in volunteer efforts and educational campaigns. These outreach event could have the additional benefit of gaining community buy in and support for the Preserve. This will not only provide the benefit of a restored ecological systems to the site, but allow the Town of Silt and AVLT to gain experience and build the capacity to conduct other restoration projects in the future. Locations and overview of restoration areas are provided *Table 8*, below, and found in *Appendix 2 – Restoration Opportunities Map.* Specific restoration activities have been identified and are included in *Appendix 3 – Restoration Activities Table*.

Table 8 - Silt River Preserve Restoration Recommendations

ECOSYSTEM ENHANCEMENT	
SHRUBLAND AND GRASSLAND	6.68
WETLAND	3.01
RIPARIAN	17.36
ECOSYSTEM CREATION	
SHRUBLAND AND GRASSLAND	33.1
WETLAND	1.02
ECOSYSTEM PRESERVATION	
SHRUBLAND AND WETLANDS	19.2

4.1 Ecosystem Creation

33.1 acres have been identified as ideal locations for shrubland and grassland ecosystem/habitat creation. These areas constitute highly degraded dry shrubland communities and the ruderal pasture adjacent to the forested riparian vegetative community.

In addition to the shrubland and grassland creation, 1.02 acres have been identified for wetland creation and enhancement. Currently, there is an approximately 1.02-acre emergent wetland located on the SW end of the property that is heavily reliant upon artificial hydrological inputs from the Last Chance Ditch. When the ditch needs to be emptied, or water diverted during high water events, this area becomes inundated. There is a slight depression in this area and wetland conditions have formed. The wetland and surrounding area are highly degraded. There is an opportunity to create a functional wetland community in this location which would require detailed deliberate efforts. Alternatively, the location and method of diverting water from the ditch may be re-assessed, and this area could be included in the shrubland and grassland creation efforts. The extent of the wetland habitat creation will depend on the desire and resources available for the efforts and a better understanding of the natural hydrology and depth groundwater will need to be assessed.

In order to revert the vegetative structure to its natural state for habitat creation, active removal and suppression of the noxious and non-native vegetation is needed as well as actively seeding and introducing native vegetation to the site through strategic planting and seeding efforts. Seeding will be the primary objective for re-vegetation efforts, but for key plant species that do not reproduce well from seed, transplanting of seedlings may be necessary. Additional plantings of shrub species in crucial areas are also recommended provide age class diversity and structure to stabilize the soil in areas of erosion. Having a well outlined and planned timeline for restoration events will be beneficial to the overall success of the project, in table x below, are the recommended guidelines to include and consider when developing restoration plans.

Figure 9 - Area identified as potential location for additional agricultural hay field.

Table 9 - Ecosystem Restoration Creation and Enhancement Activities

Creation Activities	**Description**
Establishment of Reference Community	The establishment of a reference community and conditions is essential to define the restoration goals and set a benchmark for success. It is recommended that a similar site with a healthy and functioning ecosystem be identified for comparison.
Development of Seed Mix and Planting List	Develop a comprehensive seed list based upon existing native plants found on site and reference documents for species found within the desired ecosystem. Use a diversity of graminoid and herbaceous forb species, selecting plants for their establishment, habitat and growth attributes. Each ecosystem should support a rich and vibrant habitat – selecting community specific species will help achieve this. Identify any desirable shrub or forb species that do not establish well from seed and assess whether transplanting of seedlings will be achievable.
Acquisition of seed and plant material	Identify means by which you will acquire all necessary seed material for revegetation efforts. Different options include: • Native Seed Collection and Propagation • Purchase native seed from a reputable seed distributor • Propagation of live woody plant material • Purchase native shrub and trees from locally sourced nursery Plan for storage of seed mixes and plant material
Site Preparation and Noxious Vegetation Control	Identify best seeding application methods based upon site conditions. Properly prepare site and soil bed for specified seeding method. Identify irrigation opportunities and constraints. Controlling exotic species is a critical part of most restoration efforts. Once exotics treatment has commenced, it is necessary to sustain it. Otherwise, the species will likely re-invade, especially in open habitat before native plants get established.
Revegetation	Seed areas using correct seed mix and seeding rate via drill seeding or other appropriate methods. The flat topography and openness of the site will lend itself well to drill seeding. Timing of seeding is essential and should be completed when water is most readily available and rain events or more frequent. Early spring or late fall dormant seedings will be the most viable options.
Maintenance and Management	Maintenance and management treatments are often necessary in a restoration project to ensure that conditions remain favorable for the establishment and continuing vigor of native plant communities. It will be essential to have irrigation in working order and an irrigation system in place following revegetation activities to provide water as needed to establish and support continued plant growth. Continued Noxious and Nuisance vegetation activities that minimize impacts to establishing native vegetation.
Monitoring	Regular monitoring is an essential part of a restoration project and it requires commitment and dedicated resources to ensure that it occurs. Standardized data collected through monitoring can inform treatment strategies through adaptive management and can be used to provide evidence of the value of restoration activities.

4.2 Ecosystem Enhancement

A total of 24.04 acres have been identified for riparian and shrubland & grassland restoration enhancement activities. These areas largely consist of higher densities of noxious and non-native vegetation, or have large areas of poor vegetative growth, detracting from the ecological health and overall habitat value. To restore these areas to their full ecological potential, the following restoration activities are suggested:

- Establishment of reference community
- Noxious vegetation management
- Development of site and community specific seed mixes
- Revegetation through seeding and planting
- Maintenance and Management
- Monitoring

Figure 10 - Area identified as location for shrubland and grassland enhancement.

The restoration activities for ecosystem enhancement closely resemble the information provided in table 9 for ecosystem creation. The systematic activities should focus more on limiting disturbances and promoting existing native vegetation establishment through active measures.

4.3 Wetland Ecosystem Enhancement

The three (3) freshwater ponds, consisting of 3.01 acres, have been identified for wetland habitat enhancement. Currently, these ponds provide excellent nesting, foraging habitat and cover for a diversity of birds, small mammals, reptiles and amphibians. They are heavily vegetated, and given the current trend of hydrological conditions in the west, these freshwater ponds are likely more consistent with an emergent wetland classification. The vegetative diversity within these habitats is low, consisting of high densities of cattails and softstem bullrush. The enhancement of these wetlands could go in two (2) directions, depending on the goals and available resources of the involved parties. These options include:

4.3.1 Enhancement of Freshwater Pond Habitats

Through active measures including excavation, the ponds could be reverted and enhanced to resemble a more open freshwater pond habitat type, with peripheral emergent wetland along the edges of the ponds. To proceed with this, it would be beneficial to convert a portion of the current decreed water rights from agricultural to piscatorial or storage use. This water could then be utilized to maintain more regulated inundation of water in the pond system and manage the water regime to maintain the pond capacity. Additionally, the established emergent vegetation that dominates the pond basins should be removed and maintained in a way that is beneficial to the system moving forward. The enhancement of the freshwater ponds would provide improved aquatic and water fowl habitat to the site.

4.3.2 Enhancement of Emergent Wetland Habitats

Alternatively, the ponds could be maintained as emergent wetlands. The vegetation within the wetlands could be enhanced to provide greater vegetative diversity and ecological function. Enhancement activities would include; active management the cattails and bulrush in these areas, and through seeding and planting efforts, increase the diversity of native sedges, rushes, and hydrophytic forbs. If desired, water rights could still be converted and used to maintain the hydrologic regime in these wetlands, but to a lesser extent.

With either of these options, it is recommended that the Siberian elm trees that have established along the pond margins be aggressively removed. The elm trees are the dominant canopy cover in these areas. While they provide

valuable shade, nesting and perching habitat they are outcompeting the native species. The attempted removal of all these trees at once could be detrimental to the property. A management timeline for removal should be established, prioritizing removals and establishment of native tree and shrub species along the ponds over a 3-5-year time period.

Figure 11 - Larger potential open water pond location or emergent wetland enhancement.

4.4 Ecosystem Preservation

19.2 acres have been identified for ecosystem preservation. These areas consist of relatively intact emergent shrubland wetlands, Rocky Mountain-Great Basin Lowland-foothill Riparian Shrubland and Western Interior Riparian forest vegetative communities. Though they are listed as preservation, more passive management activities may be needed including key removal of unwanted vegetative species. As a whole, these areas contain a healthier composition of vegetation consistent with their community types that could be adversely affected through more intensive restoration efforts as described in above sections.

The emergent scrub shrub wetlands are dominated by coyote willow (*Salix exigua*), and have high densities of reed canary grass within the understory vegetation. The near monoculture of coyote willow stands is not ideal, however the willows provide good wildlife habitat and protect the inside bank from erosion and disturbances from flooding and high water. The removal and attempted restoration of these communities could have detrimental effects, that would outweigh the benefits of the current ecological functions. There are select Russian olive and salt cedar that should be removed.

The Rocky Mountain-Great Basin Lowland-foothill Riparian Shrublands have a well-established shrub layer consisting largely of native species. Disturbances to these areas should be avoided aside from key removals of Russian olive and Siberian elm trees. Other existing noxious vegetation species should be included in the overall management plan for the property. As a whole, the current state of these communities provided beneficial ecological function.

The riparian woodland designated for preservation is located on the island portion of the property and in the remnant stand on the south end of the property close to the parking area. Both of these locations have active bald eagles' nest with an observed mating pair on site. Preservation of these nests and the areas around them are highly recommended for continued preservation of their existence within the preserve.

Additional wildlife installations in preserved areas include: (1) bird and bat box installations, (2) raptor nest platforms, and (3) providing passive wildlife viewing areas designed to protect wildlife and keep viewers at an appropriate distance (such as blinds, scopes, and placing signage/seating in optimal zones).

4.6 Agricultural Opportunities

The existing agricultural uses on the preserve by Highwater Farms provide cultural, wildlife and ecosystem benefits. Current operations include a Community Supported Agricultural Program (CSA) and youth program. The farm does not plan on expanding the operational size in 2021, but is actively working to refine practices around water use, soil health, vegetation management and production. The farm currently uses 3 acres out of its 5-acre lease. Short term goals for the farm are to increase financial stability and build community awareness. Long term goals include expanding operations, extending irrigation, integrating goat grazing, and a free range chicken operation. Highwater Farms is interested in partnerships and collaborations to accomplish short and long term goals.

Identified opportunities for agricultural management that support ecological restoration goals at the Preserve include: (1) expanding agricultural operations adding cultural, wildlife and ecosystem value to the preserve, (2) consider the revitalization of irrigation and haying (or similar practice) in flat areas of the property not identified for active restoration, (3) supporting collaborative ventures with additional non-profits, CSA's, local groups such as 4H and farms, (4) integration of small livestock or birds into operations to provide community benefit and create a holistic agricultural system, (5) integrate interpretive information about the benefits of agriculture and agricultural operations at the Preserve (weed management, habitat, aesthetics) into overall preserve interpretation and educational elements, finally (6) invest in irrigation solutions that support long term resilience of the agricultural uses at the Preserve.

4.4.1 Grazing

Historically, cattle grazed the property until 2018 and in the winter of 2020, a herd of approximately 500-600 goats were utilized to control undesired vegetation. The presence of grazing herbivores can both positively and negatively effect on plant health and productivity, biodiversity and species composition, nutrient cycling, and other processes. Selective grazing practices such as pasture rotation should be considered when grazing. Temporary fencing should be utilized to protect high value ecological areas within the preserve.

5.0 Recreational and Educational Opportunities

The Preserve provides a wide array of passive recreational opportunities that are in line with restoration recommendations. These fall into the following broad categories; (1) fishing, (2) site circulation, dwell spaces and character, (3) interpretation and educational elements, and (4) passive wildlife viewing. All recommendations are summarized in, *Appendix 3 – Restoration Activities Table*.

5.1 Fishing

Fishing opportunities currently exist along the Colorado River and could potentially be developed in the fresh water ponds. Building on restoration work in these areas, highlighting fishing as a passive use would have the benefit of providing a diverse activity for users, opening up potential grant funding (*Fishing is Fun),* and expanding the mix of species and habitat types on the Preserve.

5.2 Site Circulation, Dwell Spaces and Character

The character of the Preserve is largely dominated by how the user moves through the landscape. This begins with the entry sequence and parking and extends to signage, trails, and dwelling spaces. The entry to the preserve should be carefully considered and designed to highlight the uniqueness of the Preserve and the goals of the property. Additionally, the entry and parking should facilitate use by a wide range of user groups.

Trails currently exist throughout the Preserve. Formalization and planning of this network would benefit all of the recreational, agricultural and cultural uses of the property. Established trails help maintain the overall ecosystem by mitigating the areas of human impact and can heighten the overall user experience by directing users to the most interesting, beautiful or significant areas of the property.

Picnic and seating areas in carefully planned locations have similar benefits to a planned trail network. Additionally, these features benefit a diversity of users and when coupled with other recreation opportunities such as bird walking, create a center and base for activities.

Additional site features such as remnant fencing, infrastructure, buildings and roads should be evaluated for continued use, context or benefit to restoration and operational goals, and impact to desired character of the Preserve.

5.3 Interpretation and Educational Elements

The unique and special elements of the Preserve would be well highlighted by imaginatively designed interpretive signs, wayfinding and educational elements. Interpretive components would help education the public about the Preserve, aid in building community support, and create a sense of place. Similarly, entry monuments, signage and wayfinding could give cultural character to the Preserve and set it apart as a unique open space. Finally, educational elements such as an outdoor classroom or amphitheater would set the Preserve apart as a place for outdoor education with opportunities for diverse topics from agriculture, mining and wildlife to hydrology.

5.4 Passive Wildlife Viewing

Perhaps the largest opportunity at the Preserve is to enhance and highlight the opportunities for passive wildlife viewings. Restoration activities at the preserve will likely increase the use of the Preserve by Wildlife. Protecting and highlighting this resource will be a cultural and ecological benefit to the preserve. Recommendations include; installing blinds or viewing platforms in locations where wildlife can be observed from an appropriate distance, installation of a scope to view raptors, especially nesting bald eagles, creating specific areas for bird watching, and designing opportunities specific to winter deer observation. Passive wildlife viewing should be a major design consideration when layout out trails, seating areas, designing interpretive elements and considering use and circulation through the site.

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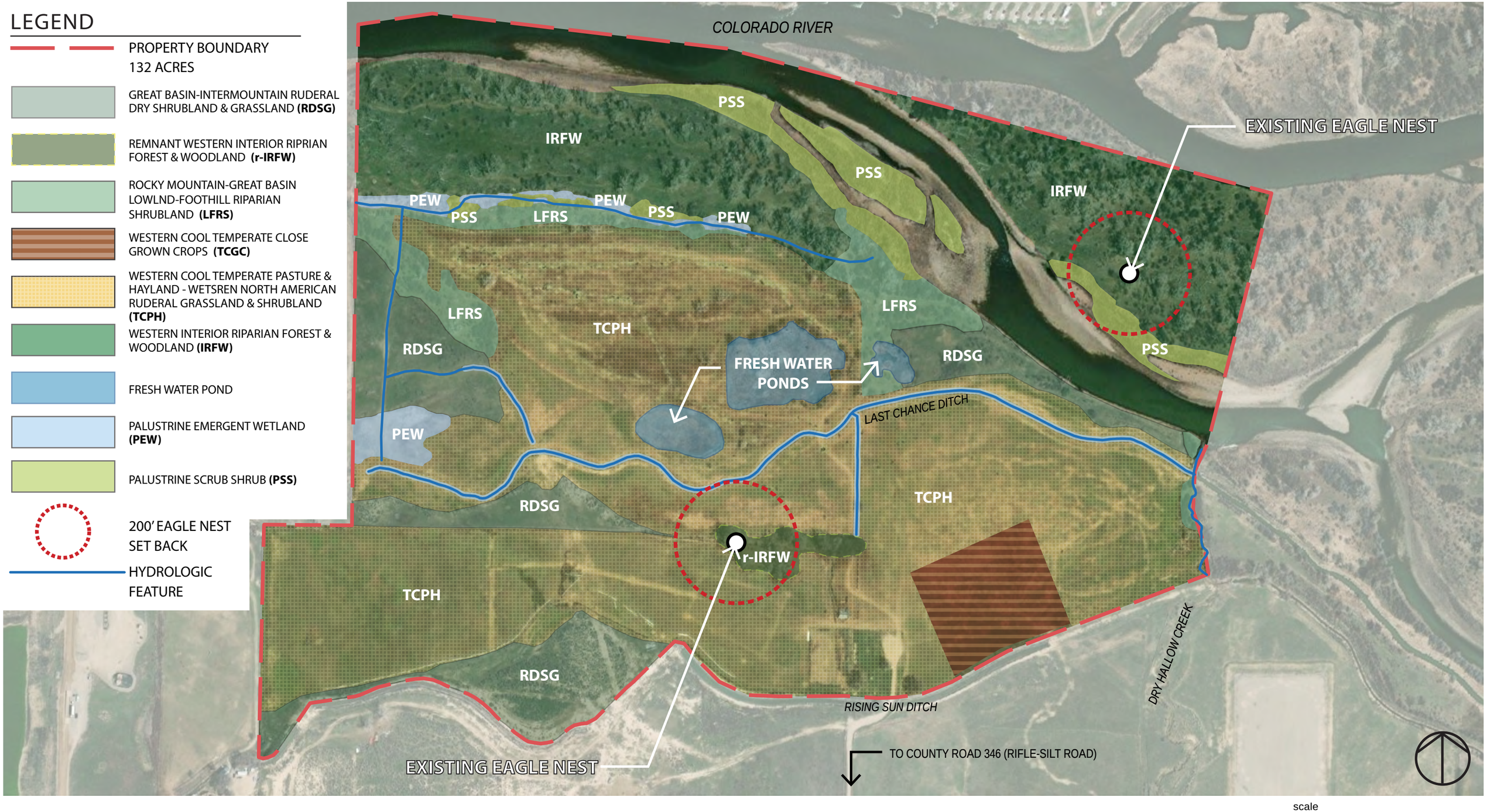
LEGEND

- PROPERTY BOUNDARY
  132 ACRES
- GREAT BASIN-INTERMOUNTAIN RUDERAL DRY SHRUBLAND & GRASSLAND **(RDSG)**
- REMNANT WESTERN INTERIOR RIPRIAN FOREST & WOODLAND **(r-IRFW)**
- ROCKY MOUNTAIN-GREAT BASIN LOWLND-FOOTHILL RIPARIAN SHRUBLAND **(LFRS)**
- WESTERN COOL TEMPERATE CLOSE GROWN CROPS **(TCGC)**
- WESTERN COOL TEMPERATE PASTURE & HAYLAND - WETSREN NORTH AMERICAN RUDERAL GRASSLAND & SHRUBLAND **(TCPH)**
- WESTERN INTERIOR RIPARIAN FOREST & WOODLAND **(IRFW)**
- FRESH WATER POND
- PALUSTRINE EMERGENT WETLAND **(PEW)**
- PALUSTRINE SCRUB SHRUB **(PSS)**
- 200' EAGLE NEST SET BACK
- HYDROLOGIC FEATURE



scale
0' 200' 400'

DHM DESIGN

EXISTING VEGETATION COMMUNITIES

SILT RIVER PRESERVE
MARCH 2021

LEGEND

- PROPERTY BOUNDARY
  132 ACRES
- CREATION
  33.1 ACRES
- ENHANCEMENT
  ACRES
- PRESERVATION
  19.2 ACRES
- WETLAND CREATION
  1.02 ACRES
- WETLAND ENHANCEMENT
  3.01 ACRES

COLORADO RIVER

ENHANCEMENT

PRESERVATION

PRESERVATION

CREATION

CREATION

WETLAND CREATION

WETLAND ENHANCEMENT

LAST CHANCE DITCH

ENHANCEMENT

PRESERVATION

ENHANCEMENT

DRY HALLOW CREEK

RISING SUN DITCH

TO COUNTY ROAD 346 (RIFLE-SILT ROAD)

scale

0’ 200’ 400’

DHM DESIGN

RESTORATION OPPORTUNITIES

SILT RIVER PRESERVE
MARCH 2021

Restoration Action	Restoration Protocol	Ecologic Priority	Restoration Timeframe	Expertise Level & Citizen Science	Potential Partnerships	Initial Capital Investment	Estimated Annual Costs (order of magnitude)
VEGETATION MANAGEMENT					**Type: nonprofit, agency, volunteers, etc**	**Cost for initial installation** *See cost categories at bottom of document*	**Cost for annual treatments and monitoring,**
Noxious Vegetation Management: Succesfully manage noxious vegetation found throughout the property through adaptive management strategies to promote establishment of native vegetation.							
*Integrating chemical, mechanical, cultural and biologic controls, noxious vegetation throughout the site should be regularly managed with timely treatments.	Optimize mechanical and biological treatments for species for appropriate species. Target three (3) treatments per year: Spring, Summer, and Fall.	High	Short - Long term should start spring 2021.	C1 & C2 Certified applicator for chemical treatments. Volunteers good option for mechanical treatments.	Local comercial applicators. RFOV, Middle Colorado Watershed Council, , Garfield County Vegetation Management and South Side Conservation District.	A	C
Woody Vegetation Removal and Management: Identify priority trees for removal and implement removal of unwanted woody vegetation through a comprehensive implementation schedule.							
*Over the course of 5 -10 years, remove all **Siberian elm**, Russian olive, and salt cedar from the property. Prioritize Russian olive, salt cedar and smaller and non-essential elms. Establish long term objectives for removing large, mature elms.	Remove using a combination of cut stump, basal bark, and drill and fill methods. Plan follow up foliar treatments to regrowth.	Medium	Moderate - long term. Plan initial removal efforts for fall of 2021.	C1,C2,C3,T1	Local commercial applicators, Local Tree Services, RFOV, Middle Colorado Watershed Council, , Middle Colorado Watershed Council, , Youth Corps, Garfield County Vegetation Management and South Side Conservation District	N/A	B or C, depending on involvement of volunteer effort.
Goat Grazing: Utilization of goats to control unwanted vegetation.							
*Useful for beginning stages of restoration. Identify low quality areas with high densities of weeds and strategically use grazing in appropriate areas as a mode of disturbance to restore vegetation.	In highly disturbed areas, use timely application of goat grazing prior to restoration and seeding efforts. Do not use goats following active restoration activities.	Low	Short	C2 & C3	Goat Contractors		C
Hazard Tree Management: In areas used for recreational activities, monitor and manage trees for removal of hazardous limbs and hazardous dead snags or standing trees.							
*In areas used for recreational activities, monitor and manage trees for removal of hazardous limbs and hazardous dead snags or standing trees.	Along the established trails, and areas of high recreational use, remove all hazardous tree material avoiding detriment to the healthy trees and surrounding vegetation.	Low	Moderate	C2 & C3	Professional Arborist	A	B

Restoration Action	Restoration Protocol	Ecologic Priority	Restoration Timeframe	Expertise Level & Citizen Science	Potential Partnerships	Initial Capital Investment	Estimated Annual Costs (order of magnitude)
WATER MANAGEMENT					**Type: nonprofit, agency, volunteers, etc.**	**Cost for initial installation** *See cost categories at bottom of document*	**Cost for annual monitoring, data collection, analysis**
Irrigation Infrastructure: Improvement or establishment of new infrastructure to improve transport and storage of water for restoration purposes.							
*Establish irrigation needs for restoration of northern field. Improve transport of water from the Rising Sun Ditch to the northern field portion of the property. Improve flood irrigation or implement temporary infrastructure for restoration needs.	Prior to any seeding and planting activities, make sure proper water infrastructure is established to meet the needs to establish and sustain vegetation. Where topography exists on the site that can be converted to wetland habitat, study piping irrigation extensions to allow water to move into these areas via gravity or for pipe extensions and a simple outfall back to the ditch or to the river.	High	Short	C2 &C3	NRCS, Restoration Ecologists or Landscape architects specializing in native restoration.	B	C
*Redirect flow of water through pond system and utilize water to maintain hydrology in pond.	Establish desires for ecological function, aesthetics and recreation values of ponds. Determine water needs and infrastructure to maintain hydrology for desired pond use.	Medium	Moderate	C2, C3, W2, W3	NRCS, Restoration Ecologists, Water Engineer, Water Attorney	F	C
*The small pond off the main ditch near the head gates could be enlarged as a viable wildlife and recreational amenity.	Establish desires for ecological function, aesthetics and recreation values of ponds. Determine water needs and infrastructure to maintain hydrology for desired pond use.	Medium	Moderate	C2, C3, W2, W4	NRCS, Restoration Ecologists, Water Engineer, Water Attorney	E	B
*Reconfigure irrigation infrastructure for overflow of the Last Chance Ditch at west end of property. Restore the overflow ditch that was cut to divert water from the Last Chance Ditch.	Work with the Last Chance Ditch owners to establish better use and re-direction of overflow water from the last chance ditch. Current ditch cut was not approved.	Medium	Moderate	C2, C3, W2, W3	NRCS, Restoration Ecologists, Last Chance Ditch Owners, Water Engineer, Water Attorney	F	C
Water Rights: Review and change use of water waters to better fit the current and future land use of the property.							
*Change a portion of the water rights from the Rising Sun Ditch to accommodate for the restoration and maintenance of the ponds. Review ability to change water use type to storage or piscatorial use.	Establish desired use and function of ponds. Work with water attorney to change portion of water rights while maintaining enough rights for irrigation.	High	Moderate	C2, C3, W2, W3	NRCS, Restoration Ecologists, Water Engineer, Water Attorney	B	C
*Record and report water use annually.	Establish a schedule and spreadsheet to record water usage and prepare annual report to submit to DWR.	Medium	Short - Long term should start spring 2021.	T1 & W3	Town of Silt Staff and Water Attorney	A	A
*Review and monitor groundwater in the area of the pond and where influenced by irrigation ditches. Assess how irrigation changes, pond use etc. influences changes in ground water and how ground water will effect restoration of ponds.	Establish piezometers in key locations to establish how groundwater dynamics (level, movement, extent) respond to changes in surface water parameters. Specifically, how management actions are maintaining or changing groundwater dynamics on the property (restoration and irrigation). Establish base ground water conditions for pond restoration.	Medium	Moderate	C2, C3, W2, W3	NRCS, Restoration Ecologists, Last Chance Ditch Owners, Water Engineer, Water Attorney	C	C

Restoration Action	Restoration Protocol	Ecologic Priority	Restoration Timeframe	Expertise Level Required	Potential Partnerships with Town	Initial Capital Investment	Estimated Annual Costs (order of magnitude)
ECOSYSTEM ENHANCEMENT AND CREATION					**Type: nonprofit, agency, volunteers, etc.**	**Cost for initial installation** *See cost categories at bottom of document*	**Cost for annual monitoring, data collection, analysis**
Pond Restoration: Restore ponds to either 1. Enhance freshwater Pond Habitats or, 2. Enhance Emergent Wetland Habitats. Establish extent of which the ponds are to be restored, considering ecological function, aesthetics, and recreation values.							
*Establish pond use (Recreation vs. Natural ecological function).	Review desires and current layout and function of pond system. Develop restoration plan and design plan set for ponds.	Medium	Moderate	C2,C3,W2,W3	Restoration Ecologists, engineers, landscape architect, Water Attorney, Wildlife Biologist (CPW).	B	B
*Excavate and cleanout current vegetation of the pond.	Based upon established desires, remove and manage vegetation in ponds and excavate pond to meet design needs.	Low	Moderate	C2,C3,W2,W3	Restoration Ecologists, engineers, landscape architect, Water Attorney, Wildlife Biologist (CPW), local excavating company.	G	D
*Improve infrastructure of ponds and establish need for pond liner	Install improved infrastructure for ponds as needed for proper maintenance and function (pond liner, head gates, dikes, weir, etc.	Low	Moderate	C2,C3,W2,W3	Engineers, landscape architect, Water Attorney, local landscaping and construction company.	D	B
Terrestrial Restoration: Restore and enhance vegetative communities to improve ecological function of the site.							
*Establish native vegetation with seeding and planting activities. Begin with key anchor locations where focus can be put on small, successful plantings associated with seeding and the ability to control noxious vegetation exists. These anchor restoration zones would provide a basis for expansion and focus efforts.	Establish vegetative community specific seed mixes and planting lists. Re-vegetate identified areas following site prep and noxious vegetation control. Drill seed cover crops and aggressive cool and warm season grasses on flat degraded historic agricultural landscapes post goat or other noxious vegetation control efforts.	High	Long	C1, C2, C3, T1	RFOV, Middle Colorado Watershed Council, , Youth Corps, NRCS, South Side Conservation District, Restoration Ecologist, Landscape architect, wildlife biologist (CPW), Local landscaping company specializing in ecological restoration.	B	C
*Reestablish irrigation and potential plantings of native cottonwoods in old ditch system near entry. These trees are in early sates of decline and provide significant habitat for raptors and a natural setting for the site aesthetically.	Establish planting protocols, spacing and layout. Design and/or reestablish irrigation system.	High	Short - Medium	C1, C2, C3, T1	RFOV, Middle Colorado Watershed Council, , Youth Corps, NRCS, South Side Conservation District, Restoration Ecologist, Landscape architect, wildlife biologist (CPW), Local landscaping company specializing in ecological restoration.	C	B
*Surgical installation of riparian plantings in low lying areas and swales near river and ponds.	Utilizing volunteer networks and advocacy groups, organize volunteer planting opportunities to install riparian vegetation in areas where natural hydrology will support establishment. Restoration areas should be mapped and planned by ecologist or landscape architect familiar with the restoration objectives of the Preserve.	Moderate	Moderate	C1, C2, C3, T1	RFOV, Middle Colorado Watershed Council, , Youth Corps, NRCS, South Side Conservation District, Restoration Ecologist, Landscape architect, wildlife biologist (CPW), Local landscaping company specializing in ecological restoration.	C	B
*Install modular fencing to protect areas of native regeneration, especially cottonwood zones, affected by extreme herbivory damage.	Map and establish a fencing plan with ecologist or landscape architect familiar with the restoration objectives of the Preserve. Include quantities of fencing material and location of modular fencing "pods" on plan. Plan to be reviewed by wildlife biologist. Fencing to be installed by qualified landscape contractor.	Moderate	Moderate	C2, C3, W2	Restoration Ecologist, Landscape architect, wildlife biologist (CPW), Local landscaping company specializing in ecological restoration.	D	C
*Monitor establishment of native vegetation and manage noxious vegetation	Develop a monitoring protocol and monitor site monthly to assess establishment and success of plantings. Manage noxious vegetation at least three (3) times per year following restoration.	High	Short - Medium	C1, C2, C3, T1	Restoration ecologist technician, AVLT Staff, Garfield County Vegetation Management, South Side Conservation District, local certified applicator.	A	B

Monitoring Action	Monitoring Protocol	Ecologic Priority	Restoration Timeframe	Expertise Level Required	Potential Partnerships with Town	Initial Capital Investment	Estimated Annual Costs (order of magnitude)
WILDLIFE					**Type: nonprofit, agency, volunteers, etc.**	**Cost for initial installation** *See cost categories at bottom of document*	**Cost for annual monitoring, data collection, analysis**
Wildlife Studies and Monitoring: Establish baseline conditions and conduct subsequent monitoring to detect changes in wildlife use of the property over time. Assess how wildlife reacts to restoration activities and recreation use.							
*Focus monitoring efforts to include Amphibian (Northern leopard frog), avian/waterfowl, Migratory birds, Fisheries observations, water quality studies, large game species, and smaller mammals.	Select locations for monitoring, considering opportunities to co-locate with other measurements. Establish game cameras and use apps (bird) and other databases to include local user input.	Medium	Moderate - Long Term	C1,C2,C3 and recreational and local bird/wildlife enthusiast.	Local non-profits, CPW, local enthusiast	A	B
Wildlife Viewing Infrastructure: Establish infrastructure to improve wildlife viewing and promote ethical wildlife viewing practices.							
*Design and construct viewable wildlife trails, benches, blinds, and educational signs for wildlife viewing purposes.	Work with CPW and reference results form initial monitoring results to establish locations of viewing areas and educational signs. Design signs and structures to blend with the aesthetics of the site.	Medium	Moderate	C1,C2,C3 and recreational and local bird/wildlife enthusiast.	Local non-profits, CPW, local enthusiast, graphic designer/architect.	A	B
*Install bat and bird boxes, and nesting platforms across the Preserve.	Work with CPW and local volunteer organizations to install habitat enhancing measures in high quality habitat or restored areas.	Medium	Moderate	C1,C2,C3 and recreational and local bird/wildlife enthusiast.	Local non-profits, CPW, local enthusiast.	B	A

Restoration Action	Restoration Protocol	Ecologic Priority	Restoration Timeframe	Expertise Level Required	Potential Partnerships with Town	Initial Capital Investment	Estimated Annual Costs (order of magnitude)
AGRICULTURAL USE					**Type: nonprofit, agency, volunteers, etc.**	**Cost for initial installation** *See cost categories at bottom of document*	**Cost for annual monitoring, data collection, analysis**
Utilization and co-op between agricultural users: Work with Highwater Farms to understand current agricultural needs with how they relate to the ecological function and restoration of the property.							
*Explore expanded leasing and utilization of many more acres of Preserve. Explore opportunities with diverse nonprofits and CSA's/farmers.	Build functionality and aesthetics across the preserve. Benefit to wildlife, local community and ecosystem health.	High	Short - Long Term	C2, C3, and agricultural lease holder.	NRCS, Restoration Ecologist, Agricultural Lease Holder, AVLT and Town of Silt.	A	A
*Overall Agricultural Study: Review irrigation/water usage needs for current operations and potential for expansion. Review how agricultural use could be used to build healthy soils for the property. Establish agricultural grazing needs and use for the benefit to promote ecological health. Discuss how to treat noxious vegetation to the extent needed for ecological restoration without detriment to agricultural practices and intentions (organic farming).	Establish an understanding and continue to meet with ag users to review relationship between agriculture and ecology.	High	Short - Long Term	C2, C3, and agricultural lease holder.	NRCS, Restoration Ecologist, Agricultural Lease Holder, AVLT and Town of Silt.	A	A

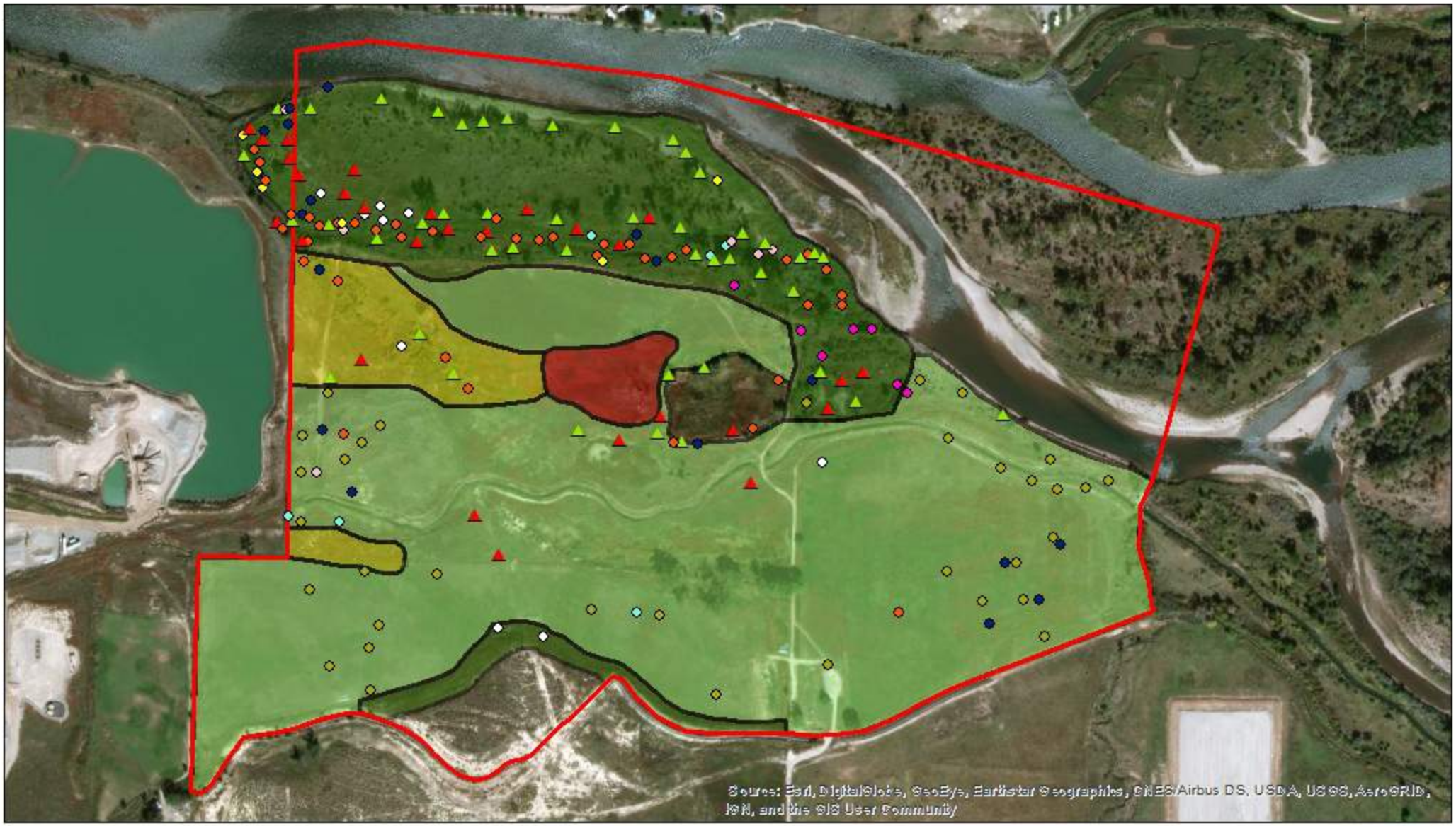
Restoration Action	Restoration Protocol	Ecologic Priority	Restoration Timeframe	Expertise Level Required	Potential Partnerships with Town	Initial Capital Investment	Estimated Annual Costs (order of magnitude)
Recreational and Educational Opportunities					**Type: nonprofit, agency, volunteers, etc.**	**Cost for initial installation** *See cost categories at bottom of document*	**Cost for annual monitoring, data collection, analysis**
*Develop fishing programs and access at river and potentially at ponds.	Research available grant funding and support for these operation. Consider holistic integration of fishing opportunities into restoration and habitat improvements.	Medium	Short - Long Term	C2, C3, W3	CPW, Restoration Ecologist AVLT and Town of Silt.	C	A
*Site Circulation, dwell spaces and site character	Carefully consider and plan for these elements when developing masterplan to keep in line with ecosystem and functional goals of the property	High	Short - Long Term	C2, C3, W3	CPW, Restoration Ecologist, Landscape Architect, AVLT and Town of Silt.	B	B
*Interpretation and Educational Elements	Carefully consider and plan for these elements when developing masterplan to keep in line with ecosystem and functional goals of the property	High	Short - Long Term	C2, C3, W2, W3	CPW, Restoration Ecologist, Landscape Architect, Graphic Designer, AVLT and Town of Silt.	D	B
*Passive Wildlife Viewing	Carefully consider and plan for these elements when developing masterplan to keep in line with ecosystem and functional goals of the property. Instal blinds or viewing platforms in locations where wildlife can be viewed from an appropriate distance, installation of a scope to view raptors, especially nesting bald eagles, creating specific areas for bird watching, and designing opportunities specific to winter deer observation. Passive wildlife viewing should be a major design consideration when layout out trails, seating areas, designing interpretive elements and considering use and circulation through the site.	High	Short - Long Term	C2, C3, W2, W3	CPW, Restoration Ecologist, wildlife biologist, AVLT and Town of Silt.	D	B

Cost Class Categories	
A	$0-500
B	$501-1000
C	$1001-5000
D	$5001-10,000
E	$10,001-20,000
F	$20,001-50,000
G	$50,000+

Personnel Type	Description	P Code
Volunteer	Generalist 1-4 years experience	C1
Consultant- Level 2	Generalist or field technician with specific training- 5 years+	C2
Consultant- Level 3	Advanced degree or specialty for high level analysis, or in-depth knowledge of a phenomena	C3
Town of Silt Staff (Seasonal	Seasonal staff, with relevant degree and on-the-job training	T1
Water Engineer	Staff with specialized training or experience (GIS, etc.)	W2
Water Attorney	Staff with specialized training, experience or management	W3

Silt River Preserve Noxious Weeds

Map: Jonathan Rose, South Side Conservation district
June 2018



Noxious Weeds

- Bull Thistle
- Canada Thistle
- Common Tansy
- Hoary Cress
- Houndstongue
- Musk Thistle
- Oxeye Daisy
- Scotch Thistle
- Russian Olive
- Salt Cedar

Russian Knapweed Percent Cover

- 1-10%
- 10-25%
- 25-50%
- 50-100%

conserving natural resources for our future

0 400 800 1,600 Feet

Silt River Preserve Noxious Weeds NE

Map: Jonathan Rose, South Side Conservation district
June 2018

Noxious Weeds

- Bull Thistle
- Canada Thistle
- Common Tansy
- Hoary Cress
- Houndstongue
- Musk Thistle
- Oxeye Daisy
- Scotch Thistle
- Russian Olive
- Salt Cedar

Russian Knapweed Percent Cover

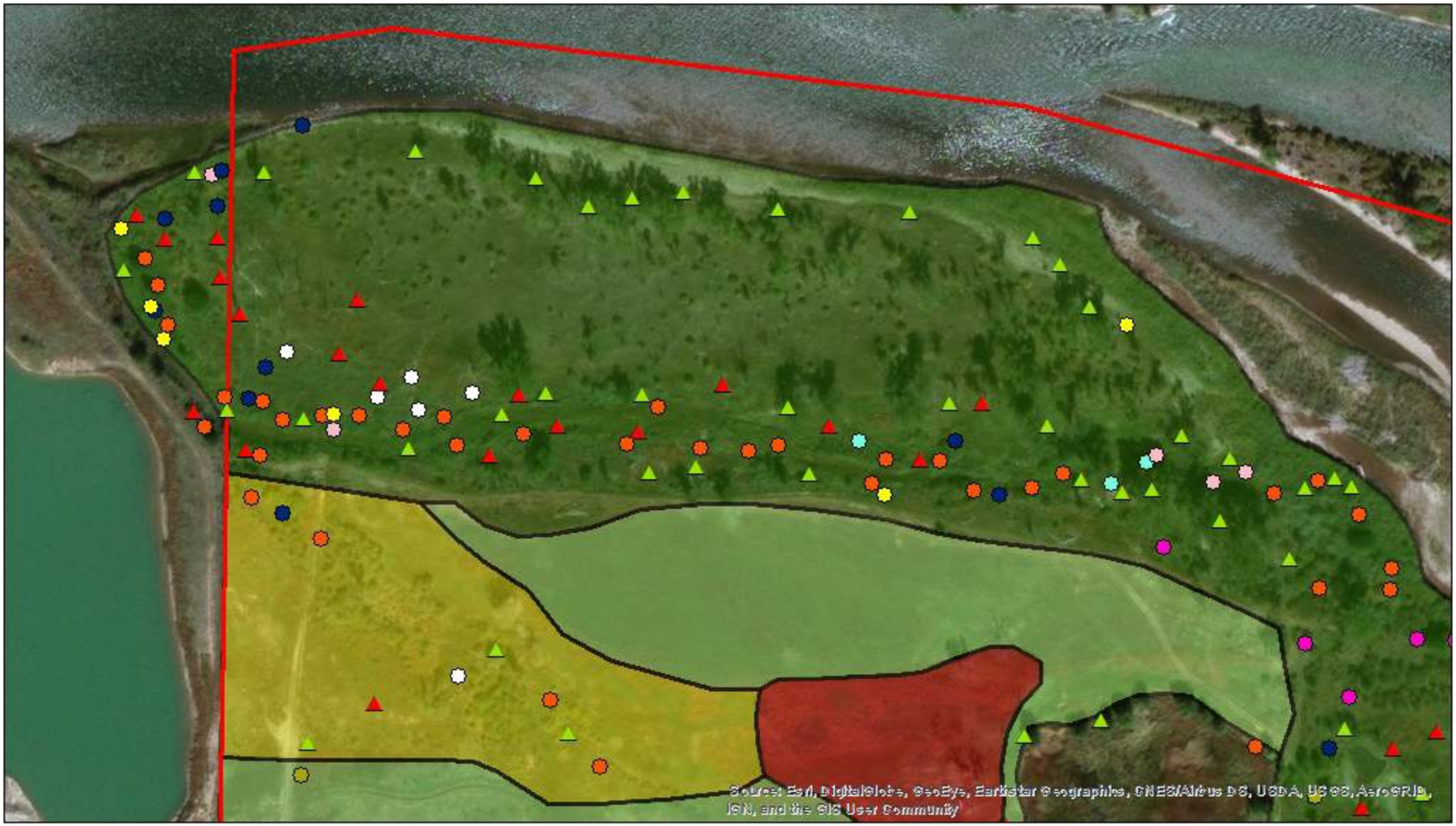
- 1-10%
- 10-25%
- 25-50%
- 50-100%

conserving natural resources for our future

0 187.5 375 750 Feet

Silt River Preserve Noxious Weeds NW

Map: Jonathan Rose, South Side Conservation district
June 2018



Noxious Weeds

- Bull Thistle
- Canada Thistle
- Common Tansy
- Hoary Cress
- Houndstongue
- Musk Thistle
- Oxeye Daisy
- Scotch Thistle
- Russian Olive
- Salt Cedar

Russian Knapweed Percent Cover

- 1-10%
- 10-25%
- 25-50%
- 50-100%

conserving natural resources for our future

0 187.5 375 750 Feet

Silt River Preserve Noxious Weeds SE

Map: Jonathan Rose, South Side Conservation district
June 2018

Noxious Weeds

- Bull Thistle
- Canada Thistle
- Common Tansy
- Hoary Cress
- Houndstongue
- Musk Thistle
- Oxeye Daisy
- Scotch Thistle
- Russian Olive
- Salt Cedar

Russian Knapweed Percent Cover

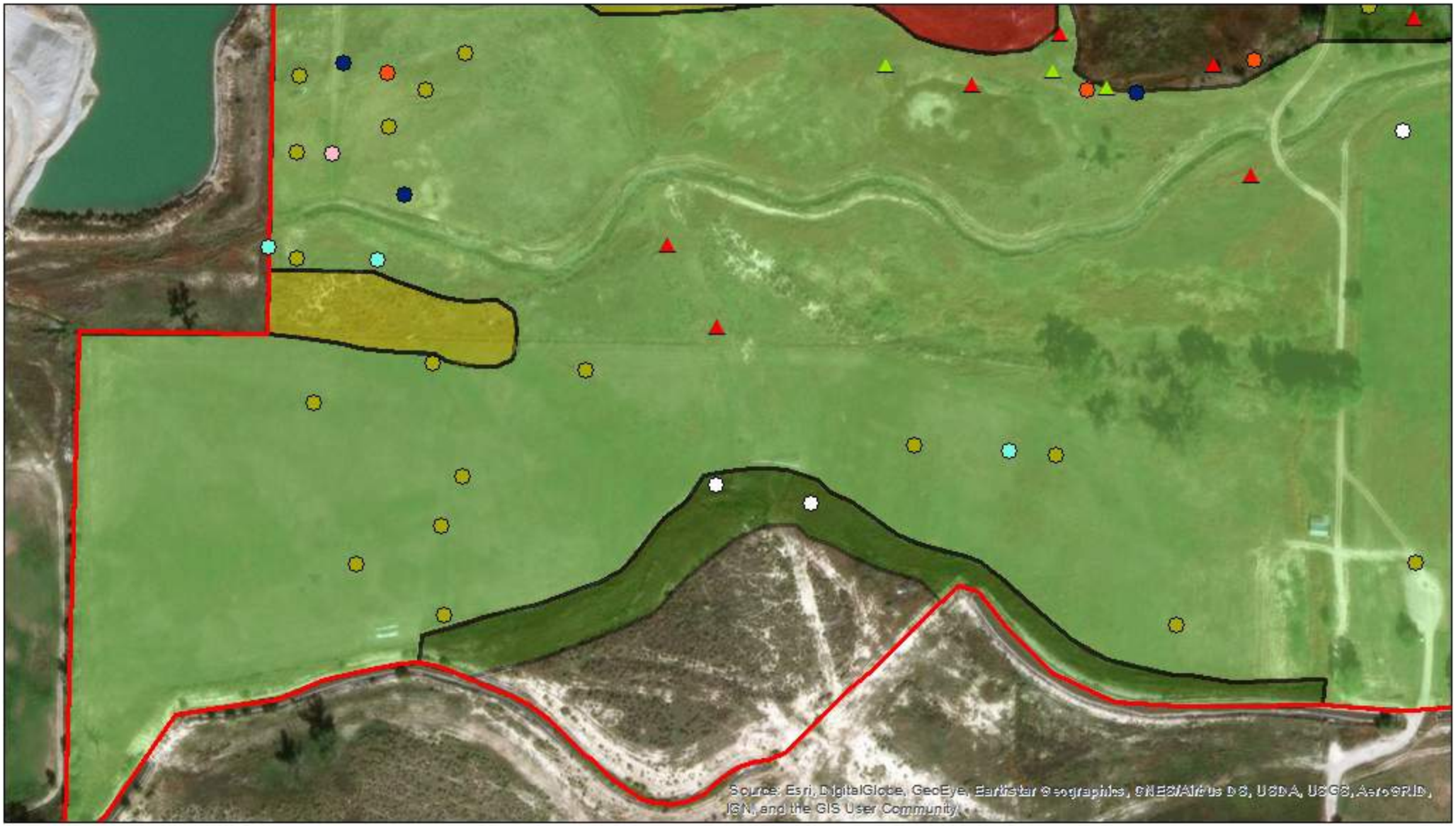
- 1-10%
- 10-25%
- 25-50%
- 50-100%

conserving natural resources for our future

0 187.5 375 750 Feet

Silt River Preserve Noxious Weeds SW

Map: Jonathan Rose, South Side Conservation district
June 2018



Noxious Weeds

- Bull Thistle
- Canada Thistle
- Common Tansy
- Hoary Cress
- Houndstongue
- Musk Thistle
- Oxeye Daisy
- Scotch Thistle
- Russian Olive
- Salt Cedar

Russian Knapweed Percent Cover

- 1-10%
- 10-25%
- 25-50%
- 50-100%

conserving natural resources for our future

0 187.5 375 750 Feet

United States Department of Agriculture

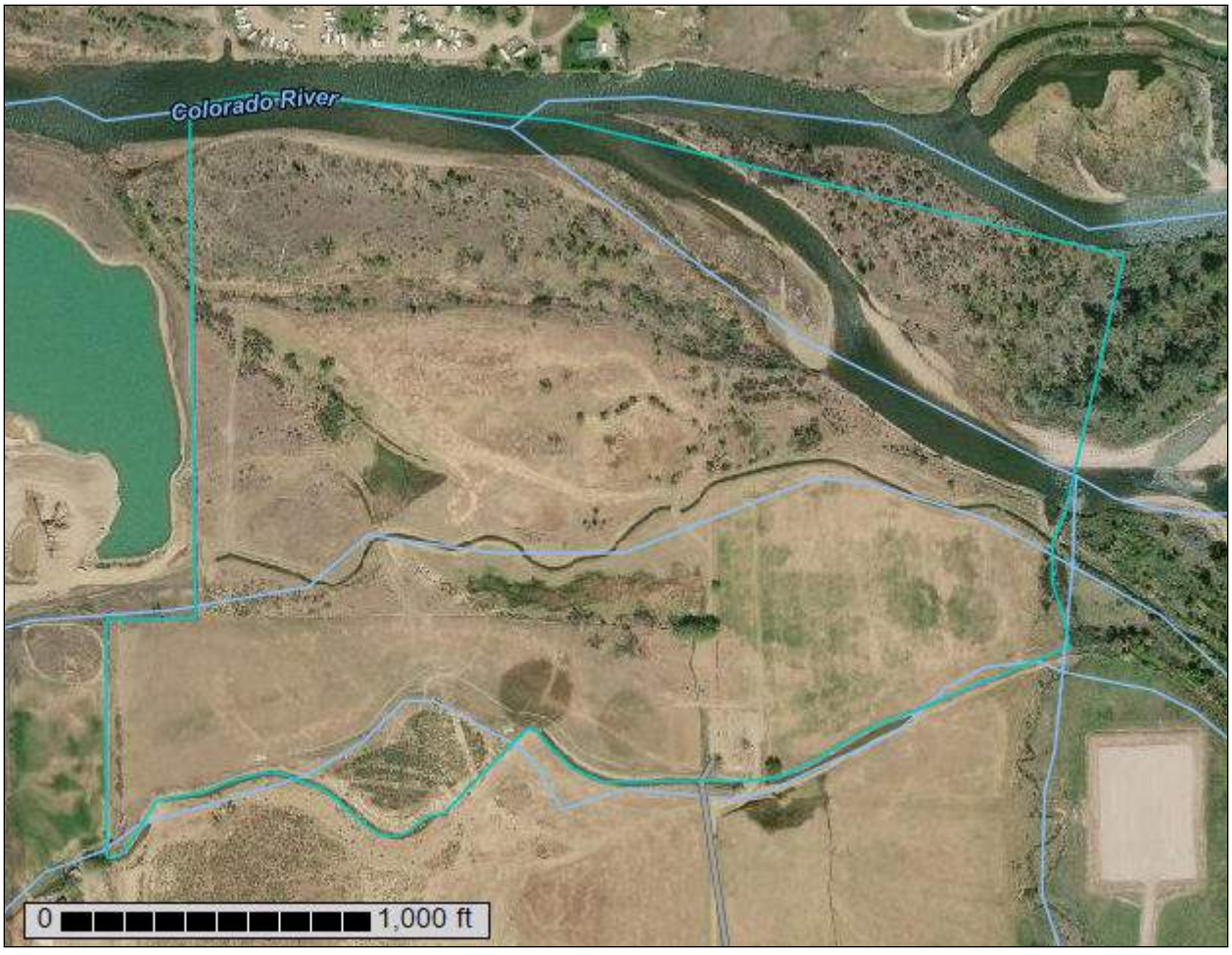
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Rifle Area, Colorado, Parts of Garfield and Mesa Counties

Silt_River_Preserve



February 12, 2021

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

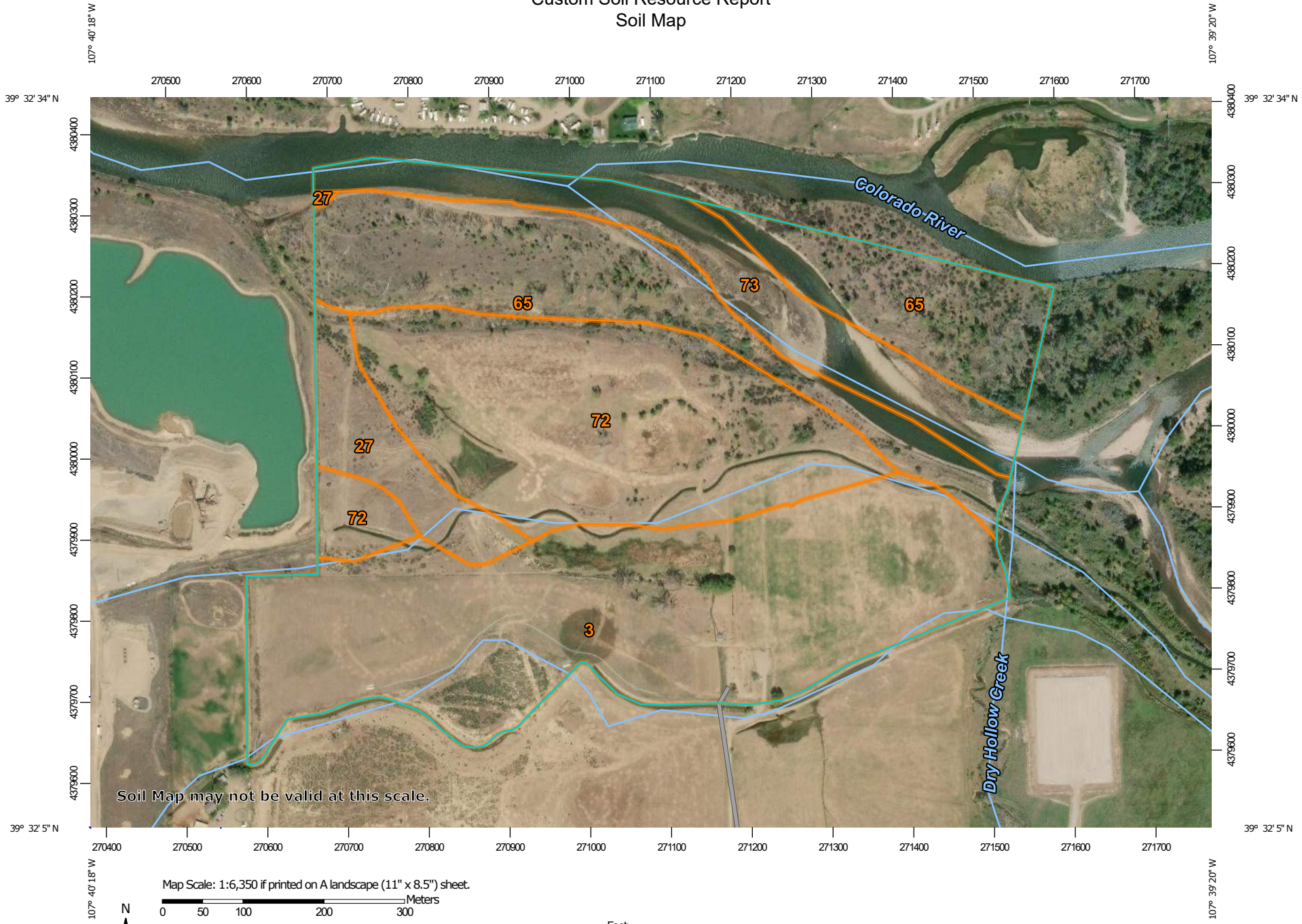
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:6,350 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 300 600 1200 1800

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Rifle Area, Colorado, Parts of Garfield and Mesa Counties
Survey Area Data: Version 13, Jun 5, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 31, 2009—Oct 12, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
3	Arvada loam, 1 to 6 percent slopes	46.9	35.3%
27	Halaquepts, nearly level	6.8	5.1%
65	Torrifluvents, nearly level	31.5	23.7%
72	Wann sandy loam, 1 to 3 percent slopes	34.0	25.6%
73	Water	13.7	10.3%
Totals for Area of Interest		**132.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate

pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Rifle Area, Colorado, Parts of Garfield and Mesa Counties

3—Arvada loam, 1 to 6 percent slopes

Map Unit Setting

National map unit symbol: jnxv
Elevation: 5,100 to 6,200 feet
Farmland classification: Not prime farmland

Map Unit Composition

Arvada and similar soils: 80 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Arvada

Setting

Landform: Terraces, fans
Landform position (three-dimensional): Tread
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Highly saline alluvium derived from sandstone and shale

Typical profile

H1 - 0 to 3 inches: loam
H2 - 3 to 17 inches: silty clay loam
H3 - 17 to 60 inches: silty clay loam

Properties and qualities

Slope: 1 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Gypsum, maximum content: 2 percent
Maximum salinity: Slightly saline to strongly saline (4.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum: 30.0
Available water capacity: Moderate (about 8.0 inches)

Interpretive groups

Land capability classification (irrigated): 7s
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: R048AY261CO - Salt Flats
Hydric soil rating: No

Minor Components

Wann

Percent of map unit: 5 percent
Landform: Terraces

Landform position (three-dimensional): Tread
Hydric soil rating: Yes

27—Halaquepts, nearly level

Map Unit Setting

National map unit symbol: jnxr
Elevation: 5,400 to 7,400 feet
Frost-free period: 101 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Halaquepts, nearly level, and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Halaquepts, Nearly Level

Setting

Landform: Terraces, fans, valleys
Landform position (three-dimensional): Tread
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Alluvium

Typical profile

H1 - 0 to 8 inches: clay loam
H2 - 8 to 24 inches: loam
H3 - 24 to 60 inches: stratified very gravelly cobbly sand

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: OccasionalNone
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Gypsum, maximum content: 5 percent
Maximum salinity: Moderately saline to strongly saline (8.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum: 30.0
Available water capacity: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

65—Torrifluvents, nearly level

Map Unit Setting

National map unit symbol: jnz3
Elevation: 5,000 to 7,000 feet
Mean annual precipitation: 12 to 15 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 90 to 120 days
Farmland classification: Not prime farmland

Map Unit Composition

Torrifluvents and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Torrifluvents

Setting

Landform: Distributaries, rivers, flood plains
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Parent material: Alluvium

Typical profile

H1 - 0 to 36 inches: loam
H2 - 36 to 60 inches: sand

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 12 to 36 inches
Frequency of flooding: OccasionalNone
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Gypsum, maximum content: 1 percent
Maximum salinity: Very slightly saline to moderately saline (2.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water capacity: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Wann
Percent of map unit: 10 percent
Landform: Terraces
Hydric soil rating: Yes

Fluvaquents
Percent of map unit: 5 percent
Landform: Marshes
Hydric soil rating: Yes

72—Wann sandy loam, 1 to 3 percent slopes

Map Unit Setting
National map unit symbol: jnzc
Elevation: 5,000 to 6,500 feet
Farmland classification: Prime farmland if irrigated and reclaimed of excess salts and sodium

Map Unit Composition
Wann and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wann

Setting
Landform: Terraces, valley floors
Landform position (three-dimensional): Tread
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Parent material: Alluvium derived from sandstone and shale

Typical profile
H1 - 0 to 8 inches: sandy loam
H2 - 8 to 60 inches: fine sandy loam, sandy loam, coarse sandy loam
H2 - 8 to 60 inches:
H2 - 8 to 60 inches:

Properties and qualities
Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: OccasionalNone
Frequency of ponding: None

Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Very high (about 26.3 inches)

Interpretive groups

Land capability classification (irrigated): 4w
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: A/D
Ecological site: R048AY265CO - Salt Meadow
Hydric soil rating: Yes

Minor Components

Torrifluvents

Percent of map unit: 5 percent
Hydric soil rating: No

Kim

Percent of map unit: 5 percent
Hydric soil rating: No

Arvada

Percent of map unit: 5 percent
Hydric soil rating: No

73—Water

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

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