



# CRYSTAL RIVER RESTORATION

RIPARIAN RESTORATION PLAN & ECOLOGICAL INTEGRITY ASSESSMENT  
GARFIELD COUNTY, COLORADO







Prepared for: The Town of Carbondale  
Prepared by: DHM Design Corp. and River Restoration  
311 Main Street, Suite 102, Carbondale, Colorado 81623

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## 1.0 Introduction

The Town of Carbondale in partnership with Roaring Fork Conservancy, Aspen Valley Land Trust, American Rivers, Colorado Parks & Wildlife, Public Counsel of the Rockies, and Trout Unlimited are developing a riparian restoration plan for in-stream and riparian improvements to the Carbondale Riverfront Park along the Crystal River. The parcel is owned by the Town of Carbondale and is approximately 14-acres, situated south of Crystal Bridge Drive. This parcel (Project Area) encompasses the 0.5 miles of the Crystal River and includes the west side of the riparian corridor to the boundary of River Valley Ranch and portions of the east bank including the Weaver Ditch (See Figure 1).

The riparian restoration plan proposes in-stream and riparian improvements. This report provides an evaluation of the existing riparian ecological conditions within and around the Project Area and identifies ecological system intervention recommendations and opportunities for amenity improvements within the project area (see figure 1). All of the proposed restoration/enhancement and recreation/educational opportunities are located on the east side of the river. Due to private property ownership and access, it is recommended that the riparian habitat on the west side of the river be preserved as is.

The following report details site survey and data collection, existing environmental and wildlife constraints and makes recommendations for stakeholder consideration. This report also provides recommendations on restoration, recreation, education and interpretation opportunities throughout the Project Area.



Figure 1-1 Overview map of Project Area

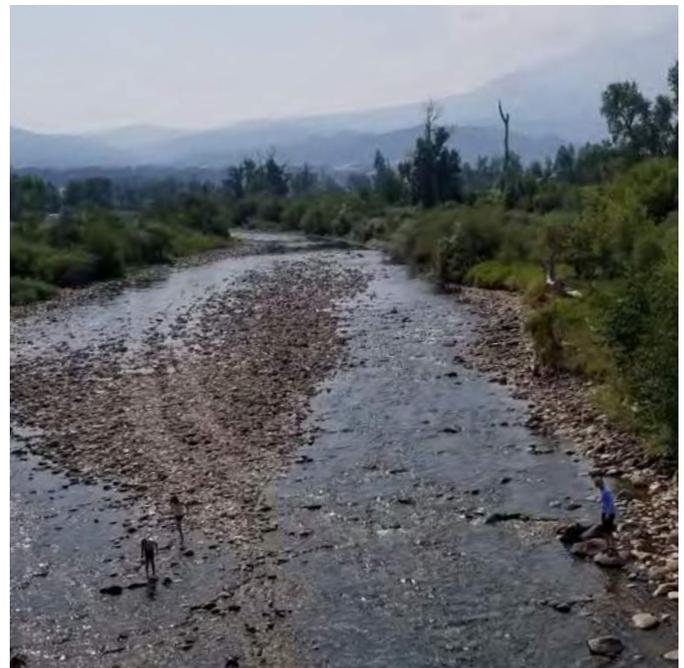


Image 1-1 A family plays in the Crystal River, near the Crystal River Bridge.

## 2.0 Methods

As part of this report a site survey, channel stability assessment, Ecological Integrity Assessment and a professional site analysis were conducted. Existing conditions are defined and recommendations are founded on the findings and data from these studies.

### 2.1 Site Survey

Hydrographic survey data were collected on April 27 and 30, May 4 and 7 and July 20, 2018. The project team collected the data using a Total Station and a survey grade RTK GPS unit. Information collected included water surface elevations, bank topography, channel bathymetry, and existing infrastructure. Local control points were used to tie the data into the North American Datum 1983 (NAD-83) State Plane Coordinate System, Colorado Central Zone, North American Vertical Datum 1988 (NAVD-88) vertical datum. This current data collection effort was supplemented with channel bathymetry collected via boat and sounders as part of the Crystal River Management Plan project in in 2014 and 2015. All data were compiled and combined with LiDAR data obtained from State of Colorado Geological Survey to create a continuous digital terrain model (DTM) was generated of the project reach, including the channel, floodplain and upland areas.

### 2.2 Channel Stability Assessment

The project team also evaluated bank and channel stability of the Crystal River through the project reach. This was accomplished through a detailed look at the channel and the banks. This process began with a desktop study of current and past aerial images and concluded with field study of channel and bank conditions. Potential issues such as channel deposition and scour areas and bank erosion or bank failure were documented and surveyed.

## 2.3 Ecological Integrity Assessment for Colorado Wetlands

To evaluate the ecologic condition of the Project Area an Ecological Integrity Assessment (EIA) for Colorado Wetlands Field Manual, Version 2.1 as developed Colorado Natural Heritage Program, Colorado State University, 2016 was used. This is an assessment method, that measures overall wetland condition with an emphasis on biological integrity. The method combines quantitative vegetation metrics with qualitative metrics that evaluate landscape context, hydrology, soils, water quality, and size into a multi-metric index. Final EIA scores rank a riparian systems condition on a four-tiered scale (excellent/good/ fair/poor), as compared to unaltered wetlands of the same type. This methodology was chosen because it has the ability to provide baseline data to establish existing conditions and evaluate restoration efforts over time. The EIA method provides land managers with a tool to measure the ecological integrity of riparian habitats and wetlands, and could be used to target sites for restoration or further protection.

### 2.3.1 Existing Conditions Analysis

A Level 2.5 EIA Assessment was conducted for the site on July 26 and July 27, 2018 by Jeremy Allinson of DHM Design, Corp. In accordance with the Field Manual, Version 2.1 (Lemly et al., 2016). Major ecological factors scored included landscape context, buffer, vegetation condition, hydrological condition, and size, and the ratings are based on deviation from “natural” reference benchmarks. The Project Area was divided into to Assessment Areas (AA-1 and AA-2) and an Ecological Integrity Assessment (EIA) was conducted for each. The scores for each assessment area were added together and the average was used for the overall Project Area.

The results of the EIA for Crystal River Project Area show the site has an Overall Ecological Integrity Score of 2.31, which represents a C+ letter grade, or a fair riparian condition. The major factors leading to the

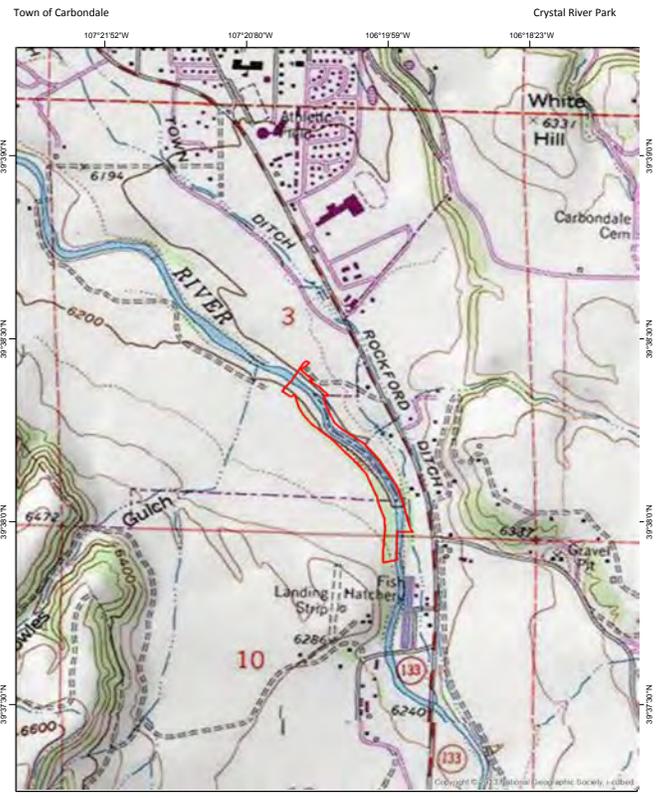
score include the lack of hydrological input; i.e., low flows reduce groundwater influence and wetland hydrology; the moderately high cover of non-native plants and invasive noxious weeds, and the adjacent land use activities. In addition, the size was determined to be a negative factor as the natural extent of good quality riparian habitat has been relegated to a narrow band along the Crystal River. See Appendix B for the EIA data form and EIA scorecards.

### 2.3.2 Post-Restoration Assessment

A proposed condition EIA was prepared assuming completion of the recommended restoration activities. Over time, the EIA rating of the Crystal River Restoration Project riparian habitat will likely increase to a 3.12 score, which represents an B letter grade, good condition. The major factors leading to the increase in ecological health include an increase of all vegetation metrics including restoration of the native plant species community, structural diversity, and elimination of noxious invasive weeds. In addition, size and connectivity scores would be increased once the riparian habitat is restored.

## 2.4 Recreational, Educational and Interpretive Field Analysis

Professional landscape architects and designers conducted a field visit, site inventory and analysis to establish the recreational, educational and interpretive opportunities on the site. Recommendations are based on projects of similar type and scale, a familiarity with the surrounding community and amenities and stakeholder goals and priorities that were communicated during meetings with the project team.



BASE: USGS 7.5' Basalt, Colorado Quadrangle  
Grid Lat/Long WGS 1984

Figure 1. Project Location Map  
Riparian Assessment Areas  
Crystal River Restoration  
Garfield County, Colorado



Scale: 1:24,000  
1 inch = 2,000 feet  
Date: October 2017



August 2018 - Riparian Restoration Plan

Figure 1-2 Project location map, riparian assessment areas

### 3.0 Existing Conditions

The existing conditions of the Project Area are diverse. The ecologic health and communities vary by location on site. In general the site ranges from hosting very intact riparian communities to areas of high degradation with opportunities for restoration.

#### 3.1 Landform, Elevation and Size

The Project Area is located on a relatively flat terrace along an unconfined section of the Crystal River at an elevation of 6,288 feet. The Project Area encompasses the east and west side of the Crystal River and is located in parts of Sections 9, 16, and 19 of Township 88 West and Range 8 South in Garfield County, Colorado, see figure 3.1. The assessment areas also encompass both sides of the Crystal River and takes into consideration the hydrological influence of the river. See maps "Existing Conditions - Study Area A" and "Existing Conditions - Study Area B" at the end of this section.

#### 3.2 Land Use

Historically, the Project Area was a working ranch with an agricultural land use component. This is evident

by the presence of European pasture grasses and apple trees. Today, as part of the Crystal River Park, the riparian corridor provides habitat for wildlife and is used for recreational activities which likely include fishing in the Crystal River, hiking/walking and wildlife observation. Adjacent land uses include River Valley Ranch Golf Course to the west and private residential land ownership to the east.

#### 3.3 Channel Characteristics

The Crystal River from the Roaring Fork River confluence through the Town of Carbondale was analyzed through aerial imagery from 1993 - 2015 to resolve geomorphic characteristics and trends over time. The selected channel reach has exhibited minimal migration over the duration of the aerial photography record, primarily due to entrenchment within quaternary terraces. Overall the river through Carbondale maintains a moderately steep slope,  $S_0$ , of approximately 0.008 ft/ft and an overall sinuosity of 1.2. Quantitative observations of the meander characteristics correspond well with empirical observations of unconfined alluvial channels made by Leopold et al. (1960). The river has been observed as relatively stable in planform over time and the values of the radius of curvature to top-width ratio and

sinuosity index indicate a high potential for erosion (Biedenharn et al., 1989; Nanson and Hickin, 1986; Brice 1984). Overall, the channel is classified as a stable, sinuous system confined within a paleo channel with strong potential for erosion and bed load transport.

The project area itself has similar characteristics to the overall river reach and is typified by a general bend of the river from a north flowing direction to a

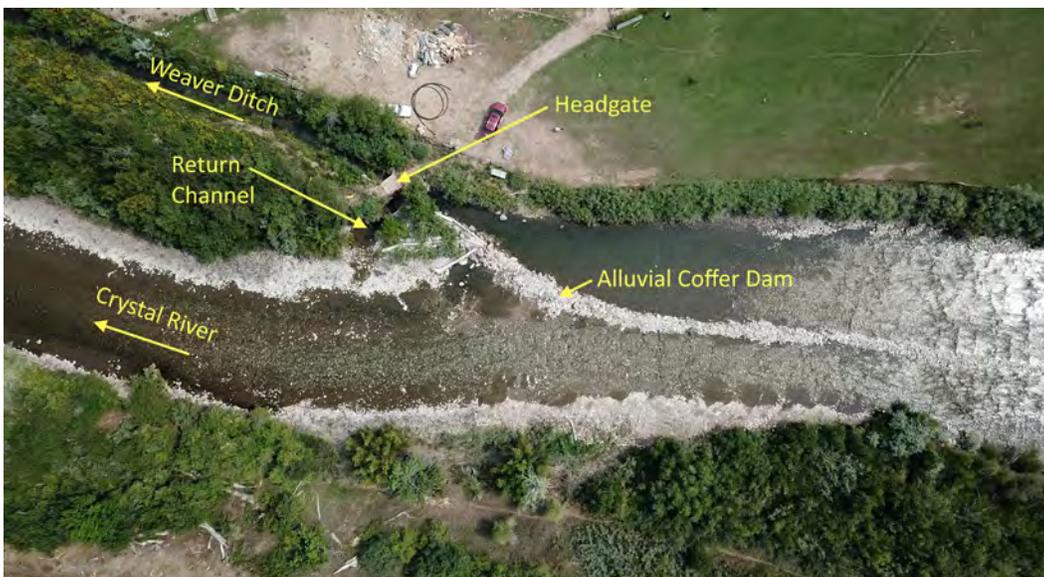


Image 3-1 Alluvium dam, boulder grade control, concrete headgate structure, and the beginning of the Weaver Ditch.

northwest direction. The Crystal River has a sinuosity of 1.06 and a bed slope of  $S=0.006$  ft/ft through the project area. A review of the past 25 years of aerial photos depicts a laterally stable channel that has not exhibited sign of meander. As would be expected from the gradual bend to the northwest, the right (east) bank is fairly steep and high with no floodplain bench. Much of this bank has been reinforced with riprap. The left (west) bank is lower with period connections to the narrow floodplain bench. Areas where vegetation has established have stable banks and areas where vegetation has been removed exhibit erosion. The banks are characterized by 3 to 4 feet of fine material overlaid on a coarse gravels and cobbles. In areas where bank erosion is occurring, the fine material is sloughing into the river, leaving vertical faces of fine material on top of the underlain cobble/gravel.

At low flows the project reach exhibits a riffle-pool geomorphology. There are currently 5 distinct riffles in the project reach. The pools between these riffles are fairly shallow. At higher flows the pools wash out and the project reach exhibits a riffle run geomorphology.

The most prominent in-channel feature is the

Weaver Diversion headgate, located approximately 1,000 feet upstream of the Crystal Bridge Drive bridge. The diversion consists of a boulder and cobble grade control structure placed in the river to maintain water surface elevations and a concrete headgate structure with sluice gate and return channel on the east bank. During low flow periods, such as in the summer of 2018, the alluvium dam will be raised and extended upstream by Town of Carbondale staff. Image 3-1 shows the alluvium dam,

boulder grade control, concrete headgate structure, and the beginning of the Weaver Ditch.

There is significant cobble deposits in the channel below the diversion point. This material is likely old alluvium push up dams washed down during past runoff events. This deposition area is also likely enhanced by the high flow constriction of the Crystal Bridge Drive bridge, which creates a backwater section upstream of the bridge at high flows. The deposit has created a wide, long riffle with no thalweg formation. During low flow periods this results in a channel wide, very shallow flow depth through this section of the project. Photo 3-2 shows the alluvium deposition area upstream the Crystal Bridge Drive bridge.

### 3.4 Vegetation

The vegetation within the Project Area is consistent with that typically found within riverine riparian systems and is characterized by cottonwood trees, shrublands and herbaceous zones with sedges and forbs. The vegetative composition and diversity is generally healthy throughout the property. The vegetative diversity and resilience is intimately tied to the hydrological regime within the riparian system. When the river overflows it's banks, it feeds water into the surrounding plants and soils, creates natural levees,



Image 3-2 Alluvium deposition area



Image 3-3 Example of the riparian shrublands within the project area



Image 3-4 Palustrine emergent wetland in the foreground with riparian forest in the background

and deposits sediment which have a direct impact on plant species and composition. The combination of a historical frequent disturbance regime and being situated adjacent to development and agriculture has increased the presence of non-native and noxious vegetation on the property.

A detailed vascular plant species list is included in Appendix A, Table 1, and vegetative species associated with the mapped ecological system types on pages 9 and 10.

### 3.5 Soils

The restoration areas are characterized by three soil mapping units including the Atencio-Aseltine Complex (unit 13), Dahlquist-Southace Complex (unit 28) and Fluvaquents (unit 42), as described and illustrated in the Soil Survey of Aspen-Gypsum Area, Colorado, Parts of Eagle, Garfield and Pitkin Counties (Soil Conservation Service, 1992). Each unit is briefly described below.

The Atencio-Azeline Complex, which occurs on alluvial fans and terraces, formed in alluvium derived predominantly from sandstone and shale. Typically, the surface layer is a sandy loam about 6 inches thick. The next layer is a sandy loam about 4 inches thick. The subsoil is about 10 inches of a sandy loam over about 4 inches of a gravelly sandy loam. The upper 6 inches of the substratum is a gravelly sandy loam. The lower part to a depth of 60 inches is a very gravelly sandy loam. Permeability is moderate to a depth of 30 inches and rapid below that depth. The available water capacity is low, runoff is slow and the hazard of erosion is slight. This soil is deep and well drained.

The Dahlquist-Southace Complex, which formed in alluvium and colluvium derived from mixed mineralogy, occurs on terraces, alluvial fans and side slopes. Typically, the surface layer is brown cobbly sandy loam and is about 6 inches thick. The upper 7 inches of the subsoil is very cobbly sandy clay loam. The lower 10 inches is very cobbly sandy loam. The



Image 3-5 Upland area of the site bordering the River Valley Ranch Golf Course



Image 3-6 Regulatory sign informing visitors of seasonal wildlife closures and present fishery pressure



Image 3-7 The wide shallow course of the river through the project area seasonally limits fish habitat and angling potential

substratum to a depth of 60 inches is calcareous extremely cobbly sandy loam. The permeability is moderately rapid and the available water capacity is low. Runoff is rapid and the hazard of water erosion is moderate to severe on steeper slopes. This soil is deep and well drained.

Fluvaquents are poorly drained and somewhat poorly drained soils that occur along floodplains of rivers. Typically, the surface layer of the Fluvaquents is grayish brown loamy sand about 5 inches thick. The underlying material extends to a depth of 80 inches or more.

### 3.6 Hydrology

The entire project area is located immediately adjacent to the Crystal River below the 100-year floodplain (see Figure 1-1). The alluvial aquifer of the river likely extends to the toe of the slope on both sides of the river. Hydro geological influences from the toe on the west side of the river increase groundwater availability and influence on the Palustrine Emergent Wetland areas located on the southwest side of the river. On the east side, the Weaver Ditch and the small agricultural ditch located further to the south, saturate subsoils in some areas of the terrace. The elevation of the Weaver Ditch is higher than the riparian vegetation and seepage occurs to the terrace as evidenced by the large stands of sandbar willows, alders, and other riparian vegetation.

Large flood event flow rates from the current Effective Flood Insurance Study will be used for the floodplain analysis. Listed flow rates for various flood events from the 10-year to the 500-year event are summarized in Table 3.6.1 below. Major flood flows on the Crystal River within the study area result from the rapid melting of mountain snow pack in the basin during the period from late May through early July. Snowmelt floods are characterized by moderate peak flows, large volumes and long durations and are marked by diurnal fluctuation in flow (FEMA, 1986).

Recurrence interval	Flowrate (cfs)
10-year	5,310 cfs
50-year	6,510 cfs
100-year	7,410 cfs
500-year	11,210 cfs

Annual peak runoff flows at the project reach were determined from the USGS gauge at Avalanche Creek (#09081600). The gauge has 63 years of daily average flow records available. The peak flow range from a high of 4,840 cubic feet per second (cfs) in 2010 to a low of 953 cfs in 2012. 2018 was the third lowest peak on record with a flow of 1,200 cfs. The average for the last 5 years is 2,216 cfs. The percentiles of these peak flow rates is summarized in table 3.6.2. These flow rates will differ from the flowrate at the project site due to inputs and diversions downstream of Avalanche Creek.

Percentile	Flowrate (cfs)
10	1,414
25	1,770
50	2,220
75	2,690
90	3,152

There is also a stream gauge at the fish hatchery, immediately upstream of the project site, which is operated by the Colorado Division of Water Resources. The gauge has been operated seasonally on and off since 2006. A continuous 12-month record began in 2017. Table 3.6.3 compares the peak flow at Avalanche Creek versus the peak flow at the fish hatchery for 2017 and 2018. There is approximately a 15-percent increase between the two gauge for the two years with data currently available.

Year	Avalanche Ranch Flowrate (cfs)	Fish Hatchery Flowrate (cfs)
2017	2,300 cfs	2,700 cfs
2018	1,200 cfs	1,450 cfs

As discussed in the Crystal River Management Plan, determining historical low flows at the project site is difficult due to the network tributary inputs and surface water diversion located between the Avalanche Gauge and the site. As part of the hydraulic modeling process the project team will look at a wide range of low flow events from 5 cfs through 500 cfs.

The recent addition of the real-time and full-time fish hatchery gauge removes much of this uncertainty moving forward. The low flow for 2017 was approximately 30 cfs. For the low water year of 2018, flow dipped as low as 5 cfs in mid-September.

### 3.7 Growing Season

The growing season is defined as that part of the year when soil temperatures at 50 cm (20 inches) below the soil surface are higher than biologic zero (5 degrees C, 41 degrees F). As this quantitative determination requires in-ground instrumentation which is not usually available, growing season can be estimated by approximating the number of frost free days. The growing season can be approximated as the period of time between the average date of the last killing frost in the spring to the average date of the first killing frost in the fall. This represents a temperature threshold of 28 degrees F or lower at a frequency of 5 years in 10.

The closest WETS weather station with information on the growing season is the Eagle County AP located near Eagle Colorado at an elevation of 6,497 feet. The

mean high temperature of 85.5°F occurs in July and the mean low of 4.7°F occurs in January. The growing season length as defined by 39°F air temperature, is 94 days with a 50% chance of occurring between June 5 and September 12 (USDANRCS, 2017).

### 3.8 Ecologic Communities Definitions

The Project Area characterized as ecological system type of Rocky Mountain Lower Mountain-Foothill Riparian Woodland and Shrubland. The major vegetative zones that occur within the Project assessment areas include Riparian Shrubland and Scrub Shrub Wetland, Riparian Palustrine Emergent, Forested Riparian and Upland.

#### 3.8.1 Riparian Scrubland / Scrub Shrub Wetland

The Riparian Scrubland / Scrub Shrub Wetland zone within the project area is dominated by woody vegetation less than 6 m (20 feet) tall. The species include true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions. The most dominant vegetative class of within the Project Area at 10.3 acres, this system occurs on both sides of the river and includes the following dominant vegetation types: Silver buffaloberry (*Shepherdia argentea*), Alder (*Alnus incan subsp. tenifolia*), Twinberry/bush honeysuckle (*Distegia involucrata* (*Lonicera*)), Redosier dogwood (*Cornus sericea* (*C. alba*)), Red haw (*Crataegus erythropoda*), Sandbar willow (*Salix exigua*), Mountain willow (*Salix monticola*), Green rabbitbrush (*Chrysothamnus viscidiflorus*).

#### 3.8.2 Palustrine Emergent Wetland

This emergent wetland class is characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens (USFWS, 2018). With vegetation present for most of the growing season, these wetlands are dominated by perennial plants. This wetland type occurs primarily in two areas within the Project Area:

along the toe of the slope at the north side of the Project Area and again towards the south side, where the wetland is large and is of very high quality, with significant vegetative composition, diversity and structure. The total acreage for this type of wetland is 2.7 acres. Dominant vegetative species for this type of system within the project area include: Woolly sedge (*Carex pellita*), Nebraska sedge (*Carex nebrascensis*), Beaked sedge (*Carex rostrata*), Nodding rush (*Isolepis cernua*), Baltic rush (*Juncus articus subs. Ater(=J.balticu)*), Colorado rush (*Juncus confusus*) and Alpine bluegrass (*Poa alpina*).

### 3.8.3 Forested Riparian

This vegetative zone includes mature trees over 6 meters (20 feet) tall and is found along the periphery of the west side of the Project Area. The dominant tree species within the project area includes the Narrow-leaf Cottonwood (*Populus angustifolia*), other tree species occurring within the project area include: Rocky Mountain Juniper (*Juniperus scopulorum*), Blue Spruce (*Picea pungens*), Siberian elm (*Ulmus pumila*), Russian Olive (*Elaeagnus angustifolia*), and cultivated Apple trees (*Malus domestica*).

### 3.8.4 Upland

On the hillside of the site, a small strip of upland occurs on the periphery of the forested riparian zone and is limited to 1.2 acres. The upland zone extends to the golf course and consists primarily of European pasture grasses including various species of brome, timothy and ryegrass. Cheatgrass (*Bromus tectorum*) is present in abundance in various locations.

## 3.9 Wildlife and Threatened and Endangered Species

The Project Area provides habitat for a variety of wildlife species. A complete list of threatened and endangered species and known and likely species to occur, is included in Appendix A, Table 2, Project Area Wildlife Species List. The Project Area provides good quality habitat for various avian species, from

waterfowl to raptors and a variety of other bird species in between. The many dead trees and snags throughout provide excellent hunting perches for a variety of raptor species and cavity nesting opportunities. An active osprey (*Pandion haliaetus*) nest is located approximately 900 feet to the south of the Project Area (see figure 3, Wildlife Map). Colorado Parks and Wildlife (CPW) recommend no surface occupancy (beyond that which historically occurred in the area) within 1/4 mile (1,320 feet) of active nests from April 1 through August 31. Some osprey populations have habituated and are tolerant to human activity in the immediate vicinity of their nests, coordination with CPW on seasonal closures is recommended. The Crystal River Park is currently closed from December 15 to March 15, to allow for bald eagle (*Haliaeetus leucocephalus*) winter foraging activities. Bird nesting boxes exist on the parcel. Additional nesting boxes for variety of species could increase nesting opportunities and provide additional birding opportunities for visitors. The Project Ecologist on site also noted a high incidence of great blue heron (*Ardea herodias*) within the Project Area.

Mammal habitat is limited due to the size and surrounding land use. Mapped habitat within the project area includes overall range and winter range for larger ungulates such as Mule deer (*Odocoileus hemionus*), Elk (*Cervus canadensis*), and Black bear (*Ursus americanus*). The project area is located within a black bear human conflict area. Additional potential mammal species likely to occur within the project area are listed in Appendix A, Table 2.

Fish species likely to occur within the Project Area include Rainbow trout (*Oncorhynchus mykiss*), Brown trout (*Salmo trutta*), Brook trout (*Salvelinus fontinalis*), Colorado Cutthroat trout (*Oncorhynchus clarki pleuriticus*), and Mountain whitefish (*Prosopium williamsoni*). Fish habitat is limited throughout the reach, and due to extremely low water conditions during certain times of the year which constrains fishing opportunities. There is a Colorado Parks and Wildlife (CPW) operated fish hatchery located immediately upstream of the project on the east bank.

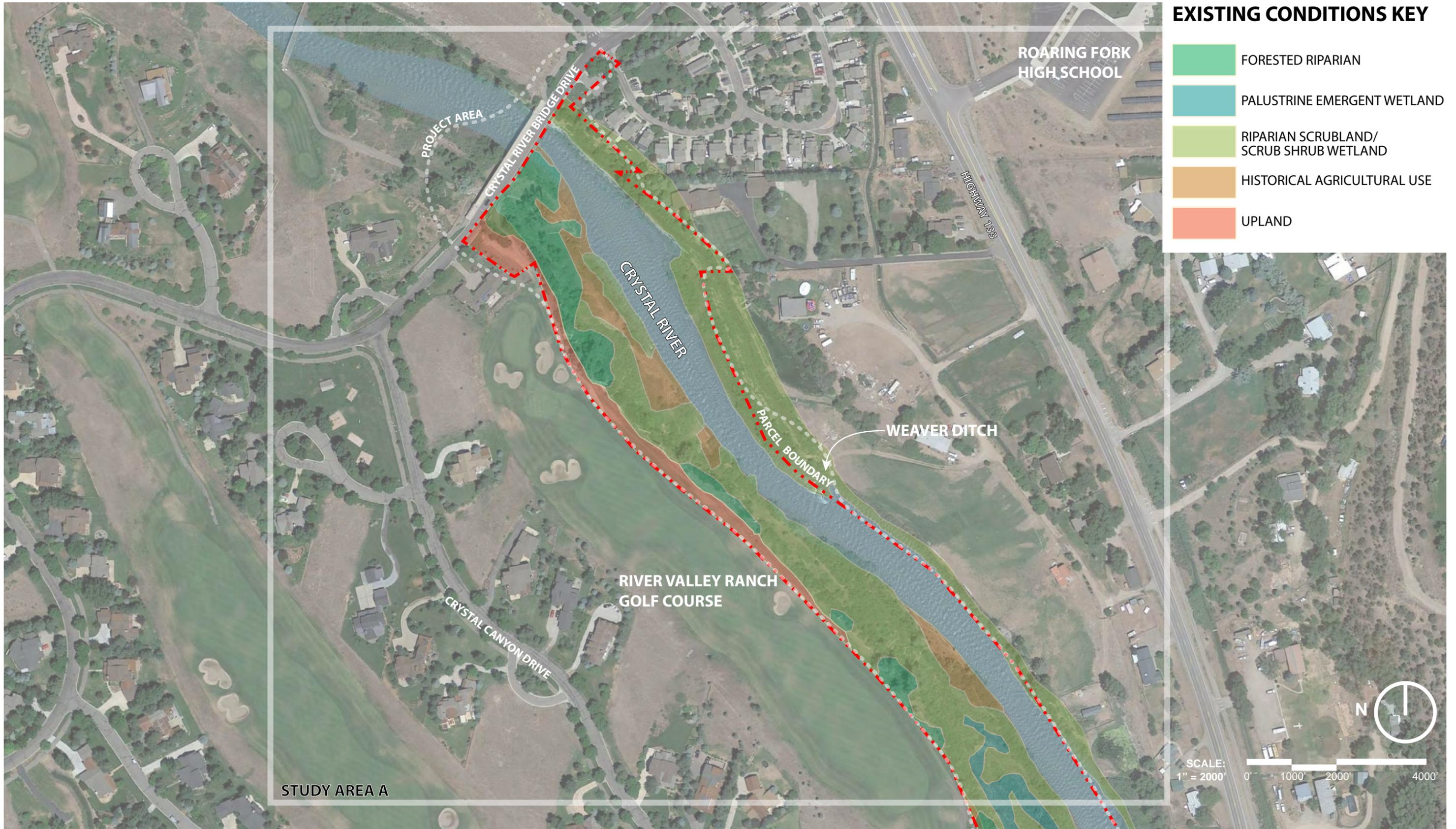
Per the CPW website, the hatchery raises rainbow trout and Snake River cutthroat trout (*Oncorhynchus clarkii bouvieri*) brood fish. The eggs generated by these brood fish as shipped to other hatcheries for hatching, raising and stocking.

No Threatened or Endangered Species (T&E) were observed within the Project Area. State and federal T&E species likely to occur in the project area include: U.S. Fish and Wildlife (USFWS) threatened and endangered tiger salamander (*Ambystoma tigrinum stebbinsi*), state listed species of concern northern leopard frog (*Lithobates pipiens*) and the peregrine falcon (*Falco peregrinus*), which is also a state listed species of concern. Colorado Parks and Wildlife Species Activity Mapping (SAM) data and USFWS Information for Planning and Consultation (IPAC) data was utilized for desktop review and to create the Existing Wildlife Conditions Map on page 13. Some T&E species listed under the USFWS IPAC report are unlikely to occur within the project area, consultation with a local biologist is recommended prior to any proposed project development.



Image 3-8 Interpretive sign at the project site describing seasonal closures to protect Bald Eagle Habitat and information on bird watching.

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**EXISTING CONDITIONS KEY**

- FORESTED RIPARIAN
- PALUSTRINE EMERGENT WETLAND
- RIPARIAN SCRUBLAND/  
SCRUB SHRUB WETLAND
- HISTORICAL AGRICULTURAL USE
- UPLAND

STUDY AREA A



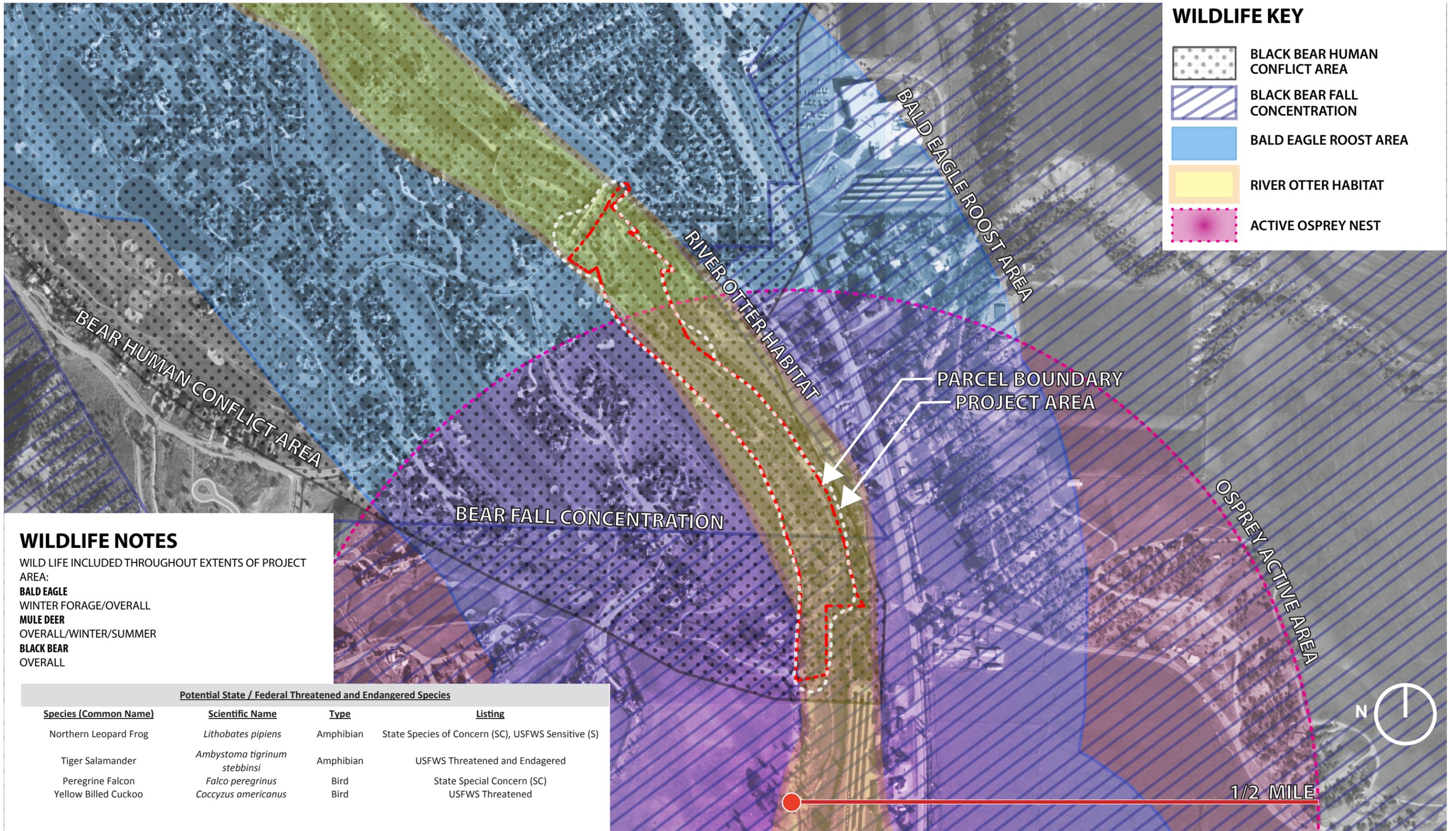


**EXISTING CONDITIONS KEY**

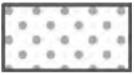
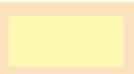
- FORESTED RIPARIAN
- PALUSTRINE EMERGENT WETLAND
- RIPARIAN SCRUBLAND/ SCRUB SHRUB WETLAND
- HISTORICAL AGRICULTURAL USE
- UPLAND







### WILDLIFE KEY

-  BLACK BEAR HUMAN CONFLICT AREA
-  BLACK BEAR FALL CONCENTRATION
-  BALD EAGLE ROOST AREA
-  RIVER OTTER HABITAT
-  ACTIVE OSPREY NEST

### WILDLIFE NOTES

WILD LIFE INCLUDED THROUGHOUT EXTENTS OF PROJECT AREA:

- BALD EAGLE**  
WINTER FORAGE/OVERALL
- MULE DEER**  
OVERALL/WINTER/SUMMER
- BLACK BEAR**  
OVERALL

Potential State / Federal Threatened and Endangered Species			
Species (Common Name)	Scientific Name	Type	Listing
Northern Leopard Frog	<i>Lithobates pipiens</i>	Amphibian	State Species of Concern (SC), USFWS Sensitive (S)
Tiger Salamander	<i>Ambystoma tigrinum stebbinsi</i>	Amphibian	USFWS Threatened and Endangered
Peregrine Falcon	<i>Falco peregrinus</i>	Bird	State Special Concern (SC)
Yellow Billed Cuckoo	<i>Coccyzus americanus</i>	Bird	USFWS Threatened



## 4.0 Restoration Opportunities

There are ample opportunities for riparian habitat preservation, enhancement and restoration across the Project Area. The project team has developed a restoration concept which addresses the existing conditions with four types of interventions by ecologic community type:

- Preserve
- Enhance
- Create
- Future Restoration Opportunities

These opportunities are conceptual in nature and based on initial field visits and data collection. The project team anticipates further collaboration with stakeholder groups to develop the presented opportunities into two (2) comprehensive concept alternatives.

### 4.1 Restoration Concept

The Project Area restoration concept focuses on three main ecologic communities, riparian, wetland and in channel. For the purpose of this report and based on stakeholder goals, upland communities are reserved for future restoration opportunities. The surveyed riparian and wetland communities are recommended for preservation, enhancement or creation.

- Preservation - The protection of intact and functioning wetland or riparian through ecologic and landscape planning and site development.
- Enhancement - The restoration of partially functioning healthy wetlands and riparian areas. This can include noxious weed elimination, planting, seeding, and other restoration techniques.
- 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 or riparian area.

The in-channel restoration opportunities are discussed in Section 4.1.3.

Maps of these opportunities can be found at the end of this section. All priorities and decisions about restoration actions should be guided by stakeholder goals and values.

#### 4.1.1 Riparian Restoration Opportunities

As discussed in the existing conditions section, the health and quality of the riparian environment within the Project Area is good. **The project team recommends 10.1 acres for preservation, 0.45 acres for enhancement, and 1.1 acres for creation.**

##### 4.1.1.1 Riparian Preservation

Riparian preservation would include developing a regular monitoring and maintenance plan to preserve the high quality riparian habitat. Monitoring noxious and native vegetation will preserve and sustain current riparian conditions. By limiting access to sensitive areas and minimizing disturbance by directing human traffic through way-finding and the creation of designated, formalized paths impacts can be reduced. The project team recommends preserving approximately 10.4 acres of high quality riparian habitat.

##### 4.1.1.2 Riparian Enhancement

Riparian enhancement will improve existing conditions to increase habitat value. This is done through the development and implementation of a weed management plan to control noxious vegetation, identifying arboricultural maintenance needs/plans and increasing plant diversity through planting and seeding. The resulting enhancement will provide increased habitat value for wildlife and improve overall ecological conditions. The project team recommends that Project Area Stakeholders consider interventions to enhance approximately .45 acres of Riparian habitat.



Image 4-1 This image demonstrates highly degraded ecologic conditions near the river on the left side of the photograph. This is an area recommended for riparian creation. Near the center of the photo, healthy forbes indicate an intact wetland which could be enhanced.



Image 4-2 A high quality wetland can be seen on the right side of the image. This area would be recommended for wetland preservation. On the left side of the image, closer to the Crystal River there is an area recommended for wetland creation

#### 4.1.1.3 Riparian Creation

Riparian creation is the most intensive of the three types of restoration. This involves grading the topography to create elevations with the appropriate available water to support native riparian vegetation plantings. Areas identified within the report are immediately adjacent to the river bank and are located in close proximity to the river water table. Areas identified for bank stabilization as part of river improvements are ideal locations for this recommended intervention as bank stabilization and riparian creation are both interventions with overlapping goals. The project team recommends 1.1 acres of Riparian Creation.

#### 4.1.2 Wetland Restoration Opportunities

As discussed in the existing conditions section, the health and quality of the wetland environment within the Project Area is good to excellent. The project team recommends 1.6 acres for preservation, .076 acres for enhancement, and .17 acres for creation.

##### 4.1.2.1 Wetland Preservation

Wetland preservation includes regular monitoring and maintenance of plant species, the percent cover of the plants, and the hydrological conditions on site. Monitoring can assist with understanding overall wetland health, identify trends, and allow for short term and long term preservation planning. The construction of boardwalks in these areas would dramatically reduce human impacts and provide excellent learning and wildlife viewing opportunities. The project team recommends 1.6 acres for wetland preservation.

##### 4.1.2.2 Wetland Enhancement

Wetland Enhancement including noxious and invasive species control, selective planting and maintenance can enhance what is already considered a high quality wetland within the Project Area. The project team recommends that at the Project Area Stakeholders consider .076 acres within the Project Area for wetland enhancement.



Image 4-3 This location of the assessment area has mature trees and shrubs suitable for riparian preservation. The herbaceous ground cover is mostly noxious weeds making it a candidate for riparian creation

#### 4.1.2.3 Wetland Creation

Appropriate hydrological conditions to support wetland plant species can be created by grading the topography of appropriate sites within the Project Area. The location of the proposed wetland creation sites (See maps "Restoration Opportunities - Study Area A" and "Restoration Opportunities - Study Area B" at the end of this section) allows for ease of colonization of adjacent wetland plant species. Minimal grading would be required to achieve successful wetland creation in this area. The project team recommends that at the Project Area Stakeholders consider approximately 7,225 square feet for wetland creation.

#### 4.1.3 Bank and Channel Restoration Opportunities

Several locations along the west bank of the river have been identified as opportunities for restoration. This restoration work can take several forms depending on the location and other project goals such as river access, angling locations and educational



Image 4-4 An example of healthy PER wetlands and riparian shrublands. Both areas are recommended for preservation



Image 4-5 The shrubs in this image are in good health and these woody vegetated zones are recommended for preservation. The wide swaths of brome in the foreground of the photograph are an opportunity for riparian enhancement.

opportunities. In higher traffic and access areas, the bank restoration will be comprised of boulders. Lower traffic area restoration activities will utilize vegetation and large wood, with boulders only used for toe reinforcement. Examples of this type of restoration are shown in Images 4-6 and 4-7. Proposed locations are shown on the maps at the end of this section.

The Weaver Ditch diversion structure will be the primary focus of the in-channel improvements. Proposed modifications will create a stable boulder structure in the river that allows for proper function at a wide range of flows with reduced maintenance requirements. The headgate structure itself will also be modified to allow for reduced maintenance needs and the ability to add an automated system in the future.

The team will also look at the section of the channel downstream of the diversion which is experiencing higher sediment accumulation. Options here include the creation of a thalweg and potentially a localized, slight narrowing of the channel to increase sediment transport capacity. Sections of river upstream of the Weaver Diversion will likely be unmodified with the exception of bank work. This area of the river is highlighted on the Existing Conditions maps in section 3.

## 4.2 Ecological Performance Standards (Success Criteria)

Ecological performance standards and success criteria for riparian enhancement and creation opportunities should be established and agreed upon by all stakeholders, designers, and agencies to provide a clear road map for success. Vegetative success criteria can include the identification of thresholds for percent cover, vegetative composition, and native vs. non native species. New plantings and seeded areas should be monitored on a regular basis to ensure success. Areas where hydrological conditions are necessary for growth should be monitored regularly. For creation and enhancement areas, adjustments to site conditions may be necessary to allow for optimal success.

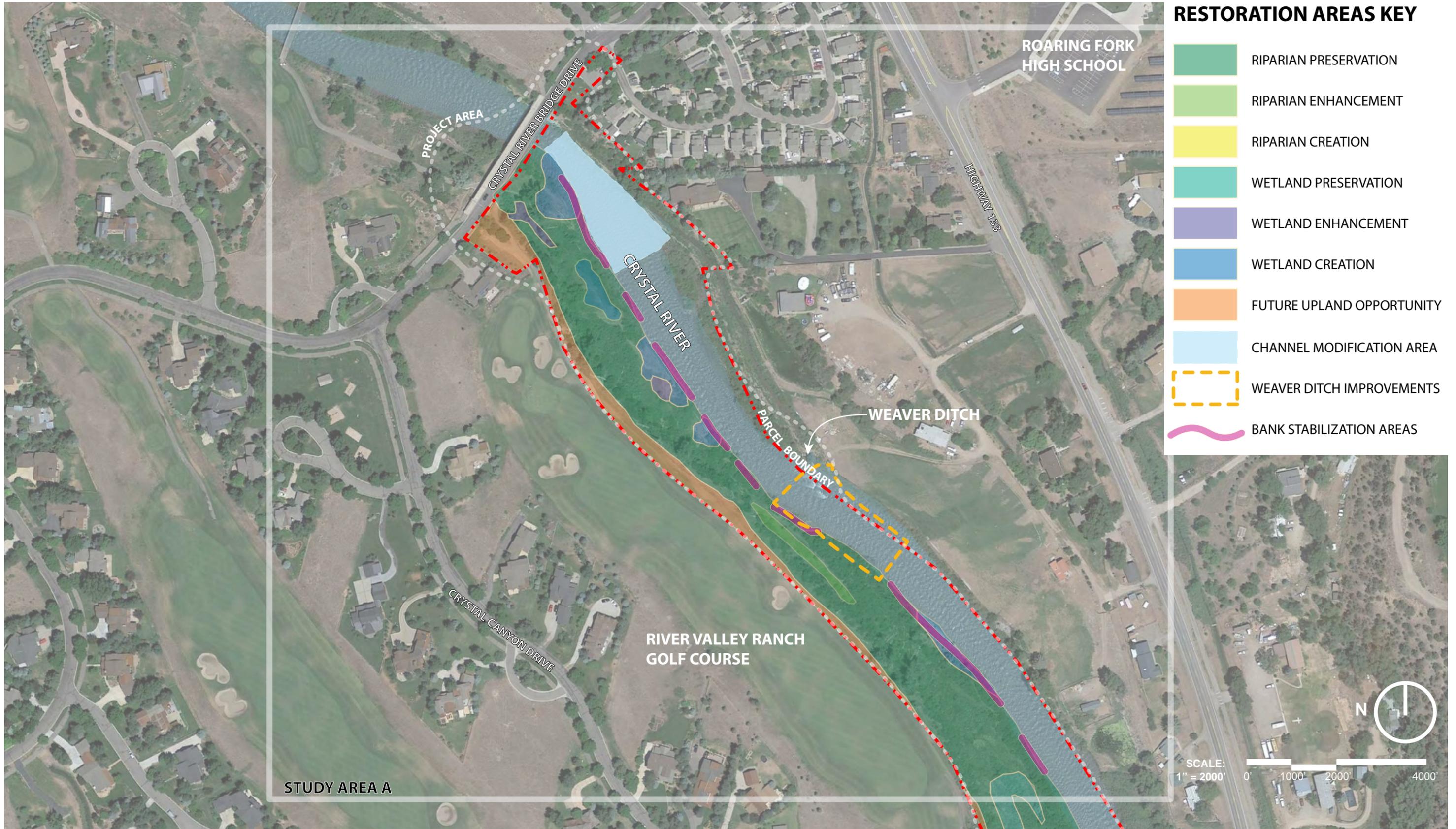


Image 4-6 An example of a bank repaired with boulders and steps



Image 4-7 An example of a bank repaired with vegetation

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**RESTORATION AREAS KEY**

- RIPARIAN PRESERVATION
- RIPARIAN ENHANCEMENT
- RIPARIAN CREATION
- WETLAND PRESERVATION
- WETLAND ENHANCEMENT
- WETLAND CREATION
- FUTURE UPLAND OPPORTUNITY
- CHANNEL MODIFICATION AREA
- WEAVER DITCH IMPROVEMENTS
- BANK STABILIZATION AREAS





**RESTORATION AREAS KEY**

- RIPARIAN PRESERVATION
- RIPARIAN ENHANCEMENT
- RIPARIAN CREATION
- WETLAND PRESERVATION
- WETLAND ENHANCEMENT
- WETLAND CREATION
- FUTURE UPLAND OPPORTUNITY

STUDY AREA B

SCALE: 1" = 2000' 0' 1000' 2000' 4000'





## 5.0 Recreation, Education and Interpretation Opportunities

### 5.1 Existing Conditions

The current on-site opportunities for people to engage with the ecology and nature of the Project Area are limited while human use of the Project Area is evident. Existing amenities such as the trail, river access, interpretive and regulatory information and gathering places have become degraded and weathered overtime. These spaces are generally in disrepair and are no longer as effective as they once were.

The main trail along the site is heavily overgrown and can be difficult to locate and navigate. Areas of the trail have eroded into the river and navigation through the overgrowth is difficult in sections. This trail overgrowth and degradation has resulted in informal “social trails” winding through the site and degraded river banks from informal access points contributing to erosion and bank destabilization.

The Project Area contains a number of interpretive signs, however these signs have become worn over time and are dated. Many signs are no longer visible due to vegetation overgrowth and do not describe the ecologies of the locations where they stand. Instructional and regulatory signs are not concentrated or clearly placed near the main access point near the bridge.

The current inventory of sign topics include:

- Bald eagle closure area notice
- No dogs or glass containers regulation
- Riverfront Park entrance sign
- 8 Interpretive Signs
  - “River Valley Ranch Wetlands”
  - “Riparian Woodland”
  - “Fisheries”
  - “Wetland Plants - What herb is this?”
  - “Aquatic Plants”



Image 5-1 View of the proposed southern gathering area with views of Mount Sopris



Image 5-2 Example of an outdoor classroom with seating and naturalized elements



Image 5-3 Navigating the overgrown trail



Image 5-4 Example of current interpretive signage



Image 5-5 Picnic benches on South end of Project Area



Image 5-6 Informal river access with visible erosion

- “Wetland Plants”
- “Willows”
- “Birds of the Wetlands”

There are no formal gathering places with the exception of two picnic tables near the south end of the site (see Image 5-5). The area is both hard to locate and in disrepair due to age and lack of maintenance. Several informal gathering spaces exist and are evident in areas where the vegetation has been disturbed.

Additional challenges existing on site are the small parking area, lack of alternative transportation options such as a bike rack, lack of designated pedestrian crossing area and a visual disconnect resulting in difficulty locating the site. The access point beneath the bridge is difficult to find, is steep and the stairs are in disrepair. The site is currently not universally accessible.

Opportunities for new recreational, educational and interpretive amenities have been identified. There are many unique features of the site that have the potential to serve as the basis for recreational, interpretive and educational programming elements for diverse audiences. There are a wealth of opportunities to program the site building on interactive, recreational, and interpretive experiences, while simultaneously improving, restoring and protecting the health and ecology of the Crystal River and its riparian corridor.

This tandem approach of creating recreational amenities that also provide ecological benefits is the recommended method to bring cultural and ecological value to the site simultaneously. The following sections identify opportunities for; public gathering spaces, educational and interpretive sites, trail and way-finding improvements, access and recreation. No significant local, state or federal permitting challenges are anticipated for the recreation, education and interpretive opportunities.

These opportunities are conceptual in nature and



Image 5-7 An apple tree in the Project Area hints at the past land uses and history of the area



Image 5-8 Example of an interactive interpretive site element, this map is both tactile and informative

based on initial field visits and data collection. The project team anticipates further collaboration with stakeholder groups to develop the presented opportunities into two (2) comprehensive concept alternatives.

## 5.2 Public Gathering Spaces

Through site visits and a discussion with stakeholders, two locations have been identified for outdoor classroom and public gathering spaces (see maps at the end of this section). One at the north end of the park near Crystal Bridge Drive and one at the south end of the park. As with all other project elements, final locations for public gathering space will be developed through a collaborative process with the project team, stakeholder group and general public.

- North end near Crystal Bridge Drive: The area along the river bank is degraded, reducing impacts to healthy riparian areas elsewhere. Optimally, gathering space would be placed along the bank with multiple access points down to the river to provide visitors with an opportunity to access the river and bank. This access could serve as an educational opportunity and/or for recreational opportunities such as angling. This gathering space could also serve as an area to inform the public about regulations or special information about the park. This is the most ideal site for a universally accessible gathering space.
- South End: The second public gathering space would be near the existing cottonwood grove at the south end of the park. This space could be more focused on the wetland and upland areas of the park. Amenities may include: a boardwalk and overlook of the enhanced wetland created by the reconnected side channel and an interactive exhibit describing ecological benefits of riparian features such as downed nurse logs and understory vegetation. This location also has the potential to serve as an outdoor classroom with seating, shade and interactive interpretive elements.

Constraints of these two sites include the limited

amount of parking available near the bridge and access to the area for people of different abilities and mobility types. Stakeholders should consider what the target audience is for these gathering places and what additional amenities will need to be on site to facilitate those user types.

## 5.3 Educational and Interpretive Opportunities

Many interpretive elements have already been introduced to the site. The proximity to schools, residential neighborhoods, and existing trail networks such as the Crystal Valley Trail create an ideal opportunity for educational and interpretive elements that could reach a large and diverse segment of the community. The project team recommends expanding and updating the current interpretive materials and making them more accessible and interactive. These interventions could include bilingual signage, the inclusion of tactile elements, view platforms and three dimensional exhibits.

Every site has a unique story to tell and this parcel is no exception. Identifying additional interpretive opportunities and communicating a larger, more engaging story is a goal moving forward. Interpretive elements to consider are as follows:

- Updating and expanding current interpretive topics
- Hydrology and river morphology
- Expanded information about variety of birds and their habitats
- Human history including indigenous populations, European settlers, ranchers and farmers
- Water infrastructure in our communities as it pertains to the Weaver Diversion
- Understanding place through landmarks such as Red Hill and Mount Sopris
- The water cycle and our local watersheds
- Insects and macro invertebrates in wetlands and riparian areas
- Angling
- Water rights and irrigation

The proposed new amenities would link together



Image 5-9 Navigating the trail can be tricky, the surface material changes through out the site



Image 5-10 Example of a boardwalk through an ecologically sensitive area



Image 5-11 Bird houses have been installed in the Project Area. Enhancing wildlife habitat would encourage passive recreation such as birding



Image 5-12 Example of a durable surface used for river access, helping to prevent erosion, fisheries health and bank destabilization

places on the site that help create a unique narrative. The project team recommends ongoing collaboration to create the educational and interpretive programming. In conjunction with the interpretive elements, an outdoor classroom area is a key recommendation of this report.

## 5.4 Recreational Opportunities

Currently the Project Area supports many passive recreation activities such as angling, walking, hiking, bird watching, picnicking, and nature play. All of these activities could be enhanced by improving, updating and programming the Project Area. A dual benefit of the proposed enhancements is that they would help to protect the restored ecology by directing people into areas specifically designed for recreation and intentionally directing people away from ecologically sensitive areas.

Angling opportunities would be greatly improved by the recommended river bank restorations and in-stream restorations proposed in Section 4.0. Fishing and fishing access could also be greatly improved and made more standardized by formalizing river access points to places along the bank which are safe, stable and offer opportunities to interact with the river.

Walking and hiking through the site could be improved in a host of ways. Trail improvements and access are discussed in the following section. Hiking and walking offer low impact exercise to many people. The gentle grade of the Project Area makes this site ideal for people of many ability levels and provides access to a wide range of people.

The existing bird watching opportunities on the site have the potential to be expanded. Wetland and riparian areas host some of the greatest bird life of any ecosystem type. The ecological restorations recommend in section 4.0 would improve the habitat of bird populations and provide birding enthusiasts with an incredible in-town amenity. Focusing on this recreation type also gives the project team an opportunity to collaborate and work with other specialty groups such as the local Audubon Society chapter. Furthermore, focusing on bird watching as a

major element of recreation on the site will encourage users to protect the ecosystem and respect the Project Area.

Finally picnicking, nature play and exploration are recreation objectives that can be easily met by formalizing public gathering areas. A focus on these types of recreation gives families, school groups and people of all ages a passive and enjoyable way to experience the natural environment. These elements can easily and imaginatively be incorporated through seating, shade and interactive interpretive elements.

## 5.5 Trail Improvements and Access

The project team advocates for an improved trail system that provides access and connectivity for park visitors. An ideal trail system would lead visitors to the different planned amenities, as well as allow them to experience the riparian corridor. The recommendation is for the trail to follow existing trail corridors, where possible, to minimize impact to healthy vegetation areas. The incorporation of a small loop trail could be a valuable asset allowing visitors to engage with unique places within the Project Area. Importantly, the existing trail needs to be cleared of obtrusive vegetation, undergo over-due maintenance, be reinforced in areas where it is eroding and have way finding practices such as clear lines of sight and signage.

There are three types of trails which would be most appropriate for the site. The primary trail type would be composed of a wide, firm surface and would connect to the universally accessible public gathering spaces and interpretive, educational areas. This trail would be accessible for less mobile individuals. The second type of trail would be more primitive and narrow. This trail could pass through several existing and healthy riparian areas. Finally, low boardwalks could be used in a few areas such as floodplains, connection areas and the re-established secondary channel.

As with all other project elements, alternatives for the trail system configuration will be developed through a collaborative process with the project team, stakeholder group and general public.

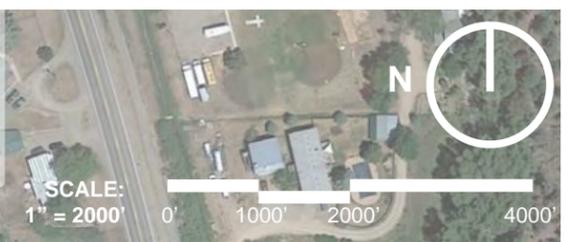


## RECREATION AREAS KEY

- EXISTING PARKING AREA
- PROPOSED IMPROVED PEDESTRAIN CROSSING AND BIKE RACK
- PROPOSED IMPROVED ACCESS AND RAMP
- PROPOSED PUBLIC GATHERING AREA
- ECOLOGIC PRESERVATION ZONE
- PROPOSED WEAVER DITCH REHABILITATION
- PROJECT AREA ACCESS ROUTE
- PROPOSED TRAIL FOLLOWING EXISTING ALIGNMENT
- PROPOSED FORMALIZED RIVER ACCESS POINT

## INTERPRETIVE OPPORTUNITIES

- ① WELCOME INFORMATION, MONUMENT SIGN, AND SITE REGULATIONS
- ② ANGING AND FISHERIES
- ③ RIPARIAN WOODLAND COMMUNITIES
- ④ WATER INFRASTRUCTURE AND WATER RIGHTS
- ⑤ RIPARIAN PLANTS, IDENTIFICATION
- ⑥ HUMAN HISTORY
- ⑦ SCRUB AND SHRUB HABITATS



STUDY AREA A



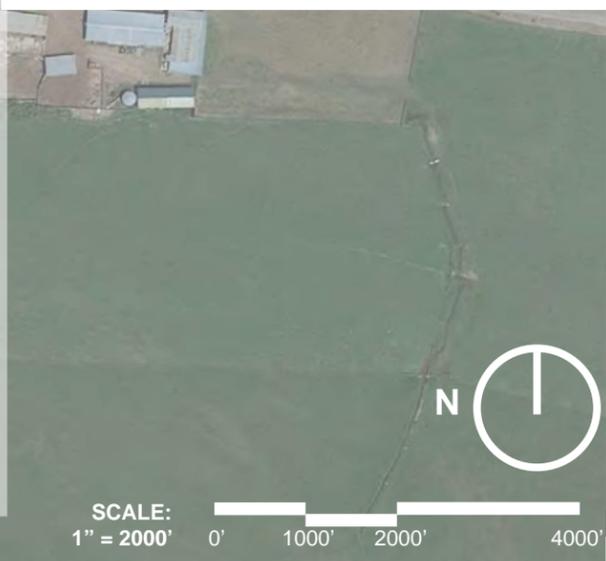


**RECREATION AREAS KEY**

- PROPOSED PUBLIC GATHERING AREA
- ECOLOGIC PRESERVATION ZONE
- PROPOSED BOARDWALK LOOP
- PROPOSED TRAIL FOLLOWING EXISTING ALIGNMENT
- PROPOSED BOARD WALK TRAIL
- PROPOSED FORMALIZED RIVER ACCESS POINT

**INTERPRETIVE OPPORTUNITIES**

- ⑧ BIRDS
- ⑨ ORIENTEERING
- ⑩ HYDROLOGY AND RIVER MORPHOLOGY  
WATER CYCLE AND LOCAL WATERSHEDS
- ⑪ INSECTS AND INVERTEBRATES
- ⑫ WILDLIFE
- ⑬ WETLAND PLANT IDENTIFICATION



SCALE: 1" = 2000'  
0' 1000' 2000' 4000'



# Appendix A: Species Lists

**TABLE 1**  
**Vascular Plant Species List**  
**Crystal River Restoration**

<u>Scientific Name</u>	<u>Common Name</u>	<u>Family</u>	<u>Origin*</u>
<b>Trees</b>			
Juniperus scopulorum	Rocky Mountain Juniper	Cupressaceae	N
Malus domestica	Apple tree (cultivated)	Rosaceae	I
Picea pungens	Blue spruce	Pinaceae	N
Populus angustifolia	Narrowleaf cottonwood	Salicaceae	N
Ulmus pumila	Siberian elm	Ulmaceae	I
Elaeagnus angustifolia	Russian Olive	Salicaceae	I
<b>Shrubs/Subshrubs</b>			
Alnus incana subsp. Tenuifolia	Alder	Betulaceae	N
Shepherdia argentea	Silver buffaloberry	Sherpherdia	N
Amelanchier alnifolia	Serviceberry	Rosaceae	N
Chrysothamnus nauseosus	Rubber rabbitbrush	Asteraceae	N
Chrysothamnus viscidiflorus	Green rabbitbrush	Asteraceae	N
Cornus sericea (C. alba)	Redosier dogwood	Cornaceae	N
Crataegus erythropoda	Red haw	Rosaceae	N
	Twinberry, Bush		
Distegia involucrata (Lonicera)	honeysuckle	Caprifoliaceae	N
Prunus virginiana var. melanocarpa	Native chokecherry	Rosaceae	N
Quercus gambelii	Gambel oak	Fagaceae	N
Ribes inerme	Whitestem gooseberry	Grossulariaceae	N
Prunus americana	American plum	Rosaceae	N
Rosa woodsii	Wood rose	Rosaceae	N
Salix exigua	Sandbar willow	Salicaceae	N
Salix frageilis	Crack willow	Salicaceae	I
Salix amygaloides	Peach willow	Salicaceae	N
Salix monticola	Mountain willow	Salicaceae	N
Betula occidentalis	Water Birch	Betulaceae	N
<b>Perennial Graminoids</b>			

Bromus inermis	Smooth brome	Poaceae	I
Dactylis glomerata	Orchardgrass	Poaceae	I
Elytrigia repens	Quackgrass	Poaceae	I+
Festuca pretensis	Meadow fescue	Poaceae	I
Carex nebrascensis	Nebraska sedge	Carex	N
Carex rostrata	Beaked sedge	Carex	N
Carex pellita	Woolly sedge	Carex	N
Isolepis cernua	Nodding rush	Cyperaceae	N
Juncus articus subs. Ater(=J. balticu)	Baltic rush	Juncaceae	N
Juncus confusus	Colorado rush	Juncaceae	N
Pascopyrum smithii (Agropyron)	Western wheatgrass	Poaceae	N
Phalaris arundinacea	Reed Canarygrass	Poaceae	I/[N]
Poa pratensis	Kentucky bluegrass	Poaceae	I
Poa alpina	Alpine bluegrass	Poaceae	N
<b>Perennial Forbs</b>			
Apocynum cannabinum	Indian dogbane	Apocynaceae	N
Asclepias speciosa	Showy milkweed	Asclepiadaceae	N
Asparagus officinalis	Asparagus	Liliaceae	I
Barbarea orthoceras	Wintercress	Brassicaceae	N
Cicuta maculata	Spotted water hemlock	Apiaceae	N
Cirsium arvense (Breea)	Canada Thistle	Asteraceae	I+
Clematis ligusticifolia	Western white clematis	Ranunculaceae	N
Convolvulus arvensis	Field bindweed	Convolvulaceae	I+
Epilobium angustifolium (Chaemerion)	Fireweed	Onagraceae	N
Heracleum sphondylium subsp. Montanum	Cow parsnip	Apiaceae	N
Leucanthemum vulgare (Chrysanthemum leucanthemum)	Ox-eye daisy	Asteraceae	I+
Medicago lupulina	Black medic	Fabaceae	I
Medicago sativa	Alfalfa	Fabaceae	I
Penstemon strictus	Rocky Mountain penstemon	Scrophulariaceae	N
Solidago velutina	Threenerve goldenrod	Asteraceae	N
Taraxacum officinale	Dandelion	Asteraceae	I

<i>Trifolium pratense</i>	Red clover	Fabaceae	I
<i>Urtica gracilis</i> subsp. <i>gracilis</i>	Stinging nettle	Urticaceae	N
<i>Veronicastrum serpyllifolia</i>	Thyme leaf speedwell	Scrophulariaceae	N
<i>Maianthemum racemosum</i>	False soloman's-seal	Maianthemum	N
<i>Vicia americana</i>	American vetch	Fabaceae	N

**Ferns and Fern Allies**

<i>Equisetum arvense</i>	Field horsetail	Equisetaceae	N
<i>Hippochaete hyemalis</i>	Scouring rush	Equisetaceae	N

**Annual/Biennial Forbs**

<i>Arctium minus</i>	Common burdock	Asteraceae	I+
<i>Carduus acanthoides</i>	Plumeless thistle	Asteraceae	I+
<i>Chenopodium album</i>	Lambs quarters	Chenopodiaceae	I
<i>Cynoglossum officinale</i>	Houndstongue	Boraginaceae	I+
<i>Lactuca serriola</i>	Prickly lettuce	Asteraceae	I
<i>Lepidium campestre</i>	Field cress	Brassicaceae	I
<i>Melilotus albus</i>	White sweet clover	Fabaceae	I
<i>Melilotus officinalis</i>	Yellow sweet clover	Fabaceae	I
<i>Sisymbrium altissimum</i>	Tumble mustard	Brassicaceae	I
<i>Tragopogon dubius</i>	Salsify	Asteraceae	I
<i>Verbascum thapsus</i>	Common mullein	Scrophulariaceae	I+
<i>Bromus tectorum</i>	Cheatgrass, Downy brome	Poaceae	I+

\*Origin

N=Native, I=Introduced, I+  
Colorado State listed Noxious  
Weed

Table 2 – Potential State / Federal Threatened and Endangered Species

<b><u>Species (Common Name)</u></b>	<b><u>Scientific Name</u></b>	<b><u>Type</u></b>	<b><u>Listing</u></b>
Peregrine Falcon	<i>Falco peregrinus</i>	Bird	State Special Concern (SC)
Northern Leopard Frog	<i>Lithobates pipiens</i>	Amphibian	State Species of Concern (SC), USFWS Sensitive (S)
Tiger Salamander	<i>Ambystoma tigrinum stebbinsi</i>	Amphibian	USFWS Sensitive (S)
<b><u>Known or Suspected Animal List</u></b>			
American dipper	<i>Cinclus mexicanus</i>	Bird	N/A
American kestrel	<i>Falco sparverius</i>	Bird	N/A
American robin	<i>Turdus migratorius</i>	Bird	N/A
Bald eagle	<i>Haliaeetus leucocephalus</i>	Bird	N/A
Black-billed magpie	<i>Pica hudsonia</i>	Bird	N/A
Black-capped chickadee	<i>Poecile atricapillus</i>	Bird	N/A
Blue wing teal	<i>Anas discors</i>	Bird	N/A
Blue-gray gnatcatcher	<i>Polioptila caerulea</i>	Bird	N/A
Canada goose	<i>Branta canadensis</i>	Bird	N/A
Chipping sparrow	<i>Spizella passerina</i>	Bird	N/A
Cinnamon teal	<i>Anas cyanoptera</i>	Bird	N/A
Common raven	<i>Common raven</i>	Bird	N/A
Cooper’s hawk	<i>Accipiter cooperii</i>	Bird	N/A
Cordilleran flycatcher	<i>Empidonax occidentalis</i>	Bird	N/A
Common snipe	<i>Gallinago gallinago</i>	Bird	N/A
Dark-eyed junco	<i>Junco hyemalis</i>	Bird	N/A
Downey woodpecker	<i>Picoides pubescens</i>	Bird	N/A
Dusky flycatcher	<i>Empidonax oberholseri</i>	Bird	N/A
Fox sparrow	<i>Passerella iliaca</i>	Bird	N/A
Great blue heron	<i>Ardea herodias</i>	Bird	N/A
Great horned owl	<i>Bubo virginianus</i>	Bird	N/A
Green-tailed towhee	<i>Pipilo chlorurus</i>	Bird	N/A
Green-winged teal	<i>Anas carolinensis</i>	Bird	N/A
Hairy woodpecker	<i>Leuconotopicus villosus</i>	Bird	N/A
House finch	<i>Haemorhous mexicanus</i>	Bird	N/A
House wren	<i>Troglodytes aedon</i>	Bird	N/A
Lewis’ woodpecker	<i>Melanerpes lewis</i>	Bird	N/A

Lincoln's sparrow	<i>Melospiza lincolnii</i>	Bird	N/A
MacGillivray's warbler	<i>Geothlypis tolmiei</i>	Bird	N/A
Mallard	<i>Anas platyrhynchos</i>	Bird	N/A
Mountain dove	<i>Spilopelia chinensis</i>	Bird	N/A
Mountain bluebird	<i>Sialia currucoides</i>	Bird	N/A
Mountain chickadee	<i>Poecile gambeli</i>	Bird	N/A
Peregrine falcon	<i>Falco peregrinus</i>	Bird	N/A
Plumbeous vireo	<i>Vireo plumbeus</i>	Bird	N/A
Northern flicker	<i>Colaptes auratus</i>	Bird	N/A
Red-tailed hawk	<i>Buteo jamaicensis</i>	Bird	N/A
Red-winged blackbird	<i>Agelaius phoeniceus</i>	Bird	N/A
Ruby-crowned kinglet	<i>Regulus calendula</i>	Bird	N/A
Song sparrow	<i>Melospiza melodia</i>	Bird	N/A
Spotted sandpiper	<i>Actitis macularius</i>	Bird	N/A
Stellars jay	<i>Cyanocitta stelleri</i>	Bird	N/A
Townsend's solitaire	<i>Myadestes townsendi</i>	Bird	N/A
Tree swallow	<i>Tachycineta bicolor</i>	Bird	N/A
Vesper sparrow	<i>Pooecetes gramineus</i>	Bird	N/A
Western tanager	<i>Piranga ludoviciana</i>	Bird	N/A

Table 2 – Potential State and Federal Threatened and Endangered Species (cont.)

<b><u>Species (Common Name)</u></b>	<b><u>Scientific Name</u></b>	<b><u>Type</u></b>	<b><u>Listing</u></b>
White-breasted nuthatch	<i>Sitta carolinensis</i>	Bird	N/A
White-crowned sparrow	<i>Zonotrichia leucophrys</i>	Bird	N/A
Yellow warbler	<i>Setophaga petechia</i>	Bird	N/A
Yellow-rumped warbler	<i>Setophaga coronata</i>	Bird	N/A
American beaver	<i>Castor canadensis</i>	Mammal	N/A
Big brown bat	<i>Eptesicus fuscus</i>	Mammal	N/A
Black bear	<i>Ursus americanus</i>	Mammal	N/A
Bobcat	<i>Lynx rufus</i>	Mammal	N/A
Bushy-tailed woodrat	<i>Neotoma cinerea</i>	Mammal	N/A
Common muskrat	<i>Ondatra zibethicus</i>	Mammal	N/A
Squirrel	<i>Sciuridae</i>	Mammal	N/A
Common porcupine	<i>Erethizon dorsatum</i>	Mammal	N/A
Coyote	<i>Canis latrans</i>	Mammal	N/A

Deer mouse	<i>Peromyscus</i>	Mammal	N/A
Elk	<i>Cervus canadensis</i>	Mammal	N/A
Ermine or short-tailed weasel	<i>Mustela erminea</i>	Mammal	N/A
Golden-mantled ground squirrel	<i>Callospermophilus lateralis</i>	Mammal	N/A
Hoary bat	<i>Lasiurus cinereus</i>	Mammal	N/A
Least chipmunk	<i>Tamias minimus</i>	Mammal	N/A
Little brown myotis	<i>Myotis lucifugus</i>	Mammal	N/A
Long-legged myotis	<i>Myotis volans</i>	Mammal	N/A
Long-tailed weasel	<i>Mustela frenata</i>	Mammal	N/A
Meadow vole	<i>Microtus pennsylvanicus</i>	Mammal	N/A
Montane vole	<i>Microtus montanus</i>	Mammal	N/A
Mountain lion	<i>Puma concolor</i>	Mammal	N/A
Mule deer	<i>Odocoileus hemionus</i>	Mammal	N/A
Northern pocket gopher	<i>Thomomys talpoides</i>	Mammal	N/A
Raccoon	<i>Procyon lotor</i>	Mammal	N/A
Silver-haired bat	<i>Lasionycteris noctivagans</i>	Mammal	N/A
Striped skunk	<i>Mephitis mephitis</i>	Mammal	N/A
Rainbow trout	<i>Oncorhynchus mykiss</i>	Fishes	N/A
Brown trout	<i>Salmo trutta</i>	Fishes	N/A
Brooke trout	<i>Salvelinus fontinalis</i>	Fishes	N/A
Colorado Cutthroat Trout	<i>Oncorhynchus clarki pleuriticus</i>	Fishes	N/A
Mountain Whitefish	<i>Prosopium williamsoni</i>	Fishes	N/A

Table 2 – Potential State / Federal Threatened and Endangered Species			
Species (Common Name)	Scientific Name	Type	Listing
Peregrine Falcon	<i>Falco peregrinus</i>	Bird	State Special Concern (SC)
Northern Leopard Frog	<i>Lithobates pipiens</i>	Amphib-ian	State Species of Concern (SC), USFWS Sensitive (S)
Tiger Salamander	<i>Ambystoma tigrinum stebbinsi</i>	Amphib-ian	USFWS Sensitive (S)
Known or Suspected Animal List			
American dipper	<i>Cinclus mexicanus</i>	Bird	N/A
American kestrel	<i>Falco sparverius</i>	Bird	N/A
American robin	<i>Turdus migratorius</i>	Bird	N/A

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Bald eagle	<i>Haliaeetus leucocephalus</i>	Bird	N/A
Black-billed magpie	<i>Pica hudsonia</i>	Bird	N/A
Black-capped chickadee	<i>Poecile atricapillus</i>	Bird	N/A
Blue wing teal	<i>Anas discors</i>	Bird	N/A
Blue-gray gnatcatcher	<i>Polioptila caerulea</i>	Bird	N/A
Canada goose	<i>Branta canadensis</i>	Bird	N/A
Chipping sparrow	<i>Spizella passerina</i>	Bird	N/A
Cinnamon teal	<i>Anas cyanoptera</i>	Bird	N/A
Common raven	Common raven	Bird	N/A
Cooper's hawk	<i>Accipiter cooperii</i>	Bird	N/A
Cordilleran flycatcher	<i>Empidonax occidentalis</i>	Bird	N/A
Common snipe	<i>Gallinago gallinago</i>	Bird	N/A
Dark-eyed junco	<i>Junco hyemalis</i>	Bird	N/A
Downey woodpecker	<i>Picoides pubescens</i>	Bird	N/A
Dusky flycatcher	<i>Empidonax oberholseri</i>	Bird	N/A
Fox sparrow	<i>Passerella iliaca</i>	Bird	N/A
Great blue heron	<i>Ardea herodias</i>	Bird	N/A
Great horned owl	<i>Bubo virginianus</i>	Bird	N/A
Green-tailed towhee	<i>Pipilo chlorurus</i>	Bird	N/A
Green-winged teal	<i>Anas carolinensis</i>	Bird	N/A
Hairy woodpecker	<i>Leuconotopicus villosus</i>	Bird	N/A
House finch	<i>Haemorhous mexicanus</i>	Bird	N/A
House wren	<i>Troglodytes aedon</i>	Bird	N/A
Lewis' woodpecker	<i>Melanerpes lewis</i>	Bird	N/A
Lincoln's sparrow	<i>Melospiza lincolni</i>	Bird	N/A
MacGillivray's warbler	<i>Geothlypis tolmiei</i>	Bird	N/A
Mallard	<i>Anas platyrhynchos</i>	Bird	N/A
Mountain dove	<i>Spilopelia chinensis</i>	Bird	N/A
Mountain bluebird	<i>Sialia currucoides</i>	Bird	N/A
Mountain chickadee	<i>Poecile gambeli</i>	Bird	N/A
Orange-Crowned warbler	<i>Vermivora celata</i>	Bird	N/A
Osprey	<i>Pandion haliaetus</i>	Bird	N/A
Peregrine falcon	<i>Falco peregrinus</i>	Bird	N/A
Plumbeous vireo	<i>Vireo plumbeus</i>	Bird	N/A
Northern flicker	<i>Colaptes auratus</i>	Bird	N/A
Red-tailed hawk	<i>Buteo jamaicensis</i>	Bird	N/A
Red-winged blackbird	<i>Agelaius phoeniceus</i>	Bird	N/A

Ruby-crowned kinglet	<i>Regulus calendula</i>	Bird	N/A
Song sparrow	<i>Melospiza melodia</i>	Bird	N/A
Spotted sandpiper	<i>Actitis macularius</i>	Bird	N/A
Stellars jay	<i>Cyanocitta stelleri</i>	Bird	N/A
Townsend's solitaire	<i>Myadestes townsendi</i>	Bird	N/A
Tree swallow	<i>Tachycineta bicolor</i>	Bird	N/A
Vesper sparrow	<i>Pooecetes gramineus</i>	Bird	N/A
Western tanager	<i>Piranga ludoviciana</i>	Bird	N/A
Table 2 – Potential State and Federal Threatened and Endangered Species (cont.)			
Species (Common Name)	Scientific Name	Type	Listing
White-breasted nuthatch	<i>Sitta carolinensis</i>	Bird	N/A
White-crowned sparrow	<i>Zonotrichia leucophrys</i>	Bird	N/A
Wild turkey	<i>Meleagris gallopavo silvestris</i>	Bird	N/A
Yellow warbler	<i>Setophaga petechia</i>	Bird	N/A
Yellow-rumped warbler	<i>Setophaga coronata</i>	Bird	N/A
American beaver	<i>Castor canadensis</i>	Mammal	N/A
Big brown bat	<i>Eptesicus fuscus</i>	Mammal	N/A
Black bear	<i>Ursus americanus</i>	Mammal	N/A
Bobcat	<i>Lynx rufus</i>	Mammal	N/A
Bushy-tailed woodrat	<i>Neotoma cinerea</i>	Mammal	N/A
Common muskrat	<i>Ondatra zibethicus</i>	Mammal	N/A
Squirrel	<i>Sciuridae</i>	Mammal	N/A
Common porcupine	<i>Erethizon dorsatum</i>	Mammal	N/A
Coyote	<i>Canis latrans</i>	Mammal	N/A
Deer mouse	<i>Peromyscus</i>	Mammal	N/A
Elk	<i>Cervus canadensis</i>	Mammal	N/A
Ermine or short-tailed weasel	<i>Mustela erminea</i>	Mammal	N/A
Golden-mantled ground squirrel	<i>Callospermophilus lateralis</i>	Mammal	N/A
Hoary bat	<i>Lasiurus cinereus</i>	Mammal	N/A
Least chipmunk	<i>Tamias minimus</i>	Mammal	N/A
Little brown myotis	<i>Myotis lucifugus</i>	Mammal	N/A
Long-legged myotis	<i>Myotis volans</i>	Mammal	N/A
Long-tailed weasel	<i>Mustela frenata</i>	Mammal	N/A
Meadow vole	<i>Microtus pennsylvanicus</i>	Mammal	N/A
Montane vole	<i>Microtus montanus</i>	Mammal	N/A

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Mountain lion	<i>Puma concolor</i>	Mammal	N/A
Mule deer	<i>Odocoileus hemionus</i>	Mammal	N/A
Northern pocket gopher	<i>Thomomys talpoides</i>	Mammal	N/A
Raccoon	<i>Procyon lotor</i>	Mammal	N/A
Silver-haired bat	<i>Lasionycteris noctivagans</i>	Mammal	N/A
Striped skunk	<i>Mephitis mephitis</i>	Mammal	N/A
Rainbow trout	<i>Oncorhynchus mykiss</i>	Fishes	N/A
Brown trout	<i>Salmo trutta</i>	Fishes	N/A
Brooke trout	<i>Salvelinus fontinalis</i>	Fishes	N/A
Colorado Cutthroat Trout	<i>Oncorhynchus clarki pleuriticus</i>	Fishes	N/A
Mountain Whitefish	<i>Prosopium williamsoni</i>	Fishes	N/A
Source: Hanks, Bill. An Inventory and Assessment of Wildlife Habitat, Crystal River Valley, May 2007.			



## **Appendix B: 2015 Colorado Wetland Ecological Integrity Assessment (EIA)**

**2015 COLORADO WETLAND ECOLOGICAL INTEGRITY ASSESSMENT (EIA) – SITE INFORMATION**

LOCATION AND GENERAL INFORMATION	
Site ID: <u>CR - 1</u> Site Name: <u>Crystal River Restoration</u>	LEVEL 2.5 ASSESSMENT
Date: <u>July 26, 2018</u> Surveyors: <u>Jeremy Allinson</u>	
General Location: <u>Near the Town of Carbondale (1.15 miles south)</u> County: <u>Garfield County</u>	
General Ownership: <u>Town of Carbondale</u> Specific Ownership: <u>Town of Carbondale</u>	
Directions to Point: From the Town of Carbondale proceed south on Highway 133, go east southeast on Crystal Bridge Drive, cross bridge and site is located upstream on both sides of river.	
Access Comments (note permit requirements or difficulties accessing the site): Contact the Town of Carbondale prior to visit for access constraints.	
GPS COORDINATES OF TARGET POINT AND ASSESSMENT AREA	
Dimensions of AA: <input type="checkbox"/> 40-m radius circle <input checked="" type="checkbox"/> Freeform polygon, limited to 0.5 ha <input type="checkbox"/> Wetland boundary, other (note in comments)	Elevation (m): <u>1893 m or 6,200 ft</u> Slope (deg): <u>1 deg (2%)</u> Aspect (deg): <u>320 deg</u>
AA-Center WP #: _____ UTM E: <u>309726</u> UTM N: <u>4362009</u> Error (+/-): <u>13.2 ft.</u> (Circle AAs Only)	
AA-1 WP #: _____ UTM E: <u>392308</u> UTM N: <u>4361916</u> Error (+/-): <u>11.8 ft</u>	
AA-2 WP #: _____ UTM E: <u>392309</u> UTM N: <u>4361711</u> Error (+/-): <u>11.5 ft.</u>	
AA-3 WP #: _____ UTM E: <u>310102</u> UTM N: <u>4361499</u> Error (+/-): <u>11.5 ft</u>	
AA-4 WP #: _____ UTM E: _____      UTM N: _____      Error (+/-): <u>12.2 ft</u>	
AA-Track Track Name: <u>Assessment Area 1 and AA 2</u> Area: <u>13.96 acres</u>	
AA Placement and Dimensions Comments:  AA 1-4 represent degraded riparian habitat of the area. AA includes the entire Assessment Area on the west side of the river.	
PHOTOS OF ASSESSMENT AREA (Taken at four points on edge of AA looking in. Record WPs of each photo in table above.)	
AA-1 Photo #: <u>162</u> Aspect: <u>180 deg</u> AA-2 Photo #: <u>163</u> Aspect: <u>180 deg</u> AA-3 Photo #: _____      Aspect: _____ AA-4 Photo #: _____      Aspect: _____	Photo Range: <u>3884 - 4309</u>  Comments: <u>None</u>

**ENVIRONMENTAL DESCRIPTION AND CLASSIFICATION OF ASSESSMENT AREA**

<p><u>Wetland / riparian / upland inclusions:</u> (should = 100%)</p> <p><u>5</u> % AA with true wetland and/or water</p> <p><u>95</u> % AA with non-wetland riparian area</p> <p><u>n/a</u> % AA with upland inclusions</p>	<p><u>Wetland origin:</u> (if known)</p> <p><input type="checkbox"/> Natural feature with minimal alteration</p> <p><input checked="" type="checkbox"/> Natural feature, but altered or augmented by modification</p> <p><input type="checkbox"/> Non-natural feature created by passive or active management</p> <p><input type="checkbox"/> Unknown</p>
--	---

Ecological System: (see manual for key and pick the *best match*) Fidelity: High Med Low

<p><u>Cowardin Classification</u> Fidelity: High Med Low (see manual and pick <i>one each</i> of System, Class, Water Regime, and optional Modifier for dominant type)</p> <p style="text-align: center;">Palustrine Forested / Scrub Shrub / Emergent</p>	<p><u>HGM Class:</u> (pick <i>only one</i>) Fidelity: High Med Low</p> <p><input checked="" type="checkbox"/> Riverine* <input type="checkbox"/> Lacustrine Fringe</p> <p><input type="checkbox"/> Depressional <input type="checkbox"/> Slope</p> <p><input type="checkbox"/> Flats <input type="checkbox"/> Novel (Irrigation-Fed) Riverine / Slope</p> <p><i>*Specific classification and metrics apply to the Riverine HGM Class</i></p>
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**RIVERINE SPECIFIC CLASSIFICATION OF THE ASSESSMENT AREA**

<p><u>Confined vs. Unconfined Valley Setting</u></p> <p><input type="checkbox"/> Confined Valley Setting (valley width &lt; 2x bankfull width)</p> <p><input checked="" type="checkbox"/> Unconfined Valley Setting (valley width ≥ 2x bankfull width)</p> <p><u>Stream Flow Duration</u></p> <p><input checked="" type="checkbox"/> Perennial</p> <p><input type="checkbox"/> Intermittent</p> <p><input type="checkbox"/> Ephemeral</p>	<p><u>Proximity to Channel</u></p> <p><input type="checkbox"/> AA includes the channel and both banks</p> <p><input checked="" type="checkbox"/> AA is adjacent to or near the channel (&lt; 50 m) and evaluation includes one or both banks</p> <p><input type="checkbox"/> AA is &gt; 50 m from the channel and banks were not evaluated</p> <p><u>Stream Depth at Time of Survey (if evaluated)</u></p> <p><input checked="" type="checkbox"/> Wadeable</p> <p><input type="checkbox"/> Non-wadeable</p>
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**MAJOR ZONES WITHIN THE ASSESSMENT AREA** (See manual for rules and definitions. Mark each zone on the site sketch.)

Zone 1	Description <u>Scrub Shrub Riparian</u>	Dom spp: <u>UPDATE</u>	% of AA: _____
Zone 2	Description <u>Forested Riparian</u>	Dom spp: <u>UPDATE</u>	% of AA: _____
Zone 3	Description <u>Palustrine Emergent</u>	Dom spp: <u>UPDATE</u>	% of AA: _____
Zone 4	Description _____	Dom spp: _____	% of AA: _____
Zone 5	Description _____	Dom spp: _____	% of AA: _____

**ENVIRONMENTAL AND CLASSIFICATION COMMENTS**

Classification Issues (important for sites with medium or low fidelity to one or more classification systems):

The vegetation has been modified in some areas from it's pre-disturbance condition.

**AA REPRESENTATIVENESS**

Is AA the entire wetland/riparian area?  Yes  No

*If no*, is AA representative of larger wetland/riparian area?  Yes  No  NA (if AA is the entire wetland)

Comments:

**ASSESSMENT AREA DRAWING**

Add north arrow and approx. scale bar. Document **habitat features** and **biotic and abiotic zones** (particularly open water), inflows and outflows, and indicate direction of drainage. Include location of **AA points**, **soil pits**, and **water chemistry** samples. If appropriate, add a **cross-sectional diagram** and indicate slope of side.



**ASSESSMENT AREA DESCRIPTION AND COMMENTS**

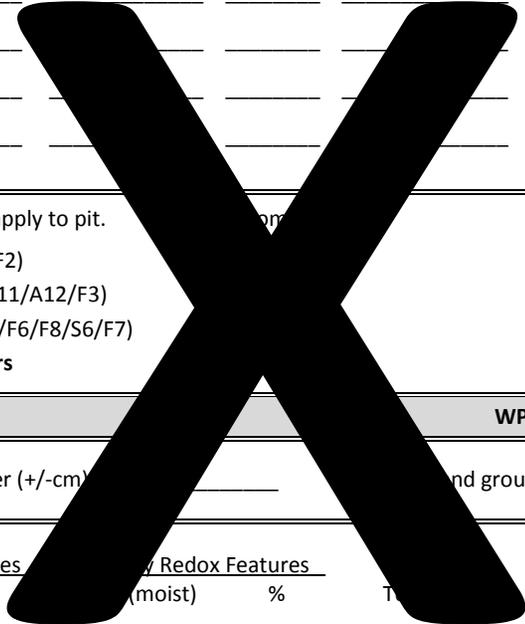
Overall site description and details on site hydrology, soil, and vegetation.





GROUND COVER BY HABITAT TYPE			
<i>Estimate cover of each ground cover by habitat type. Estimate cover based on 1% or 5% increments (not cover classes).</i>			
Cover (unless otherwise noted) →	C	Comments	
Actual cover of water (any depth, vegetated or not, standing or flowing) (A+B+C below)		minimal surface water present	
Actual cover of open water zone and no vegetation (or only algae) (A)			
Actual cover of water zone with emergent vegetation (B)	<1%		
Actual cover of water zone with submergent / floating vegetation (C)			
Actual predominant <u>depth</u> of water (cm)			
Actual max <u>depth</u> of water (cm)			
Potential cover of water at ordinary high water			
Potential predominant <u>depth</u> at ordinary high water (cm)			
Stability of water level ( <i>Pick one</i> : A: permanent and stable / B: permanent but fluctuates / C: intermittent or ephemeral)	B		
Cover of exposed bare ground (any substrate, can have algae cover)	<5%		
Cover of litter (all cover, <u>including under water or vegetation</u> )	15%		
<u>Depth</u> of litter (cm) – average of four non-trampled locations where litter occurs	2-5cm		
<u>Count</u> of standing dead trees (>25 cm diameter at breast height)	13		
Cover of standing dead shrubs or small trees (<25 cm diameter at breast height)	0**		
Cover of downed coarse woody debris (fallen trees, rotting logs, >25 cm diameter)	9		
Cover of downed fine woody debris (<25 cm diameter)	0**		
Cover bryophytes (all cover, <u>including under water, vegetation or litter cover</u> )	<3%		
Cover lichens (all cover, <u>including under water, vegetation or litter cover</u> )	0%		
Cover algae (all cover, <u>including under water, vegetation or litter cover</u> )	0%		
VERTICAL STRATA BY HABITAT TYPE			
<i>Estimate cover of each vertical strata by habitat type. Estimate height using classes. Estimate cover base on 1% or 5% increments (not classes).</i>			
Height Classes 0: <0.2 m 1: 0.2–0.5 m 2: 0.5–1m 3: 1–2 m 4: 2–5 m 5: 5–10 m 6: 10–15 m 7: 15–20 m 8: 20–35 m 9: 35–50 m 10: >50 m			
Vertical Vegetation Strata (live or very recently dead)	Height / Cover →	H	C
(T1) Dominant canopy trees (>5 m and >~ 30% cover)	Populus angustifolia	7	15%
(T2) Sub-canopy trees (>5m but < dominant canopy height) or trees with sparse cover	Elaeagnus angustifolia	5	8%
(S1) Tall shrubs, tree saplings or seedling (>2 m)	Alnus incana subsp. Tenuifolia, Salix exigua	5	40%
(S2) Short shrubs (<2 m)	Ribes inerme	3	30%
(HT) Herbaceous total	Variety of species	1	42%
(H1) Graminoids (grass and grass-like plants)	Variety of species	1	38%
(H2) Forbs (all non-graminoids)	Variety of species	1	2%
(AQ) Submergent or floating aquatics		--	0

SOIL PROFILE DESCRIPTION – SOIL PIT 1 <input type="checkbox"/> Representative Pit?						WP # _____	Photo #s _____	(mark on site sketch)
Depth to saturated soil (+/-cm): _____		Depth to free water (+/-cm): _____		<input type="checkbox"/> Pit dry and groundwater not observed		Settling Time: _____		
Horizon (optional)	Depth (cm)	Matrix Color (moist)	Dominant Redox Features Color (moist) %	Secondary Redox Features Color (moist) %	Texture	Remarks (note % visible salts in each layer)		
<b>Hydric Soil Indicators:</b> See field manual for descriptions and check all that apply to pit.						<b>Major Soil Type:</b>		
<input type="checkbox"/> Histosol (A1)		<input type="checkbox"/> Gleyed Matrix (S4/F2)					<input type="checkbox"/> Histosol	
<input type="checkbox"/> Histic Epipedon (A2/A3)		<input type="checkbox"/> Depleted Matrix (A11/A12/F3)					<input type="checkbox"/> Histic Epipedon	
<input type="checkbox"/> Mucky Mineral (S1/F1)		<input type="checkbox"/> Redox Features (S5/F6/F8/S6/F7)					<input type="checkbox"/> Clayey/Loamy	
<input type="checkbox"/> Hydrogen Sulfide Odor (A4)		<input type="checkbox"/> <b>No Hydric Indicators</b>					<input type="checkbox"/> Sandy	
SOIL PROFILE DESCRIPTION – SOIL PIT 2 <input type="checkbox"/> Representative Pit?						WP # _____	Photo #s _____	(mark on site sketch)
Depth to saturated soil (+/-cm): _____		Depth to free water (+/-cm): _____		<input type="checkbox"/> Pit dry and groundwater not observed		Settling Time: _____		
Horizon (optional)	Depth (cm)	Matrix Color (moist)	Dominant Redox Features Color (moist) %	Secondary Redox Features Color (moist) %	Texture	Remarks (note % visible salts in each layer)		
<b>Hydric Soil Indicators:</b> See field manual for descriptions and check all that apply to pit.						<b>Comments:</b>		<b>Major Soil Type:</b>
<input type="checkbox"/> Histosol (A1)		<input type="checkbox"/> Gleyed Matrix (S4/F2)						<input type="checkbox"/> Histosol
<input type="checkbox"/> Histic Epipedon (A2/A3)		<input type="checkbox"/> Depleted Matrix (A11/A12/F3)						<input type="checkbox"/> Histic Epipedon
<input type="checkbox"/> Mucky Mineral (S1/F1)		<input type="checkbox"/> Redox Features (S5/F6/F8/S6/F7)						<input type="checkbox"/> Clayey/Loamy
<input type="checkbox"/> Hydrogen Sulfide Odor (A4)		<input type="checkbox"/> <b>No Hydric Indicators</b>						<input type="checkbox"/> Sandy



**SOIL PROFILE DESCRIPTION – SOIL PIT 3**  Representative Pit? **WP # \_\_\_\_\_ Photo #s \_\_\_\_\_ (mark on site sketch)**

Depth to saturated soil (+/-cm): \_\_\_\_\_ Depth to free water (+/-cm): \_\_\_\_\_  Pit dry and groundwater not observed Settling Time: \_\_\_\_\_

Horizon (optional)	Depth (cm)	Matrix Color (moist)	Dominant Redox Features Color (moist) %	Secondary Redox Features Color (moist) %	Texture	Remarks (note % visible salts in each layer)

**Hydric Soil Indicators:** See field manual for descriptions and check all that apply to pit.

<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Gleyed Matrix (S4/F2)	Major Soil Type: <input type="checkbox"/> Histosol <input type="checkbox"/> Histic Epipedon <input type="checkbox"/> Clayey/Loamy <input type="checkbox"/> Sandy
<input type="checkbox"/> Histic Epipedon (A2/A3)	<input type="checkbox"/> Depleted Matrix (A11/A12/F3)	
<input type="checkbox"/> Mucky Mineral (S1/F1)	<input type="checkbox"/> Redox Features (S5/F6/F8/S6/F7)	
<input type="checkbox"/> Hydrogen Sulfide Odor (A4)	<input type="checkbox"/> No Hydric Indicators	

**BASIC WATER CHEMISTRY - PH, EC, AND TEMPERATE MEASUREMENTS**  No water observed

Take pH, EC, and water temperature recording at up to four locations within the AA. Use the appropriate test methods. Take measurements within representative examples of the water within or adjacent to the AA, including channels, pools, and/or groundwater. Take depth measurements at each location. Report water depth in cm, + for surface water, - for groundwater.

#	GPS WP#	Time of day	Location	Depth (cm)	Surface OR Ground	Standing OR Flowing (NA for ground)	Clear OR Turbid (NA for ground)	Open OR Shade (NA for ground)	pH	EC	Temp
1					Surface / Ground	Standing / Flowing	Clear / Turbid	Open / Shade			
2					Surface / Ground	Standing / Flowing	Clear / Turbid	Open / Shade			
3					Surface / Ground	Standing / Flowing	Clear / Turbid	Open / Shade			
4					Surface / Ground	Standing / Flowing	Clear / Turbid	Open / Shade			
5					Surface / Ground	Standing / Flowing	Clear / Turbid	Open / Shade			
6					Surface / Ground	Standing / Flowing	Clear / Turbid	Open / Shade			

Water chemistry measurement comments:

**2015 COLORADO WETLAND ECOLOGICAL INTEGRITY ASSESSMENT (EIA) – METRICS**

LANDSCAPE METRICS			
L1. CONTIGUOUS NATURAL LAND COVER		L2. LAND USE INDEX	
Select the statement that best describes the <b>contiguous natural land cover</b> within the 500 m envelope surrounding the AA. See list of natural land covers in the field manual.		Select the statement that best describes the intensity of surrounding land use. Use the <b>Land Use Index</b> Worksheet (last page) to calculate the Land Use Index score.	
Intact: AA embedded in 90–100% contiguous natural land cover.	<b>A</b>	Land Use Index = 9.5–10.0	<b>A</b>
Variegated: AA embedded in 60–90% contiguous natural land cover.	<b>B</b>	Land Use Index = 8.0–9.4	<b>B</b>
Fragmented: AA embedded in 20–60% contiguous natural land cover.	<input checked="" type="checkbox"/> <b>C</b>	Land Use Index = 4.0–7.9	<input checked="" type="checkbox"/> <b>C</b>
Relictual: AA embedded within <20% contiguous natural land cover.	<b>D</b>	Land Use Index = <4.0	<b>D</b>
Landscape comments:			
BUFFER METRICS			
B1. PERIMETER WITH NATURAL BUFFER		B2. WIDTH OF NATURAL BUFFER	
Select the statement that best describes the <b>perimeter of the AA with natural buffer</b> . Buffer land covers must be ≥ 5 m wide and extend along ≥ 10 m of the AA perimeter. See list of buffer land covers in the field manual.		Select the statement that best describes the <b>width of the natural buffer</b> . Estimate the width of buffer land covers along eight lines radiating out from the AA at the cardinal and ordinal directions (N, NE, E, SE, S, SW, W, NW) and average their width. Estimate up to 100 m.	
Natural buffer surrounds 100% of the AA perimeter.	<b>A</b>	Average buffer width is 100 m	<b>A</b>
Natural buffer surrounds 75–99% of the AA perimeter.	<b>B</b>	Average buffer width is 75–99 m	<b>B</b>
Natural buffer surrounds 25–74% of the AA perimeter.	<b>C</b>	Average buffer width is 25–74 m	<b>C</b>
Natural buffer surrounds <25% of the AA perimeter.	<input checked="" type="checkbox"/> <b>D</b>	Average buffer width is <25 m	<input checked="" type="checkbox"/> <b>D</b>
B3. CONDITION OF NATURAL BUFFER			
Select the statement that best describes the <b>natural buffer condition</b> . Select one statement per column. Only consider <u>the actual natural buffer</u> measured in metrics above. <i>Remember to look for <b>non-native hay grasses</b> when evaluating native / non-native vegetation in the buffer.</i>			
Abundant (≥95%) relative cover native vegetation and little or no (<5%) cover of non-native plants.	<b>A</b>	Intact soils, no water quality concerns, little or no trash, AND little or no evidence of human visitation.	<b>A</b>
Substantial (75–95%) relative cover of native vegetation and low (5–25%) cover of non-native plants.	<b>B</b>	Intact or minor soil disruption, minor water quality concerns, moderate or lesser amounts of trash, AND/OR minor intensity of human visitation or recreation.	<b>B</b>
Low (25–75%) relative cover of native vegetation and moderate to substantial (25–75%) cover of non-native plants.	<b>C</b>	Moderate or extensive soil disruption, moderate to strong water quality concerns, moderate or greater amounts of trash, AND/OR moderate intensity of human use.	<input checked="" type="checkbox"/> <b>C</b>
Very low (<25%) relative cover of native vegetation and dominant (>75% cover) of non-native plants OR no buffer exists.	<input checked="" type="checkbox"/> <b>D</b>	Barren ground and highly compacted or otherwise disrupted soils, significant water quality concerns, substantial amounts of trash, extensive human use, OR no buffer exists.	<b>D</b>
Buffer comments:			

**VEGETATION COMPOSITION METRICS**

V1. NATIVE PLANT SPECIES COVER (RELATIVE)		V2. INVASIVE NONNATIVE PLANT SPECIES COVER (ABSOLUTE)	
Select the statement that best describes the <u>relative cover</u> of <b>native plant species</b> within the AA.		Select the statement that best describes the <u>absolute cover</u> of <b>invasive nonnative plant species</b> within the AA. Use list provided in the manual.	
AA contains >99% relative cover of native plant species.	<b>A</b>	Invasive nonnative species are absent from all strata.	<b>A</b>
AA contains 95–99% relative cover of native plant species.	<b>B</b>	Invasive species present, but sporadic (<4% absolute cover).	<b>B</b>
AA contains 85–95% relative cover of native plant species.	<b>C</b>	Noxious weeds somewhat abundant (4–10% cover).	<b>C</b>
AA contains 60–85% relative cover of native plant species.	<b>C-</b>	Noxious weeds abundant (10–30% cover).	<b>C-</b>
AA contains <60% relative cover of native plant species.	<b>D</b>	Noxious weed very abundant (>30% cover).	<b>D</b>

**V3. NATIVE PLANT SPECIES COMPOSITION**

Select the statement that best describes the <b>native plant species composition</b> (species abundance and diversity) within the AA. Look for native species diagnostic of the system vs. native increasers that may thrive in human disturbance.	
Native plant species composition with expected natural conditions: i) Typical range of native diagnostic species present, AND ii) Native species sensitive to anthropogenic degradation are present, AND iii) Native species indicative of anthropogenic disturbance (i.e., increasers, weedy or ruderal species) absent to minor.	<b>A</b>
Native plant species composition with minor disturbed conditions: i) Some native diagnostic species absent or substantially reduced in abundance, OR ii) Native species indicative of anthropogenic disturbance are present with low cover.	<b>B</b>
Native plant species composition with moderately disturbed conditions: i) Many native diagnostic species absent or substantially reduced in abundance, OR ii) Native species indicative of anthropogenic disturbance are present with moderate cover.	<b>C</b>
Native plant species composition with severely disturbed conditions: i) Most or all native diagnostic species absent, a few remain in low cover, OR ii) Native species indicative of anthropogenic disturbance are present with high cover.	<b>D</b>
Vegetation composition comments:	

**VEGETATION STRUCTURE METRICS**

V4. VEGETATION STRUCTURE (VERTICAL AND HORIZONTAL)	
Select the statement below that best describes the <b>overall vertical and horizontal structure</b> within the AA. Vertical structure relates to the number of vertical vegetation strata. Horizontal structure relates to the number and complexity of biotic and abiotic patches within the wetland/riparian area. See reference card for potential structural patches. Assess each site based on the expected conditions within its Ecological System type. For woody systems, rate regeneration and woody debris individually on next page, then consider those ratings in the overall assessment of structure.	
<b>Herbaceous systems: Marsh, Meadow, Playa</b>	<b>Woody systems: Riparian and Floodplain</b>
<i>General: Vegetation structure is at or near minimally disturbed natural conditions. Little to no structural indicators of degradation evident.</i>	
Structural patches/zones are appropriate in number and type for the system (can be few in playas, fens, meadows). There is diversity in vertical strata within the herbaceous vegetation (some tall and some short layers and/or low cover of shrubs or trees, where appropriate). Litter and other organic inputs are typical of the system (i.e., playas should have low litter while meadows and marshes should have moderate amounts of litter).	AA is characterized by a complex array of nested or interspersed patches. Canopy (if present) contains a mosaic of different ages or sizes, including large old trees and obvious regeneration. Number of live stems is well within expected range. Shrub and herbaceous layers are complex, providing a diversity of vertical strata. Woody species are of sufficient size and density to provide future woody debris to stream or floodplain. Litter layer is neither lacking nor extensive.
<b>A</b>	

<i>General: Vegetation structure shows minor alterations from natural conditions.</i>			
<p><b>Marshes:</b> cattail and bulrush density may prevent animal movement in some areas of the wetland, but not throughout.</p> <p><b>Meadows:</b> grazing and mowing have minor effects.</p> <p><b>Playas:</b> natural areas of bare ground are still prevalent, though non-native or weedy species may be encroaching.</p>		<p>AA is characterized by a moderate array of nested or interspersed zones with no single dominant zone, though some structural patches (especially open zones) may be missing. Canopy still heterogeneous in age or size, but may be missing some age classes. Vertical strata may be somewhat less complex than natural conditions. Woody debris or litter may be somewhat lacking.</p>	<b>B</b>
<i>General: Vegetation structure is moderately altered from natural conditions.</i>			
<p><b>Marshes:</b> cattail and bulrush density may prevent animal movement in half or more of the wetland.</p> <p><b>Meadows:</b> grazing and mowing have moderate effects.</p> <p><b>Playas:</b> natural areas of bare ground are present, but non-native or weedy species have filled in many area.</p>		<p>AA is characterized by a simple array of nested or interspersed zones. One zone may dominate others. Vertical strata may be moderately less complex than natural conditions. Site may be denser than natural conditions (due to non-native woody species) or may be more open and decadent. Woody debris or litter may be moderately lacking.</p>	<b>C</b>
<i>General: Vegetation structure is greatly altered from natural conditions.</i>			
<p><b>Marshes:</b> cattail and bulrush density prevent animal movement throughout the wetland.</p> <p><b>Meadows:</b> grazing and mowing greatly affect the structure of the vegetation and prevalence of litter.</p> <p><b>Playas:</b> natural areas of bare ground are absent due to an abundance of non-native or weedy species.</p>		<p>AA is characterized by one dominant zone and several expected structural patches or vertical strata are missing. Site is either extremely dense with non-native woody species or open with predominantly decadent or dead trees. Woody debris and/or litter may be absent entirely or may be excessive due to decadent trees.</p>	<b>D</b>
<b>V5. REGENERATION OF NATIVE WOODY SPECIES</b>		<b>V6. COARSE AND FINE WOODY DEBRIS</b>	
Select the statement that best describes the <b>regeneration of native woody species</b> within the AA.		Select the statement that best describes <b>coarse and fine woody debris</b> within the AA.	
Woody species are naturally uncommon or absent.	<b>NA</b>	There are no obvious inputs of woody debris or woody species are naturally uncommon.	<b>NA</b>
All age classes of <i>native</i> woody species present. Native tree saplings /seedlings and shrubs common to the type present in expected amounts and diversity. Regeneration is obvious.	<b>A</b>	AA characterized by moderate amount of coarse and fine woody debris, relative to expected conditions. There is wide size-class diversity of standing snags and downed logs in various stages of decay. For riverine wetlands, debris is sufficient to trap sediment, but does not inhibit stream flow. For non-riverine wetlands, woody debris provides structural complexity, but does not overwhelm the site.	<b>A/B</b>
Age classes of <i>native</i> woody species restricted to mature individuals and young sprouts. Middle age groups appear to be absent or there is some other indication that regeneration is moderately impacted.	<b>B</b>		
<i>Native</i> woody species comprised of mainly mature individuals OR mainly evenly aged young sprouts that choke out other vegetation. Regeneration is obviously impacted. Site may contain Russian Olive and/or Salt Cedar.	<b>C</b>	AA characterized by small amounts of woody debris OR debris is somewhat excessive. For riverine wetlands, lack of debris may affect stream temperatures and reduce available habitat.	<b>C</b>
<i>Native</i> woody species predominantly consist of decadent or dying individuals OR are absent from an area that should be wooded. Site may be dominated by Russian Olive / Salt Cedar.	<b>D</b>	AA lacks woody debris, even though inputs are available.	<b>D</b>
Vegetation structure comments (including regeneration and woody debris):			

**HYDROLOGY METRICS**

**H1. WATER SOURCE**

Check off all <i>major</i> water sources in the table to the right. Select the statement below that best describes the <b>water sources</b> feeding the AA during the growing season.	<input checked="" type="checkbox"/>	Overbank flooding	<input type="checkbox"/>	Irrigation via direct application
	<input checked="" type="checkbox"/>	Alluvial aquifer	<input type="checkbox"/>	Irrigation via seepage
	<input type="checkbox"/>	Groundwater discharge	<input type="checkbox"/>	Irrigation via tail water run-off
	<input type="checkbox"/>	Natural surface flow	<input type="checkbox"/>	Urban run-off / culverts
	<input type="checkbox"/>	Precipitation	<input type="checkbox"/>	Pipes (directly feeding wetland)
	<input type="checkbox"/>	Snowmelt	<input type="checkbox"/>	Other:

Water sources are natural. Site hydrology is fed by precipitation, groundwater, natural runoff, or natural flow from an adjacent freshwater body. The system may naturally lack water at times, even for several years. There is no indication of direct artificial water sources, either point sources or non-point sources. Land use in the local watershed is primarily open space or low density, passive use with little irrigation. A

Water sources are mostly natural, but also include occasional or small amounts of inflow from anthropogenic sources. Indications of anthropogenic sources include developed land or irrigated agriculture that comprises < 20% of the immediate drainage area, some road runoff, small storm drains or other minor point source discharges. No large point sources control the overall hydrology. B

Water sources are moderately impacted by anthropogenic sources, but are still a mix of natural and non-natural sources. Indications of moderate contribution from anthropogenic sources include developed land or irrigated agriculture that comprises 20–60% of the immediate drainage area or moderate point source discharges into the wetland, such as many small storm drains or a few large ones or many sources of irrigation runoff. The key factors to consider are whether the wetland is located in a landscape position that supported wetlands before irrigation / development *AND* whether the wetland is still connected to its natural water source (e.g., modified ponds on a floodplain that are still connected to alluvial aquifers or natural stream channels that now receive substantial irrigation return flows). C

Water sources are primarily from anthropogenic sources (e.g., urban runoff, direct irrigation, pumped water, artificially impounded water, or another artificial hydrology). Indications of substantial artificial hydrology include developed or irrigated agricultural land that comprises > 60% of the immediate drainage basin of the AA, or the presence of major drainage point source discharges that obviously control the hydrology of the AA. The key factors to consider are whether the wetland is located in a landscape position that likely never supported a wetland prior to human development *OR* did support a wetland, but is now disconnected from its natural water source. The reason the wetland exists is because of direct irrigation, irrigation seepage, irrigation return flows, urban storm water runoff, or direct pumping. D

Water source comments:

**H2. HYDROPERIOD**

Select the statement below that best describes the **hydroperiod** within the AA (extent and duration of inundation and/or saturation). Search the AA and 500 m envelope for hydrologic stressors (see list on following pages). Use best professional judgment to determine the overall condition of the hydroperiod. For some wetlands, this may mean that water is being channelized or diverted away from the wetland. For others, water may be concentrated or increased. *Please add comments on next page.*

Hydroperiod is characterized by natural patterns of inundation/saturation and drawdown and/or flood frequency, duration, level and timing. There are no major hydrologic stressors that impact the natural hydroperiod. Riparian channels are characterized by equilibrium conditions with no evidence of severe aggradation or degradation indicative of altered hydrology. A

Hydroperiod inundation and drying patterns deviate slightly from natural conditions due to presence of stressors such as: flood control/water storage dams upstream; berms or roads at/near grade; minor pugging by livestock; small ditches or diversions removing water; or minor flow additions from irrigation return flow or storm water runoff. Outlets may be slightly constricted, but not to significantly slow outflow. Riparian channels may have some sign of aggradation or degradation, but approach equilibrium conditions. Playas are not significantly impacted pitted or dissected. *If wetland is artificially controlled*, the management regime closely mimics a natural analogue (it is very unusual for a purely artificial wetland to be rated in this category). B

Hydroperiod inundation and drying patterns deviate moderately from natural conditions due to presence of stressors such as: flood control/water storage dams upstream or downstream that moderately effect hydroperiod; two lane roads; culverts adequate for base stream flow but not flood flow; moderate pugging by livestock that could channelize or divert water; shallow pits within playas; ditches or diversions 1–3 ft. deep; or moderate flow additions. Outlets may be moderately constricted, but flow is still possible. Riparian channels may show distinct signs of aggradation or degradation. *If wetland is artificially controlled*, the management regime approaches a natural analogue. Site may be passively managed, meaning that the hydroperiod is still connected to and influenced by natural high flows timed with seasonal water levels. C

Hydroperiod inundation and drawdown patterns deviate substantially from natural conditions from high intensity alterations such as: significant flood control / water storage das upstream or downstream; a 4-lane highway; large dikes impounding water; diversions > 3ft. deep that withdraw a significant portion of flow, deep pits in playas; large amounts of fill; significant artificial groundwater pumping; or heavy flow additions. Outlets may be significantly constricted, blocking most flow. Riparian channels may be concrete or artificially hardened. *If wetland is artificially controlled*, the site is actively managed and not connected to any natural season fluctuations.

**D**

Hydroperiod comments:

**H3. HYDROLOGIC CONNECTIVITY**

Select the statement below that best describes the degree to which **hydrology within the AA is connected to the larger landscape** throughout the year, but particularly at times of high water. Consider the effect of impoundments, entrenchment, or other obstructions to connectivity that occur within the surrounding landscape, if those impoundments clearly impact the AA.

<i>Marsh / Meadow variant</i>	<i>Playa variant</i>	<i>Riverine / Riparian variant</i>	
No unnatural obstructions to lateral or vertical movement of surface or ground water. Rising water in the site has unrestricted access to adjacent upland, without levees, excessively high banks, artificial barriers, or other obstructions to the lateral movement of flood flows.	Surrounding land cover / vegetation does not interrupt surface flow. No artificial channels feed water to playa.	Completely connected to floodplain (backwater sloughs and channels). No geomorphic modifications made to contemporary floodplain. Channel is not entrenched.	<b>A</b>
Minor restrictions to the lateral or vertical movement of surface and ground water by unnatural features such as levees, road grades or excessively high banks. Up to 25% of the site may be restricted by barriers to drainage. Restrictions may be intermittent along the margins of the AA, or they may occur only along one bank or shore. Flood flows may exceed the impoundments, but drainage back into the wetland may be incomplete due to the impoundments.	Surrounding land cover / vegetation may interrupt a minor amount of surface flow. Artificial channels may feed minor amounts of excess water to playa.	Minimally disconnected from floodplain. Up to 25% of stream banks may be affected by dikes, rip rap, and/or elevated culverts. Channel may be somewhat entrenched, but overbank flow occurs during most floods.	<b>B</b>
Moderate restrictions to the lateral or vertical movement of surface and ground water by unnatural features such as levees, road grades or excessively high banks. Between 25–75% of the site may be restricted by barriers to drainage. Flood flows may exceed the impoundments, but drainage back into the wetland may be incomplete due to the impoundments.	Surrounding land cover / vegetation may interrupt a moderate amount of surface flow. Artificial channels may feed moderate amounts of excess water to playa.	Moderately disconnected from floodplain due to multiple geomorphic modifications. Between 25-75% of stream banks may be affected by bikes, rip rap, concrete, and/or elevated culverts. Channel may be moderately entrenched and disconnected from the floodplain except in large floods.	<b>C</b>
Essentially no hydrologic connection to adjacent landscape. Most or all stages may be contained within artificial banks, levees, or comparable features. Greater than 75% of the site is restricted by barriers to drainage.	Surrounding land cover / vegetation may dramatically restrict surface flow. Artificial channels may feed significant amounts of excess water to playa.	Channel is severely entrenched and entirely disconnected from the floodplain. More than 75% of stream banks may be affected by dikes, rip rap, concrete and/or elevated culverts. Overbank flow never occurs or only in severs floods.	<b>D</b>

Hydrologic connectivity comments:

**PHYSIOCHEMICAL METRICS**

**S1. SUBSTRATE / SOIL DISTURBANCE**

Select the statement below that best describes disturbance to the substrate or soil within the AA. For playas, the most significant substrate disturbance is sedimentation or unnaturally filling, which prevents the system's ability to pond after heavy rains. For other wetland types, disturbances may lead to bare or exposed soil and may increase ponding or channelization where it is not normally. For any wetland type, consider the disturbance relative to what is expected for the system.

No soil disturbance within AA. Little bare soil OR bare soil areas are limited to naturally caused disturbances such as flood deposition or game trails OR soil is naturally bare (e.g., playas). No pugging, soil compaction, or sedimentation.	<b>A</b>
Minimal soil disturbance within AA. Some amount of bare soil, pugging, compaction, or sedimentation present due to human causes, but the extent and impact are minimal. The depth of disturbance is limited to only a few inches and does not show evidence of altering hydrology. Any disturbance is likely to recover within a few years after the disturbance is removed.	<b>B</b>
Moderate soil disturbance within AA. Bare soil areas due to human causes are common and will be slow to recover. There may be pugging due to livestock resulting in several inches of soil disturbance. ORVs or other machinery may have left some shallow ruts. Sedimentation may be filling the wetland. Damage is obvious, but not excessive. The site could recover to potential with the removal of degrading human influences and moderate recovery times.	<b>C</b>
Substantial soil disturbance within AA. Bare soil areas substantially degrade the site and have led to altered hydrology or other long-lasting impacts. Deep ruts from ORVs or machinery may be present, or livestock pugging and/or trails are widespread. Sedimentation may have severely impacted the hydrology. The site will not recover without active restoration and/or long recovery times.	<b>D</b>

Substrate / soil comments and photo #'s:

<b>S2. SURFACE WATER TURBIDITY / POLLUTANTS</b>	<b>S3. ALGAL GROWTH</b>
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Select the statement that best describes the <b>turbidity or evidence or pollutants</b> in surface water within the AA.		Select the statement that best describes <b>algal growth</b> within surface water in the AA. Exclude <i>Chara</i> (multicellular algae) in cover estimate.	
No open water in AA	<b>NA</b>	No open water in AA or evidence of open water.	<b>NA</b>
No visual evidence of turbidity or other pollutants.	<b>A</b>	Water is clear with minimal algal growth.	<b>A</b>
Some turbidity in water (such as turbidity caused by high flows or naturally occurring in playas) OR presence of other pollutants, but limited to small and localized areas within the wetland. Water may be slightly cloudy.	<b>B</b>	Algal growth is limited to small and localized areas of the wetland. Water may have a greenish tint or cloudiness.	<b>B</b>
Water is cloudy or has unnatural oil sheen, but the bottom is still visible. <i>Note: If the sheen breaks apart when you run your finger through it, it is a natural bacterial process and not water pollution.</i>	<b>C</b>	Algal growth occurs in moderate to large patches throughout the AA. Water may have a moderate greenish tint or sheen.	<b>C</b>
Water is milky and/or muddy or has unnatural oil sheen. The bottom is difficult to see. <i>Note: If the sheen breaks apart when you run your finger through it, it is a natural bacterial process and not water pollution.</i>	<b>D</b>	Algal mats are extensive, blocking light to the bottom. Water may have a strong greenish tint and the bottom is difficult to see.	<b>D</b>

Water quality comments and photo #'s:

*Turbidity and algal growth may be natural depending on recent weather patterns and flow timing (i.e., higher flows are often more turbid). Please rank the system as you see it, regardless of whether the conditions are natural. Include good notes and take photos.*

**SIZE METRICS**

**Z1. COMPARATIVE SIZE**

Select the statement below that best describes the **absolute size** of the wetland, as compared with others of its type.

<i>Meadows and Marshes</i>	<i>Playas and Fens</i>	<i>Riparian Areas</i>	
>10 hectares (>25 acres)	>2 hectares (>5 acres)	>5 km (>3 miles)	<b>A</b>
2–10 hectares (25 acres)	0.5–2 hectares (5 acres)	1–5 km (3 miles)	<b>B</b>
0.5–2hectares (5 acres)	0.1–0.5 hectares (1 acre)	0.1–1 km (0.6 mile)	<b>C</b>
<0.5 hectare (<1 acre)	<0.1 hectare (<0.25 acre)	<0.1 km (<0.06 mile)	<b>D</b>

Comparative size comments:

**Z2. CHANGE IN SIZE**

Select the statement below that best describes the **change in size** of the wetland.

Occurrence is at, or only minimally reduced (<15%) from its original, natural extent, and has not been artificially reduced in size.	<b>A</b>
Occurrence is only somewhat reduced (15-10%) from its original natural extent.	<b>B</b>
Occurrence is modestly reduced (10-30%) from its original, natural extent.	<b>C</b>
Occurrence is substantially reduced (>30%) from its original, natural extent.	<b>D</b>

Change in size comments:

**Land Use Index Worksheet**

Land Use Categories <sup>1</sup>	Coefficient	500 m Envelope	
		% Area	Score
Paved roads, parking lots, domestic, commercial, and industrial buildings	0	15	0
Gravel pit operation, open pit mining, strip mining, abandoned mines	0		
Unpaved roads (e.g., driveway, tractor trail, 4-wheel drive roads)	1	.03	.03
Resource extraction (oil and gas)	1		
Tilled agricultural crop production (corn, wheat, soy, etc.)	2	10	20
Intensively managed golf courses, sports fields, lawns	2	65	130
Vegetation conversion (chaining, cabling, rotochopping, clearcut)	3		
Heavy grazing by livestock	3		
Logging or tree removal with 50-75% of large trees removed	4		
Intense recreation (ATV use / camping / popular fishing spot, etc.)	4		
Permanent crop agriculture (hay pasture, vineyard, orchard)	4	10	40
Dam sites and disturbed shorelines around water storage reservoirs. Include open water of reservoir if there is intensive recreation, such as boating.	5		
Old fields and other disturbed fallow lands dominated by non-native species	5		
Moderate grazing on rangeland	6		
Moderate recreation (high-use trail)	7	.004	.028
Selective logging or tree removal with <50% of large trees	8		
Light grazing on rangeland	9		
Light recreation (low-use trail)	9	.001	.009
Natural area / land managed for native vegetation	10	0.65	6.5
*Percentages estimated based of aerial imagery		Total Land Use Score	196.57

**Buffer Width Worksheet**

1: <u>78</u>	5: <u>103</u>
2: <u>135</u>	6: <u>89</u>
3: <u>102</u>	7: <u>92</u>
4: <u>96</u>	8: <u>96</u>
Average width: <u>98.88 m</u>	



	STRESSORS CHECKLIST	500 m Envelope Landscape			ASSESSMENT AREA (0.5 ha)									Comments	
		Scope	Severity	IMPACT	Vegetation			Soil / Substrate			Hydrology				
					Scope	Severity	IMPACT	Scope	Severity	IMPACT	Scope	Severity	IMPACT		
S O I L	22. Excessive sediment or organic debris (inputs from recently logged sites, sedimentation in playas)	_____													
	23. Excessive erosion or loss of organic matter (gulying, decay of organic soils)	_____													
	24. Trash or refuse dumping	_____													
	25. Filling or dumping of sediment (spoils from excavation)	_____													
	26. Substrate removal (excavation)	_____													
	27. Indirect soil disturbance (compaction or trampling by livestock, human use, vehicles)	1	1	1											
	28. Direct soil disturbance (grading, compaction, plowing, discing, deeply dug fire lines)	1	1	1											
	29. Physical resource extraction (rock, sand, gravel, minerals, etc.)	_____													
	30. Obvious excess salinity (dead or stressed plants, salt crusts)	_____													
	31. Other [specify]:	_____													
H Y D R O L O G Y	32. PS discharge (waste water treatment, factory discharge, septic)										_____				
	33. NPS discharge (urban / storm water runoff)										_____				
	34. NPS discharge (agricultural runoff, excess irrigation, feedlots, excess manure)										1	1	1		
	35. NPS discharge (mine runoff, discharge from oil and gas)										_____				
	36. Large dams / reservoirs										_____				
	37. Impoundments, berms, dikes, levees that hold water in or out										_____				
	38. Canals, diversions, ditches, pumps that move water in or out							✓			_____				
	39. Excavation for water retention (gravel ponds, pitted playas)										_____				
	40. Groundwater extraction (few small wells=2, extensive extraction cause a lowered water table=4)										_____				
	41. Flow obstructions (culverts, paved stream crossings)										_____				
42. Engineered channel (riprap, armored channel bank, bed)										_____					
43. Control of flow and energy (weir/drop structure, dredging)										_____					
44. Other [specify]:										_____					
<b>Stressors Very Minimal or Not Evident (check box, if true)</b>		<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>				
<b>STRESSOR RATING BY CATEGORY (Envelope, Veg, Soils, Hydro)</b>		Score: 16	Rating: VH	Score: 8	Rating: M	Score: n/a	Rating:	Score: 1.2	Rating: L	HIS Score: 9.6		HIS Rating: High			
<b>OVERALL HUMAN STRESSOR INDEX (HSI) – use category weights</b>		<b>0.3</b>			<b>0.3</b>			<b>0.1</b>			<b>0.3</b>				

Threat Impact Calculator		Scope			
		Pervasive = 4	Large = 3	Restricted = 2	Small = 1
Severity	Extreme = 4	VERY HIGH = 10	High = 7	Medium = 4	Low = 1
	Serious = 3	High = 7	High = 7	Medium = 4	Low = 1
	Moderate = 2	Medium = 4	Medium = 4	Low = 1	Low = 1
	Slight = 1	Low = 1	Low = 1	Low = 1	Low = 1

Category / HSI Roll-up Formulas	
Score	Rating
10+	Very High
7 – 9.9	High
4 – 6.9	Medium
1 – 3.9	Low
0 – 0.9	Absent

# COLORADO ECOLOGICAL INTEGRITY ASSESSMENT (EIA) SCORECARD

Made by: Colorado Natural Heritage Program, Version: August 31, 2015



Site ID: Crystal River Restoration

Site Name: Assessment Area 1

Project: Baseline EIA Data for Riparian Health Assessment

Date: 7/27/2018

Ecol System: Rocky Mt. Lower Montane-Foothill Riparian Woodland

HGM: Riverine

Cowardin: Palustrine Forested Intermittently Flooded

	Wt	Field Rating	Field Points	Calc Points	Calc Rating
<b>Overall Ecological Integrity Score and Rank</b>				<b>2.26</b>	<b>C+</b>
<b>Overall Ecological Integrity + Size Score and Rank</b>				<b>2.51</b>	<b>B-</b>
<b>Rank Factor: LANDSCAPE CONTEXT</b>	0.30			<b>1.48</b>	<b>D</b>
<b>LANDSCAPE METRICS</b>	0.33			<b>2.00</b>	<b>C+</b>
L1. Contiguous Natural Land Cover	1	c	2		
L2. Land Use Index	1	c	2		
<b>BUFFER METRICS</b>	0.67			<b>1.22</b>	<b>D</b>
B1. Perimeter with Natural Buffer	n/a	d	1		
B2. Width of Natural Buffer	n/a	d	1		
B3.1. Condition of Natural Buffer - Veg	n/a	d	1		
B3.2. Condition of Natural Buffer - Soils	n/a	c	2		
<b>Rank Factor: CONDITION</b>	0.70			<b>2.59</b>	<b>B-</b>
<b>VEGETATION METRICS</b>	0.55			<b>2.50</b>	<b>B-</b>
V1. Native Plant Species Cover	1	c	2		
V2. Invasive Nonnative Plant Species Cover	1	c	2		
V3. Native Plant Species Composition	1	c	2		
V4. Vegetation Structure	1	b	3		
V5. Regen. of Native Woody Species (opt.)	1	b	3		
V65. Coarse and Fine Woody Debris (opt.)	1	b	3		
<b>HYDROLOGY METRICS</b>	0.35			<b>2.33</b>	<b>C+</b>
H1. Water Source	1	d	1		
H2. Hydroperiod	1	b	3		
H3. Hydrologic Connectivity	1	b	3		
<b>PHYSIOCHEMISTRY METRICS</b>	0.10			<b>4.00</b>	<b>A+</b>
S1. Soil Condition	1	a	4		
S2. Surface Water Turbidity / Pollutants (opt.)	0.5	a	4		
S3. Algal Growth (opt.)	0.5	a	4		
<b>Rank Factor: SIZE</b>	n/a			<b>3.00</b>	<b>B+</b>
<b>SIZE METRICS</b>	1			<b>3.00</b>	<b>B+</b>
Z1. Comparative Size (opt.)	1	a	4		
Z2. Change in Size (opt.)	1	c	2		

Input field metric ratings into empty boxes to calculate Rank Factor and Final EIA Scores. Fill in all metrics that are not marked as optional. Optional metrics depend on method used and wetland type.

# COLORADO ECOLOGICAL INTEGRITY ASSESSMENT (EIA) SCORECARD

Made by: Colorado Natural Heritage Program, Version: August 31, 2015



Site ID: Crystal River Restoration

Site Name: Assessment Area 2

Project: Baseline EIA Data for Riparian Health Assessment

Date: 7/27/2018

Ecol System: Rocky Mt. Lower Montane-Foothill Riparian Woodland

HGM: Riverine

Cowardin: Palustrine Forested Intermittently Flooded

	Wt	Field Rating	Field Points	Calc Points	Calc Rating
<b>Overall Ecological Integrity Score and Rank</b>				<b>2.36</b>	<b>C+</b>
<b>Overall Ecological Integrity + Size Score and Rank</b>				<b>2.61</b>	<b>B-</b>
<b>Rank Factor: LANDSCAPE CONTEXT</b>	0.30			<b>1.65</b>	<b>C-</b>
<b>LANDSCAPE METRICS</b>	0.33			<b>2.50</b>	<b>B-</b>
L1. Contiguous Natural Land Cover	1	b	3		
L2. Land Use Index	1	c	2		
<b>BUFFER METRICS</b>	0.67			<b>1.22</b>	<b>D</b>
B1. Perimeter with Natural Buffer	n/a	d	1		
B2. Width of Natural Buffer	n/a	d	1		
B3.1. Condition of Natural Buffer - Veg	n/a	d	1		
B3.2. Condition of Natural Buffer - Soils	n/a	c	2		
<b>Rank Factor: CONDITION</b>	0.70			<b>2.66</b>	<b>B-</b>
<b>VEGETATION METRICS</b>	0.55			<b>2.50</b>	<b>B-</b>
V1. Native Plant Species Cover	1	c	2		
V2. Invasive Nonnative Plant Species Cover	1	c	2		
V3. Native Plant Species Composition	1	c	2		
V4. Vegetation Structure	1	b	3		
V5. Regen. of Native Woody Species (opt.)	1	b	3		
V65. Coarse and Fine Woody Debris (opt.)	1	b	3		
<b>HYDROLOGY METRICS</b>	0.35			<b>2.67</b>	<b>B-</b>
H1. Water Source	1	d	1		
H2. Hydroperiod	1	b	3		
H3. Hydrologic Connectivity	1	a	4		
<b>PHYSIOCHEMISTRY METRICS</b>	0.10			<b>3.50</b>	<b>A-</b>
S1. Soil Condition	1	b	3		
S2. Surface Water Turbidity / Pollutants (opt.)	0.5	a	4		
S3. Algal Growth (opt.)	0.5	a	4		
<b>Rank Factor: SIZE</b>	n/a			<b>3.00</b>	<b>B+</b>
<b>SIZE METRICS</b>	1			<b>3.00</b>	<b>B+</b>
Z1. Comparative Size (opt.)	1	a	4		
Z2. Change in Size (opt.)	1	c	2		

Input field metric ratings into empty boxes to calculate Rank Factor and Final EIA Scores. Fill in all metrics that are not marked as optional. Optional metrics depend on method used and wetland type.