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ECOLOGICAL FUNCTIONS APPROACH FOR TERRESTRIAL HABITATS AT CHATFIELD RESERVOIR

Prepared for—

U.S. Army Corps of Engineers
106 South 15th Street
Omaha, Nebraska 68102

Prepared by—

ERO Resources Corporation
1842 Clarkson Street
Denver, Colorado 80218
(303) 830-1188

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ERO

ERO Resources Corp.
1842 Clarkson Street
Denver, CO 80218
(303) 830-1188
Fax: (303) 830-1199
www.eroresources.com
ero@eroresources.com

ERO Resources Corporation

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Introduction

Background

The U.S. Army Corps of Engineers (Corps) is preparing a Feasibility Report/Environmental Impact Statement (FR/EIS) for proposed reallocation of water within Chatfield Reservoir (Chatfield). The habitat surrounding Chatfield (study area) provides shared ecological functions for the primary terrestrial ecological resources evaluated during the Chatfield Reallocation FR/EIS process. Those ecological resources (target resources) are Preble's meadow jumping mouse (Preble's), overall wildlife habitat represented by a diverse avian community (birds), and wetlands. Because habitat attributes (also referred to as ecological features) can occur in the same location and provide overlapping ecological functions for each of the target resources, it is important to accurately describe the overlap and capture it in the impact assessment and mitigation planning. Several resource agencies, including the National Oceanic and Atmospheric Administration (NOAA), Bureau of Land Management (BLM), U.S. Environmental Protection Agency (EPA), Corps, and others, advocate functional assessment as an assessment tool for wetland and riparian ecosystems. This document provides the logic and methodology used in developing an assessment and mitigation planning approach for terrestrial resources impacted by the Chatfield reallocation. The foundation of the approach is evaluating resources based on their ecological functions following the recommendations and guidance of the agencies listed above. The approach is a compilation and adaptation of several commonly used functional assessment methods and is referred to as the Ecological Functions Approach (EFA).

Purpose, Goals, and Objectives

The purpose of the EFA is to develop a site-specific foundation for improved decision making and mitigation planning for ecological resources in the EIS process. The primary goals of the EFA are to:

1. Address and account for the overlapping habitats of the three target resources found at Chatfield.
2. Base impact assessment and corresponding compensatory mitigation on the ecological functions of the habitat that supports target resources.
3. Provide a standard unit of measure to quantify the resource functions impacted by reallocation, and the corresponding mitigation of those functions so that affected resources can be replaced in kind. The standard unit developed in this EFA is the Ecological Function Unit (EFU).

This model should be viewed as a set of hypotheses of species/habitat and habitat/function relationships based on the best available information and input from experts, rather than statements of proven cause-and-effect relationships.

Target Resource Summary

Preble's

Typical Preble's habitat consists of well-developed plains riparian vegetation with adjacent undisturbed grassland communities and a nearby water source (67 Fed. Reg. 47154, 2002). The water source can include ephemeral streams, in-stream ponds, and canals or ditches. Well-developed plains riparian vegetation typically includes multistrata vegetation consisting of a diverse and a dense combination of grasses, forbs, and shrubs (Bakeman and Deans 1997; Clippinger 2002; Meaney et al. 1996, 1997; Trainor et al. 2007). A taller shrub and tree canopy also may be present (Bakeman and Deans 1997). Preble's have rarely been trapped in uplands adjacent to riparian areas (Bakeman 1997; Clippinger 2002; Corn et al. 1995; Dharman 2001; Meaney et al. 1996, 1997; PTI Environmental Services 1998), and several studies indicate that movements occur within or adjacent to riparian communities, or nearby seasonal ponds (Ryon 1999; Schorr 2001, 2003; Shenk and Sivert 1999a). However, in detailed studies of movement patterns using radio telemetry, Preble's has been recorded in upland habitat more than 330 feet (100 meters) beyond the 100-year floodplain (Schorr 2001; Shenk and Sivert 1999a, 1999b).

Habitat connectivity and enhancing intact movement/dispersal corridors is a major component of the Preble's Draft Recovery Plan (Service 2003). Extensive surveys to determine the occurrence and distribution of Preble's have been conducted within the upper South Platte River watershed, including within and near Chatfield. Breeding populations of Preble's have been confirmed within Chatfield and at upstream locations, with apparent breaks in connectivity in between. Numerous surveys conducted in industrial and residential areas immediately upstream of Chatfield on both the South Platte River and Plum Creek have not detected Preble's. Preble's has been detected further upstream on Big and Little Willow Creek (South Platte tributaries), Indian Creek (Plum Creek tributary), both mainstems of East and West Plum creeks, and various tributaries. The Draft Recovery Plan targets the Upper South Platte River watershed, with a focus on Plum and West Plum creeks to support a large self-sustaining Preble's population (Service 2003). At least 57 connected stream miles would have to be conserved to support a large Preble's population (Service 2003).

Habitat connectivity is not specifically addressed in this EFA. While habitat connectivity is a major focus of Preble's overall recovery, the EFA primarily addresses ecological functions, measured as EFUs, at a parcel-specific scale. Broader regional scale functions, including connectivity, will be evaluated and addressed as weighting factors in implementation of the Compensatory Mitigation Plan (CMP). For example, in addition to the EFUs contained within a mitigation parcel, the parcel will contain attributes (or services) such as connectivity, proximity, and buffer values that contribute to ecological functions at regional and ecosystem scales. Implementation of the CMP accounts for these services by assigning a credit, or weighting factor, to the parcel EFUs (see the CMP for further information on weighting factors).

Birds

The riparian areas within Chatfield State Park, including areas bordering the reservoir, the South Platte River, and its tributaries, provide important habitat for numerous species of migratory birds during the breeding season, nesting season, spring and fall migration, and winter. Because these riparian areas offer important habitat to many different species of birds, Chatfield State Park has been designated as an Important Bird Area (IBA) by Audubon Colorado (Audubon Colorado 2009). An IBA is a site that provides essential habitat to one or more bird species during some portion of the year, including breeding season, migration, and/or winter. Chatfield State Park meets four of the five IBA criteria, including (1) being important to endangered or threatened species in Colorado; (2) containing rare or unique habitat that holds important species or species assemblages largely restricted to a distinctive habitat type; (3) significant numbers of birds concentrate for breeding, during migration, or in the winter; and (4) the site is important for long-term research and/or monitoring projects that contribute substantially to ornithology, bird conservation, and/or education.

Wetlands

Wetlands are one of the most productive and biologically diverse ecosystems on earth. Wetlands serve many different functions including providing unique habitats for many different species of aquatic and terrestrial wildlife, protecting and improving water quality, storing floodwaters, protecting shorelines, recharging ground water aquifers, and maintaining surface water flow during dry periods. These beneficial functions are the result of the inherent and unique natural characteristics of wetlands as ecotones between terrestrial and aquatic systems.

The variety of hydrology and topography within the study area provides a range of wetland types including riverine, palustrine, and lacustrine. The riverine system includes all wetlands and deepwater habitats contained within a channel. The palustrine system consists of forested wetlands dominated by trees, scrub/shrub wetlands dominated by shrubs, and emergent wetlands dominated by nonwoody species that are outside tidal influences (Cowardin et al. 1979). This system is found in association with the adjacent floodplain wetland pockets along Plum Creek, Deer Creek, the South Platte River upstream and downstream of the reservoir, and shorelines of the various ponds and natural or human-made depressions near and adjacent to Chatfield (Draft FR/EIS). The lacustrine system includes wetlands and deepwater habitats situated on a topographic depression. This system lacks trees, shrubs, and persistent emergents with greater than 30 percent cover, and the total area exceeds 20 acres (Cowardin et al. 1979). Chatfield is categorized as a lacustrine system, as are the ponds that occur in the study area.

Model Development

Review of Assessment Tools

ERO conducted an extensive review of available assessment tools prior to the developing the EFA, including terrestrial habitat indices, procedures, and various functional assessment models. This section summarizes the review and selection of the appropriate assessment tools.

The Functional Assessment of Colorado Wetlands Method (FACWet) (Johnson et al. 2009) was developed to incorporate the latest advancements in wetland science and assessment technology. The FACWet was developed in a collaborative effort involving the Colorado Department of Transportation, Colorado State University, ECOMetrics LLC., the Corps, and the EPA. This Colorado-specific model for wetland habitats meets the criteria used to assess wetland functions in the EFA. The application of FACWet to the EFA is discussed in more detail in the Wetlands section.

Conversely, no single existing functional assessment model is capable of accurately representing the site-specific characteristics of Preble's and bird resources addressed in the FR/EIS. ERO researched and evaluated several existing models, including Hydrogeomorphic Classification (HGM), Habitat Equivalency Analysis (HEA), Habitat Evaluation Procedures (HEP), and Habitat Suitability Indices (HSI). HGM is a broad, regional, or systemwide classification system focused on wetland ecosystem functions (Brinson 1993; Gebhardt et al. 2005). HEP and HSI are habitat-based impact assessment models that can be used to quantify the type and quality of existing wildlife habitat (Galbraith 2004; Service 1980). HEA is used to estimate the approximate level of compensation of injuries (impacts) to natural resources (NOAA 1995). The structure of HEA involves determining how much habitat to restore or replace based on estimates of the total loss in services supplied by the damaged or lost habitat. Total loss is estimated from the degree of initial damage to the resource and the loss in service that occurs during the time between the initial damage and when the restored or replaced habitat becomes fully functional (Ray 2008). In a sense, estimating total loss is analogous to paying off a bank debt.

These models often require empirical or objective data sets that are not available for the target resources in the FR/EIS (e.g., no HSI exists for Preble's), lacks the specificity needed to address the Chatfield target resources (HGM), have a broader application than needed for this approach (e.g., HEA includes human services), or have not been certified by the Corps. Thus, ERO adapted many of the concepts found in these models to the site-specific terrestrial issues identified in the FR/EIS. Concepts and assumptions from HEP/HSI (Service 1980) and/or HEA analysis (King 1997; NOAA 2000) and FR/EIS incorporated into the Chatfield EFA model include:

1. This analysis is based on the FR/EIS evaluation of all potential terrestrial habitat impacts from rising pool elevation measured by habitat type and area. There may be other impacts to target resources not represented by this analysis.
2. The EFA is a planning tool used in this analysis to approximate the impacts to target resources from changing reservoir levels, assuming a total loss of functions for those resources.
3. It is expected that not all resource functions will be lost, but will be changed; providing different functions or a different level of functions. These changed functions and/or new areas of habitat created will be captured in a monitoring and adaptive monitoring approach not covered here, but will be addressed in the CMP.
4. Habitats provide multiple services, and opinions may differ concerning which service should be the focus of restoration efforts (Ray 2008). The value of ecological functions assigned to target resources were determined by an expert panel, and are a relative measure of life cycle needs or habitat functions met by habitat type.
5. Incorporation of the EFA into the CMP will help identify on-site and off-site mitigation opportunities. Mitigation opportunities will not be limited solely to those areas identified by this process.

Definitions

Ecosystems **Features –** The site-specific characteristics of an ecosystem (e.g., soil, ground cover, and hydrology).

Ecosystem **Functions –** The biophysical processes that actually take place within an ecosystem (e.g., fish and wildlife habitat, carbon cycling, and trapping nutrients).

Ecosystem **Services** – The beneficial outcomes that result from ecosystem functions (e.g., better fishing and hunting, cleaner water).

Ecosystem **Values** – Defined in economic terms as the "willingness to pay" for services (King 1997).

EFA (Ecological Function Approach) – The site-specific approach developed for Chatfield.

EFV (Ecological Functional Value) – The value determined for specific target resource functions.

EFI (Ecological Functioning Index) – The index value for the cumulative functions of target resources.

EFU (Ecological Function Unit) – The standard unit used to calculate overlapping ecological impacts and compensatory mitigation needs for target resources.

Model Inputs and Outputs

Based on the concepts listed above, the following inputs were incorporated into the EFA:

1. Habitat mapping of the target resources and area of the impacted habitat to be assessed, as provided by the FR/EIS.
2. Statewide riparian habitat mapping developed by the Colorado Division of Wildlife (CDOW). This mapping was used to determine corresponding areas of target resource habitat outside of impacted habitat.
3. Criteria for selecting and assigning value (EFV) to ecological functions developed by an expert panel.
4. A process for calculating EFI and EFU adapted from models described above.

The primary outputs of the EFA will be to:

1. Calculate impacts of selected reallocation alternatives on individual target terrestrial resources in terms of loss of resource functions, specifically EFUs.
2. Calculate the cumulative loss of resource functions.
3. Calculate the amount of restored EFUs necessary to offset total losses of the selected alternative.

Model Use and Limitations

- The EFA is a planning model developed to 1) determine impacts of overlapping ecological functions of three target resources, 2) assist in the selection of on-site and off-site mitigation locations and activities, and 3) determine the feasibility of compensatory mitigation.
- The EFA is site-specific and is not intended for broader application outside of the Chatfield FR/EIS process.
- The FR/EIS did not use a standardized vegetation classification system.
- Habitat mapping in the FR/EIS was developed as a tool to assess impacts to target resources resulting from the application of selected reallocation alternatives – it did not include mapping of habitats throughout the entire Chatfield State Park or areas outside the park.

The limitation of using a nonstandardized vegetation classification system is that it cannot be compared and incorporated into existing regional vegetation mapping (e.g., statewide riparian habitat mapping). This limitation was resolved by standardizing vegetation/habitat mapping between the study area (5,444 foot elevation) and both on-site (within Chatfield State Park) and off-site areas, as summarized below.

Initial habitat mapping for the three target resources used in the FR/EIS resources was based on resource-specific mapping. Wetland mapping was based on standard Corps procedures (Cowardin et al. 1979) and included the upper limit of the maximum proposed pool elevation of 5,444 feet (Figure 1). Preble's habitat mapping was based on habitat quality, while bird habitat mapping was based on coarsely defined vegetation communities. Mapping for Preble's and birds extended a distance of approximately 50 feet beyond the maximum proposed pool elevation of 5,444 feet, but did not include all areas within Chatfield State Park or any off-site areas. Statewide riparian mapping by CDOW was used for mapping target resources habitat outside of the Chatfield study area. CDOW uses extensive riparian mapping based on satellite imagery interpretation and analysis conducted over the entire South Platte River/Plum Creek watersheds.

Initial comparison of the Chatfield Reallocation habitat mapping and CDOW riparian mapping revealed considerable similarities between the two efforts. CDOW mapping was standardized with Chatfield mapping using a systematic Geographic Information Systems (GIS) overlay process described in more detail in Appendix A. The resultant standardized CDOW mapping was then used for planning purposes to test the EFA on off-site properties, and to determine the feasibility of compensatory mitigation. Implementation of the EFA as part of the CMP will involve site-specific habitat mapping of both off-site and on-site mitigation parcels using identical classification and field assessment techniques (see the CMP for more details).

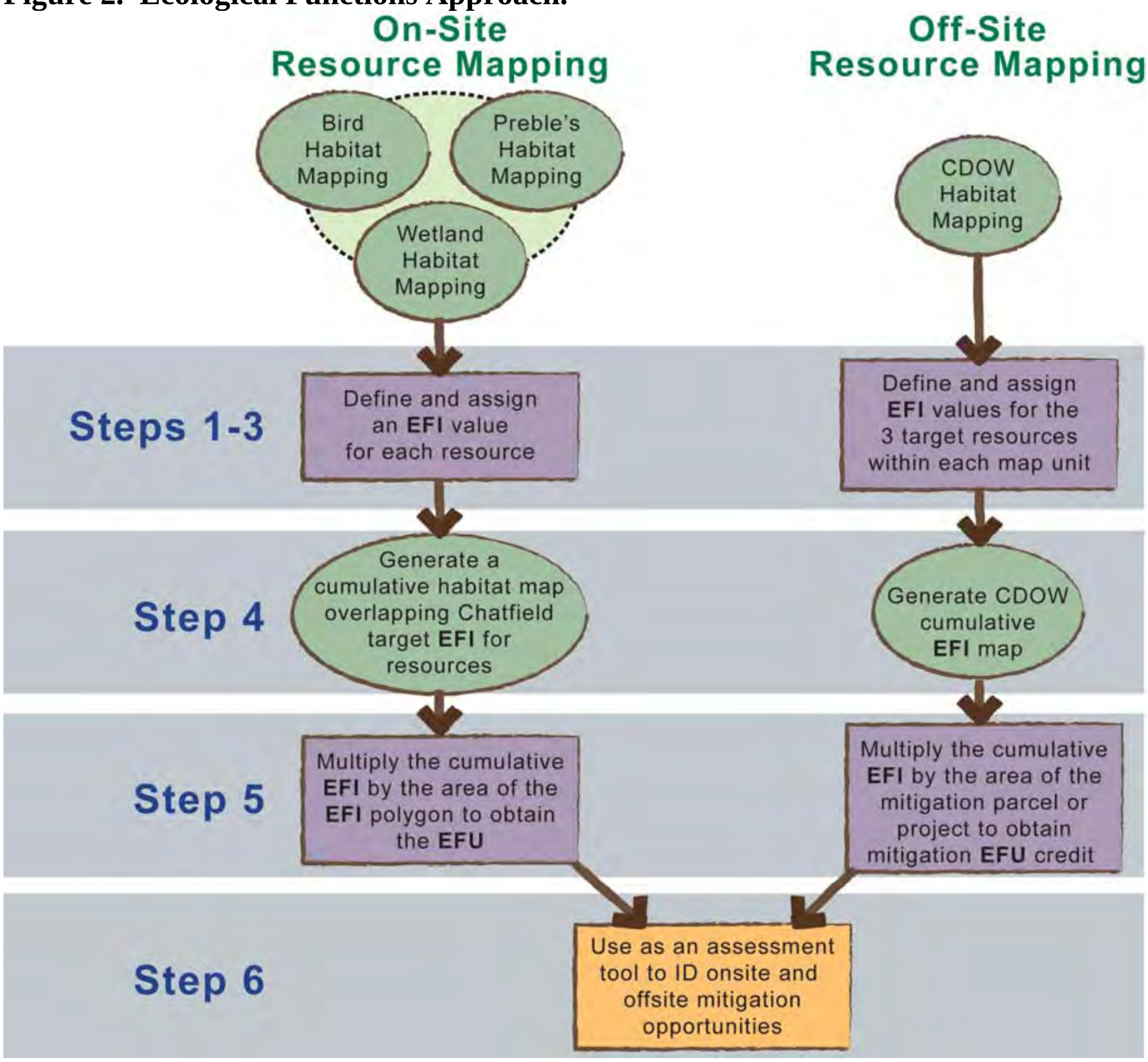
Approach Overview

To provide an ecologically meaningful assessment of impacts to the overlapping habitats of the target resources, the EFA determines a unit value for the important ecological functions (EFUs) contained within each target resource habitat mapping type. The EFU was determined by a logical progression of the following steps (Figure 1):

1. Define important ecological functions for each mapped habitat type for the target resources used in the FR/EIS.
2. Assign an EFV to each habitat type for each function.

3. Calculate an aggregate EFI that represents the cumulative ecological function of each particular habitat type.
4. Generate a cumulative EFI map that overlaps and sums the EFIs for target resources.
5. Multiply the EFIs within a mapped habitat type by the area of the habitat to determine the EFU.
6. Calculate overall impacts of reallocation as EFUs.

Figure 2. Ecological Functions Approach.



Step 1. Define important ecological functions. Important ecological functions include such things as providing breeding or foraging habitat, contributing to species richness, or supporting sensitive species.

Step 2. Once important functions are determined, then a functional value needs to be assigned to each habitat type. This EFV must be assigned using a scaling system (0.0 to 1.0) that accurately describes the resource functions and provides comparable results for the target resources. Because little site-specific data exist on the functional relationships and interaction between the Preble's, bird, and wetland habitats at Chatfield steps 1 and 2 were achieved by convening a panel of local experts (see the Methods section).

Step 3. Once EFVs for individual habitat types are determined, the EFA compiles, or sums the aggregate EFV into an ecological functioning index (EFI) for each habitat type. Because the different target resources are assessed for a variable number of functions, the EFI is scaled to 1 by dividing the sum of the EFVs by the number of functions provided by that habitat type. For example, there are four functions of Preble's habitat evaluated in the EFA. The sum of the EFV for those functions was divided by four to obtain the EFI.

Step 4. Using GIS, an overlay map of EFI by respective target resource, and a cumulative EFI that sums the EFIs of Preble's, birds, and wetlands by habitat type or polygon was created.

Step 5. The EFIs for the target resource habitat types are then multiplied by the area of impact to determine the number of impacted ecological functional units (EFU) for each target resource.

Step 6. The total number of EFUs impacted in a particular area is the sum of EFUs provided in that area for each target resource.

An identical process will be used to determine EFUs at potential mitigation sites. This EFA addresses Steps 1 through 5. Step 6 will be conducted on a provisional basis using the preferred alternative (Alternative 3), described in the FR/EIS. Final impacts will be calculated based on the alternative eventually selected.

Relationship to Compensatory Mitigation Plan

Referring back to the bank loan analogy, the overall impact in EFUs establishes the "debit" side of the equation for impact determination. The CMP will address the "credit" side of the equation. Debits are the number of EFUs impacted by reallocation and credits are the number of EFUs secured through on- and off-site mitigation. In other words, the CMP will develop a specific plan of on- and off-site mitigation that preserves, protects, and increases the EFUs on mitigation sites to offset the loss of EFUs due to reallocation. In general the CMP will:

a. Generate existing EFUs of possible mitigation sites, both on-site and off-site using CDOW mapping.
b. Use the EFUs for preliminary evaluation and selection of mitigation sites.
c. Assign Weighting Factors – Additional ecological services such as habitat connectivity and proximity to Chatfield would be applied to individual mitigation parcels and projects as appropriate. Weighting factors would be driven by regulatory requirements associated with the Endangered Species Act (ESA) as it relates to Preble's habitat.
d. Establish a process for tracking actual impacts (debits) and mitigation (credits).
e. Develop an implementation and monitoring schedule.

Methods

Resource Mapping for FR/EIS

The resource habitat mapping used in this EFA relies completely on vegetation community and wildlife habitat mapping used in the FR/EIS. The mapped habitat types were identified using aerial photo interpretation to draw coarse scale habitat polygons of the study area based on vegetation characteristics. These polygons were then verified and refined in the field by biologists with expertise in wetlands determination, avian habitat use and ecology, and Preble's ecology. A brief summary of resource mapping is provided below.

Preble's

Preble's habitat is defined in terms of quality and habitat type (riparian or upland), as mapped for and described in the FR/EIS (Figure 3). Preble's habitat types identified in the FR/EIS were intended to be large blocks of habitat found within known and suspected occupied range within Chatfield. For example, small patches of low quality habitat were incorporated into larger blocks of high quality habitat if the low quality patch was less than 1 acre. During the field verification, shrub habitats more typical of uplands (e.g., chokecherry, American plum, and snowberry) that occurred in close proximity to both high and low value riparian habitat were incorporated into the appropriate riparian type based on its habitat value as both summer breeding/cover and winter hibernaculum habitat. More distant patches of upland shrub habitat were mapped as scrubland in the Vegetation section of the FR/EIS, but no suitable patches of scrubland that could provide Preble's hibernacula were identified. An additional subsequent review of aerial photography and field reconnaissance indicated there is little to no upland shrub patches or other suitable hibernation habitat contained within the upland habitat type at Chatfield.

The Service has identified the primary ecosystem features, or constituent elements (PCEs), for Preble's habitat that are essential for the biological needs of reproducing, rearing of young, foraging, sheltering, hibernation, dispersal, and genetic exchange. Specifically, PCEs for Preble's include (67 Fed. Reg. 47160, August 12, 2005):

1. A pattern of dense riparian vegetation consisting of grasses, forbs, and shrubs in areas along rivers and streams that provides open water through Preble's active season.
2. Adjacent floodplains and vegetated uplands with limited human disturbance (including hayed fields, grazed pasture, other agricultural lands that are not plowed or disced regularly, areas that have been restored after past aggregate extraction, areas supporting recreational trails, and urban/wildland interfaces).
3. Areas that provide connectivity between and within populations. These may include river and stream reaches with minimal vegetative cover or that are armored for erosion control; travel ways beneath bridges, through culverts, along canals and ditches; and other areas that have experienced substantial human alteration or disturbance.
4. Dynamic geomorphological and hydrological processes typical of systems within the Preble's range (i.e., those processes that create and maintain river and stream channels, floodplains, and floodplain benches, and promote patterns of vegetation favorable to Preble's).

The availability of these PCEs within a mapped habitat polygon generally determines the quality of the habitat. Preble's habitat that exists within the FR/EIS study area was defined and segregated into four habitat types based on habitat quality, as described below:

1. High Quality Riparian Habitat
2. Low Quality Riparian Habitat
3. Upland Habitat
4. Nonhabitat

High Quality Riparian Habitat – Habitat areas within the floodplain that support well-developed plains riparian vegetation, including multistrata woody riparian vegetation with relatively high plant diversity, especially in the understory. Willow shrubs are the dominant plant species. High quality Preble's habitat provides for most or all of the ecological services and functions identified as PCEs, and was ranked as optimal (Table 1).

Low Quality Riparian Habitat – Habitat areas that support a multistrata woody riparian vegetation, but with limited vegetative cover. These areas do not support high plant diversity or are lacking in woody riparian vegetation (i.e., missing an important structural component such as willow shrub or diverse herbaceous understory), but still contain herbaceous plants of adequate diversity to provide Preble's habitat. This includes mid-succession riparian forest lacking a shrub or grass/forb understory or recently inundated areas that may support vegetation but not enough to provide thick cover. Low quality Preble's habitat provides varying levels of ecological services and functions identified as PCEs, and was ranked between fair and good (Table 1).

Upland Habitat – Areas outside of the normal riparian zone that provide upland grasses and shrubs of substantial cover and provide forage for Preble's. Nearly all uplands adjacent to high or low quality riparian habitat meet this definition. Upland sites provide some functions for Preble's but are limited in many of the ecological services and functions identified as PCEs, and was ranked between poor and good (Table 1).

Nonhabitat – Areas that do not support vegetation including paved and dirt roads, parking lots (paved and unpaved), buildings, open water on ponds and the main reservoir, and the dam face east of Plum Creek. These areas provide none of the ecological services or functions described above or identified as PCEs for Preble's.

Birds

Biologists created a habitat map for the FR/EIS of six bird habitats that would be within the maximum inundation area (Figure 4). Mapped bird habitats included wetlands, woodlands (including mature cottonwood forest), shrublands, open water, shorelines, and upland habitats. This area of inundation represents the FR/EIS ecological study area. High resolution aerial photography was used to map habitats in the field. The field maps were digitized into a GIS and further summarized. The mapped bird habitat types identified in the FR/EIS are described below.

Mature Cottonwood – Mature cottonwood habitat types are found along the South Platte River that have old, large plains cottonwoods (*Populus deltoides* ssp. *monilifera*), but narrowleaf cottonwood (*Populus angustifolia*), peachleaf willow (*Salix amygdaloides*), and other deciduous species also occur within this area. The understory is relatively open and is comprised of riparian grasses and forbs, as well as some shrubs such as coyote willow (*Salix exigua*).

Other Trees – This habitat unit is the remaining forested areas within the study area and comprises the riparian areas dominated by plains and narrowleaf cottonwood, peachleaf willow, and box elder (*Negundo aceroides*). The habitat unit includes the even-aged stands of cottonwoods along the reservoir edges, as well as the multiaged stands at the mouths of Deer Creek, Plum Creek, and the South Platte River that are in various successional stages. These forests do not have substantial areas of mature cottonwood. Understories can be bare (such as along shorelines) to thick with grasses, forbs, and shrubs.

Shrubs – This shrub habitat unit is composed of riparian shrubs (mostly coyote willow), and other associated shrubs adjacent to streams and floodplains within the study area. This shrub habitat may include crack willow (*Salix fragilis*), chokecherry (*Padus virginiana* ssp. *melanocarpa*), snowberry (*Symphoricarpos occidentalis*), and skunkbush sumac (*Rhus aromatica* ssp. *trilobata*).

Uplands – Upland areas are dominated by grasslands including smooth brome (*Bromopsis inermis*), crested wheatgrass (*Agropyron cristatum*), western wheatgrass (*Pascopyron smithii*), blue grama (*Chondrosum gracile*), and sand dropseed (*Sporobolus cryptandrus*). These areas also can include weedy areas on upper creek terraces that support Canada thistle (*Breea arvensis*), mullein (*Verbascum thapsis*), cheatgrass (*Anisantha tectorum*), and knapweed (*Acosta* sp.).

Wetland/Nonwoody – The wetland/nonwoody habitat unit is found on riparian and shoreline areas that do not contain trees or shrubs, and are mostly composed of wetland-associated plants such as cattails (*Typha* sp.), rushes, sedges (*Carex* spp.), reed canarygrass (*Phalaroides arundinacea*), great cane (*Phragmites australis*), and quack grass (*Elytrigia repens*). These areas are typically inundated due to spring flooding, summer rain storms, or reservoir levels.

Shoreline – Unvegetated shoreline areas are found around the reservoir and inlets. This habitat unit can be gravelly, sandy, or silty, and includes riprap.

Nonhabitat – This habitat includes parking areas, roadways, and other areas generally lacking any natural habitat value for birds.

Water – This habitat includes open water bodies, including Chatfield and various ponds and former gravel pits along the South Platte River. This habitat does not include the South Platte River, Plum Creek, or Deer Creek, which were mapped as wetlands or riparian habitat. It is assumed that open water and the ecological functions it provides for terrestrial species associated with water (primarily water birds) would not be adversely affected by the proposed reallocation; therefore, water as a habitat unit for terrestrial species is not included in this analysis.

Wetlands

Wetland areas were mapped into five main categories: emergent, submergent, scrub/shrub, forested, and seasonal wetlands. These categories were developed with input from the Corps, following the Cowardin classification (Cowardin et al. 1979), and include natural or man-made wetlands.

Defining Ecological Functions (Steps 1 and 2)

Habitat provides numerous ecological and societal services and functions, and no standard method exists for selecting the important functions for assessment or metrics for determining the ecological value of those functions. Adapting the consensus approach, often used in HEA, an Ecological Functions Technical Committee (committee) was convened consisting of locally recognized experts with expertise in the three target resources, Preble's, Colorado Front Range bird communities, and wetlands (Appendix

B). This committee met on several occasions to discuss and reach consensus on a process for evaluating and assigning values to the EFA. Wetlands were evaluated using the Functional Assessment of Colorado Wetlands Method (FACWet) (Johnson et al. 2009). The Corps' Denver Regulatory Office was involved in developing FACWet and recommended its use in assessing wetland functional impacts and mitigation for the Chatfield Reallocation project. Because FACWet would be used for developing EFIs for wetland habitats, the committee focused on defining and valuing functions for Preble's and bird habitats.

Defining ecological features pertaining to Preble's and birds focused on identifying how the ecological features support life requisites such as breeding, over-wintering and migration, forage, and cover. The committee discussed and defined detailed definitions of the ecological functions for Preble's and birds, which briefly described below.

Preble's Habitat Functions

Ecological services of Preble's habitat generally are described by the Service (63 Fed. Reg. 26517, May 13, 1998) and CDOW (Shenk 1999; Shenk and Eussen 1999). The draft recovery plan for Preble's (Service 2003) states that delineation of Preble's habitat "needs to include all the necessary resources for Preble's to nest/breed, find cover, travel, feed and hibernate." Based on this information, ecological services provided at Chatfield for Preble's generally consist of:

1. Breeding,
2. Hibernating,
3. Foraging, and
4. Protection from predators (cover).

EFVs were assigned to each Preble's habitat variable by consensus of the committee based on habitat affinities described in the literature and summarized earlier in this document, the Preble's Draft Recovery Plan, and the final designation of critical habitat (68 Fed. Reg. 37276, 2003). The general criteria used in assigning Preble's values include:

- General quality of the habitat unit (e.g., general cover including multistrata vegetation and plant diversity) as an indicator of cover value;

- Importance of habitat to provide general cover and forage including thick understory vegetation and downed woody debris as an indicator of forage and breeding value;
- Juxtaposition of riparian habitat to uplands (e.g., adjacent or isolated) and active stream channel (e.g., river, stream, or pond in terms of relative ability to maintain or create new habitat) as an indicator of foraging value; and
- Vegetation structure and habitat unit juxtaposition (location of suitable vegetation structure outside of typical high flood zone) as an indicator of hibernation potential.

Table 1. Preble's ecological functions rating definitions.

Rating	Description	Ecological Features of Preble's Habitat			
		Breeding	**Winter**	**Forage**	**Cover**
1.00	Optimal	Currently provides for all PCEs related to breeding: • Dense multiage to mature riparian shrub • Dense native herbaceous understory • Near open water	Provides adequate vegetation and soil characteristics for hibernacula: • Clay to silty soils including loams • Abundant mature riparian shrubs with developed root structure • At or above defined bench/terrace above ordinary high water mark	Currently provides for all PCEs related to foraging: • Dense native upland grasses and forbs • Limited to no human disturbance • No recreational trails • Distant to urban/ wildlife interface	Currently provides for all PCEs related to cover: • Dense multiage to mature shrub (riparian and/or upland) or dense native herbaceous cover
0.75	Good	Currently provides for most of PCEs related to breeding: • Moderately dense, multiage to mature riparian shrub • Moderately dense native to mixed herbaceous understory • Near open water	Provides for hibernacula, but lacks either quantity or quality of suitable habitat: • Clay to silty soils including loams • Sparse to abundant mature riparian shrubs with developed root structure • Above ordinary high water mark	Currently provides for most of PCEs related to foraging: • Moderately dense, predominantly native to mixed herbaceous cover • Limited human disturbance • Sparse designated recreational trails • Distant to urban/ wildlife interface	Currently provides for most of PCEs related to cover: • Moderately dense multiage to mature shrub (riparian and/or upland) or moderately dense native to mixed herbaceous cover
0.50	Fair	Currently provides for some of PCEs related to breeding: • Moderately dense young to multiage to riparian shrub	Lacks both quantity or quality of suitable habitat for hibernacula: • Sandy loam, gravelly, or cobble soils • Riparian shrubs	Currently provides for some of PCEs related to foraging: • Sparse to moderately dense mixed herbaceous cover • Limited human	Currently provides for some of PCEs related to cover: • Sparse to moderately dense young to multiage shrub (riparian and/or

Rating	Description	Ecological Features of Preble's Habitat			
		Breeding	Winter	Forage	Cover
		• Sparse to moderately dense mixed herbaceous understory • Distant to open water	generally young without a well-developed root structure • Above ordinary high water mark	disturbance • Designated and social recreational trails • Moderately distant to urban/ wildlife interface	upland) or moderately dense mixed herbaceous cover
0.25	Poor	Currently provides very few of PCEs related to breeding: • Sparse riparian shrub • Sparse herbaceous understory – nonnative dominant • Distant to open water	Patches of suitable habitat for hibernacula exist but quantity and quality is very limited: • Sandy or cobble • Sparse to absent riparian shrubs with well-developed root structure • Below ordinary high water mark	Currently provides very few of PCEs related to foraging: • Sparse herbaceous cover – nonnative dominant • Human disturbance • Abundant designated and social recreational trails • Close to urban/ wildlife interface	Currently provides very few of PCEs related to cover: • Sparse young to multiage shrub (riparian and/or upland) and sparse nonnative to mixed herbaceous cover
0.00	None	Currently provides no PCEs related to breeding	No suitable habitat for hibernacula provided	Currently provides no PCEs related to foraging	Currently provides no PCEs related to cover

Rating Preble's Habitat EFVs

Ratings for habitat functions were assigned based on a combination of qualitative and quantitative rating criteria (Table 2). Preble's EFVs were based on a general quality scale ranging from nonhabitat (EFV = 0.0) to optimal habitat for Chatfield (EFV = 1.0).

Table 2. Preble's habitat EFVs.

Chatfield EIS Mapping Habitat Type	Preble's EFV			
	Breeding	Winter	Forage	Cover
Chatfield EIS Preble's Habitat				
High Value Riparian	1	1	1	1
Low Value Riparian	0.5	0.5	0.75	0.75
Upland	0.25	0.25	0.75	0.5
Nonhabitat	0	0	0	0
None*	0	0	0	0

Bird Habitat Functions

The bird habitats found within the study area provide the ecological functions necessary to support breeding, wintering, and migrating avian communities. The committee determined that, for the purposes of this study, the assessment of bird ecological functions would focus on four specific attributes of avian habitats within the South Platte River/Plum Creek watershed:

1. Supports diverse bird species (species richness),
2. Supports large numbers of birds (abundance),
3. Provides habitats that are limited or rare on a local or regional scale, and
4. Provides seasonal habitats for sensitive species.

These functions are very similar to the IBA criteria described earlier. The EFVs of these attributes at Chatfield were determined from several data sources, including point counts conducted by TetraTech as part of the FR/EIS baseline inventory, surveys and bird counts conducted by the Audubon Society of Greater Denver, the Colorado Breeding Bird Atlas (Kingery 1998), and the National Audubon Society Christmas Bird Count (CBC) data summarized by U.S. Geological Survey (USGS 2009). Specific methods for determining EFVs for bird habitat attributes are described below.

Species Richness and Abundance

Available data from bird species lists collected by Chatfield State Park and Audubon, and surveys conducted by volunteers and experienced birders were reviewed and evaluated by the committee. Hugh Kingery conducted a breeding bird census between 1971 and 1986 documenting the change in bird communities as the area transitioned from a riverine and riparian habitat to an inundated reservoir; however, this census did not include all habitat types potentially impacted by reallocation and may not reflect the current bird community. Joey Kellner conducted point counts at Chatfield State Park between 1996 and 2006. These studies and additional information from Rocky Mountain Bird Observatory (RMBO), Colorado Urban Wildlife Partnership, and CDOW were reviewed in the FR/EIS to develop an overall sense of bird species richness within Chatfield.

The Service recommended that site-specific bird surveys be conducted to assess Chatfield reallocation impacts to migratory birds. Based on the Service's recommendation, two point counts were conducted in nonwoody wetland/wet meadow, low to mid-level (shrubs) woody habitat, and mid-level to high-level (trees) woody habitat (Appendix C). In June 2006, 12 point-count stations located along both the South Platte River and Plum Creek were visited twice over a 2-week period. An index of species richness and abundance by habitat was determined from data collected during these two point counts (Appendix C). The two point counts were combined and summarized by total species observed in each habitat (species richness) and total number of birds observed in each habitat (abundance) (Appendix D). A comparison of these point counts with similar studies in the western U.S. found that avian assemblages at Chatfield State Park have a consistent pattern with observations at other riparian communities (Farley et al. 1994; Hubbard 1971; Szaro 1980). These studies found that bird assemblages generally have increased richness and complexity as riparian stands increase in age. Detailed line transects and point counts within different-aged stands of riparian forest on the Rio Grande in New Mexico had comparable species richness as point counts conducted on Chatfield State Park (Farley et al. 1994). Both species richness and abundance were included as functions because the data indicated that species-rich habitats may be low in abundance (e.g., wetlands) and vice versa. The point count data did not include counts within upland or mature cottonwood habitats. Because of similarities in structure and species composition, the committee assigned mature cottonwood habitat the same value calculated for riparian tree habitat. Based on site-specific knowledge of uplands in the study area and general knowledge of the quality of uplands within the region, upland habitat was assigned a value one step below the lowest EFV calculated for the three measured habitats.

Limited Habitat

Limited habitat was identified based on a combination of aerial photo interpretation and a calculation of the relative spatial extent (total acres) of each habitat, as mapped by CDOW riparian mapping. The habitat was mapped both within Chatfield State Park boundaries and over a larger region that encompassed both the South Platte River and Plum Creek drainages from C-470 south to the Waterton Bridge and Sedalia (Figure 5). This area was selected because habitat markedly changes from a prairie to a lower montane system west of the Waterton Bridge, and riparian habitat changes from a system with a tree overstory north of Sedalia to a system with a dominant willow shrub overstory with few trees south of Sedalia. Land use and habitat along the South Platte River north of C-470 change from a rural to an urban environment. Because CDOW riparian mapping concentrated on riparian areas, uplands are underrepresented; therefore, uplands were determined to be common based on aerial photo interpretation. Habitats were rated from very limited to abundant as follows:

Very limited = less than 15 percent of available habitat either regionally or locally
Limited = 15 to 35 percent of available habitat either regionally or locally
Common = 36 to 55 percent of available habitat either regionally or locally
Abundant = greater than 55 percent of available habitat both regionally and locally

Table 3 provides the overall rating of the bird functions described above.

Table 3. Bird ecological functions rating definitions.

Rating	Description	Bird Functions			
		Species Richness* (# species)	Species Abundance* (# Individuals/ ha)	# of Sensitive species	Limited Habitat (% of habitat available within region)
1.00	Optimal/High	> 25	>16	>10	Very limited (<15%)
0.75	Good/ Moderately High	17-24	11-15	7-9	Limited (15 to 35%)
0.50	Fair/Moderate	9-16	6-10	4-6	Common (36 to 55%)
0.25	Poor/Low	1-8	1-5	1-3	Abundant (>55%)
0.00	None	0	0	0	- -

* = Data from point counts (FR/EIS).

Sensitive Species

Sensitive species are defined as federal- or state-listed species, and species tracked by the Colorado Natural Heritage Program (CNHP) and Birds of Conservation Concern (BCC) (Service 2002) for Regions 16 (Southern Rockies) and 18 (Shortgrass Prairie). A list of sensitive species based on the data sources described above was compiled and reviewed by the committee (Table 4). Each sensitive species was placed into appropriate habitat(s) by season of occurrence based on literature accounts, professional opinion, and the consensus expertise of the committee.

Table 4. Sensitive species by season of use and habitat.

Season of Use	Wetlands	Riparian Trees	Shrubs	Uplands	Mature Cottonwood
Year-Round	Bald eagle	Bald eagle	Bald eagle	Bald eagle, Golden eagle	Bald eagle
Summer (Breeding)		Lewis's woodpecker, Swainson's hawk		Burrowing owl, Swainson's hawk	Ovenbird, Red-eyed vireo, Lewis's woodpecker
Winter (Nonbreeding)	Northern harrier			Northern harrier, Ferruginous hawk	
Migration	Peregrine falcon, Rufous hummingbird	Virginia's warbler, Rufous hummingbird	Virginia's warbler, Rufous hummingbird	Loggerhead shrike, Rufous hummingbird, Brewer's sparrow, Prairie falcon, Peregrine falcon	Virginia's warbler
Total #	**4**	**5**	**3**	**11**	**5**

Each species was placed into one or more of the five mapped habitat types based on its primary season of use within the Chatfield basin: year-round, summer (breeding), winter (nonbreeding), and migration. A brief description of each species' seasonal habitat affinities is provided in Appendix E.

Rating Bird Habitat EFVs

Ratings for limited bird habitat was based on a general abundance scale ranging from abundant (EFV = 0.25) to very limited (EFV = 1.0) (Table 5). The increments used to determine the EFV ratings for bird richness, abundance, and sensitive species habitat were primarily mathematical. The highest number in the data was divided by the number of rating categories (4), excluding zero. For example, for species richness, the highest number of species observed among all habitat types was 30 in wetlands. Dividing 30 by

4 results in increments of about 7 (1-8, 9-16, 17-24, >25). For sensitive species, ratings were calculated by dividing the highest number of species within a single habitat (11) by the number of rating categories (4). Eleven species divided by four categories equals 2.75, which was rounded up to 3. Breakouts were scored in increments of 3 (0, 1-3, 4-6, 7-9, >9). When compared to the data tables, these increments closely matched natural breaks in the data.

Table 5. Bird Habitat EFVs.

Chatfield EIS Mapping Unit	Bird EFV			
	Species Richness	Species Abundance	Supports Sensitive Species	Limited Habitat (local or regional)
Chatfield EIS Bird Habitat				
Shrub (riparian)	0.75	1	0.25	0.75
Trees	0.75	0.75	0.5	0.75
Upland	0.5	0.5	1	0.5
Wetland/Nonwoody	1	0.75	0.25	1
Mature Cottonwood	0.75	0.75	0.5	1
Nonhabitat	0	0	0	0

Wetlands

Biologists mapped areas within the study area for the FR/EIS that had indicators of the three characteristics the Corps considers necessary for an area to be determined a wetland (hydrophytic vegetation, adequate hydrology, and wetland soils) (Figure 6). The mapping was limited to the study area.

Wetland areas were grouped into five main habitat types according to Cowardin et al. (1979)—palustrine aquatic bed, palustrine emergent, palustrine scrub/shrub, palustrine forested, and lacustrine emergent. These habitat types were developed with input from the Corps and include natural or man-made wetlands.

Biologists assessed wetland functions using the FACWet method (Johnson et al. 2009). FACWet is a Colorado-specific, qualitative rapid assessment method that relies on professional judgment to assess the functional conditions of wetlands and riparian areas. The method focuses on determining the degree of departure between existing conditions and natural or reference-standard conditions. The method attributes differences between existing and reference-standard conditions to "stressors" or deleterious, anthropogenic alterations to key physical and vegetational attributes, or "state variables" (Johnson et al. 2009). The FACWet method assesses wetlands by evaluating and scoring the condition of nine state variables in three categories. The categories and their state variables are:

1. Buffer and Landscape Context
    a. Habitat connectivity – neighboring wetland habitat loss
    b. Habitat connectivity – migration/dispersal barriers
    c. Buffer capacity
2. Hydrology
    a. Water source
    b. Water distribution
    c. Water outflow
3. Abiotic and Biotic Habitat
    a. Chemical environment
    b. Geomorphology
    c. Vegetation structure and complexity

The method scores the state variables by estimating the extent and severity of stressors that may impair wetland functions. Once the state variables are evaluated and scored, an algorithm then relates the scores to functions they influence. The functions assessed by FACWet are:

1. Wildlife habitat
2. Fish/aquatic habitat
3. Flood attenuation
4. Short- and long-term water storage
5. Nutrient/toxicant removal
6. Sediment retention/shoreline stabilization
7. Production export/food chain support

The first step of FACWet is to define the Area of Interest (AOI), which is the area that encompasses all possible project impacts; and the Assessment Area (AA), which is the unit of target habitat in the AOI. Under FACWet, most AAs would be delineated to include the total area of wetlands within the AOI. For larger AOIs, multiple wetlands can be included in an AA if they are subject to similar stressors and possess a similar level of impairment.

For purposes of this study, the AOI is the band between the highest (5,444 feet above mean sea level (msl)) and the lowest (5,432 feet above msl) alternative pool elevations. According to the PDEIS, these wetlands would be impacted by the alternative with the highest pool elevation and reflects the maximum acres of wetlands that would be inundated. Because the AOI is relatively large, nine AAs were defined (Figures and F-1 through F-10; Appendix F). Using multiple AAs provides a more accurate assessment because they represent differences in stressors, landscape location, and stream systems.

The nine AAs listed below were delineated based on topographic and hydrologic differences between wetland complexes. For example, three AAs are found in the Plum Creek drainage. AA Plum Creek 1 encompasses wetlands that are primarily under the hydrologic influence of Chatfield. AA Plum Creek 2 also is strongly influenced by the reservoir, but unlike AA Plum Creek 1, it is at the mouth of Plum Creek so the creek also has a strong influence. The rationales used to define the nine AAs (Figures F-1 through F-10; Appendix F) are:

1. **Deer Creek 1 –** This AA occurs adjacent to Deer Creek and is relatively uniform throughout.
2. **Plum Creek 1 –** This AA encompasses wetlands that are primarily under the hydrologic influence of Chatfield.
3. **Plum Creek 2 –** This AA is strongly influenced by Chatfield Reservoir, but because it is at the mouth of Plum Creek, the creek also has a strong influence.
4. **Plum Creek 3 –** This AA extends farther up the Plum Creek drainage and the influence of Chatfield Reservoir is lower.
5. **South Platte River 1 –** The hydrology of this AA is related to Chatfield Reservoir. This AA is somewhat physically separated from wetlands along the South Platte River.
6. **South Platte River 2 –** This AA is associated with the South Platte River and is not influenced by Chatfield Reservoir. This AA also is somewhat separated from other wetlands.
7. **South Platte River 3 –** This AA is somewhat separated from other wetlands by the park perimeter road and open water. Although in the South Platte River floodplain, this AA does not abut the river, and is primarily influenced by ground water.
8. **South Platte River 4 –** This AA is primarily influenced by Chatfield Reservoir. This AA is physically separated from other wetlands by the park perimeter road and open water.

9. **South Platte River 5 –** This AA is around the perimeter of a gravel pond supplied by ground water. The influence of Chatfield Reservoir and the South Platte River are minimal.

Once the AAs were delineated in GIS, 250- and 500-meter buffers were created around the AAs, potential barriers to plant and animal dispersal and movement were identified, existing riparian areas were identified (based on CDOW riparian mapping), and areas where riparian habitat has been lost (based on USGS quadrangle mapping and best professional judgment) were identified (Appendix F). Once these preparatory steps were completed, the evaluator applied the FACWet method to each AA (Appendix G), which resulted in a composite Functional Capacity Index (FCI) score for each AA (Table 6; Figure F-11 Appendix F, and Appendix G). A few small scattered wetlands around the perimeter of Chatfield were outside of the FACWet AAs. Because of their similarity in landscape position, these small wetlands were assigned the FCI of the South Platte River 5 AA.

Table 6. Functional capacity indices for Chatfield FACWet AAs.

Assessment Area	Functional Capacity Index
DC1	0.82
PC1	0.80
PC2	0.81
PC3	0.85
SPR1	0.71
SPR2	0.84
SPR3	0.75
SPR4	0.74
SPR5	0.67

Because the AAs were defined using a landscape approach rather than by wetland habitat type, the AAs contained more than one wetland habitat type. All of the wetlands in a particular AA received the same FCI, regardless of wetland habitat type. This means that mapped polygons of the same wetland habitat type have different FCIs if they were not in the same AA. Because the EFA is based on habitat types mapped for the FR/EIS, the landscape-based FCIs were converted to wetland habitat-based EFIs to be consistent with the Preble’s and bird EFIs. Each Preble’s and bird habitat type has one EFI value, which reflects the average condition of the habitat type throughout the study area. Therefore, averaging the FCIs of each polygon of a particular wetland habitat type provides an EFI consistent with the other target resources. However, the differing sizes of the wetland polygons means the polygons do not contribute equally to the average. To reflect the unequal contributions of different sized polygons with various FCIs, the EFI for each wetland habitat type was calculated using a weighted average.

Calculating EFI (Step 3)

Assigning EFIs for Preble's and Bird Habitats

The committee held a series of workshops and email exchanges (Appendix H) to reach consensus on assigning EFVs for Preble's and bird habitat variables (Tables 1 and 3). A numerical EFV was assigned for each variable on a 0.0 to 1.0 scale. The average EFVs for each habitat type were then calculated and used as the EFI for each habitat type (Table 7). The resulting EFIs were entered spatially into habitat polygons for the target resource files using GIS (Figures 8, 9, and 10).

Calculating Wetland EFIs

As previously described, applying the FACWet Method to each AA resulted in a composite FCI score for each AA (Appendix G). As a result, different polygons of a particular wetland habitat type have different FCIs if they are not in the same AA. A weighted arithmetic mean was used to calculate the average FCI for each wetland habitat type. The average FCI was used as the EFI for wetland habitat types (Tables 7 and 8). The EFI for each wetland habitat type represents the average condition of that wetland habitat type in the study area.

Table 7. Wetland ecological functions ratings.

Wetland Habitat Type	Ecological Functioning Index
Lacustrine emergent	0.67
Palustrine aquatic bed	0.75
Palustrine emergent	0.79
Palustrine forested	0.82
Palustrine scrub-shrub	0.79

ERO
Resources
Corporation

The EFIs for each wetland habitat type were calculated by multiplying the acreage of each wetland habitat polygon by the FCI of the AA in which the polygon occurred. The sum of these products was divided by the total acreage of the wetland habitat type. The EFI for each wetland habitat type was calculated using the following formula:

Wetland Habitat EFI = $\sum^{n}_{I=1} W_i \, FCIAA_i / \sum^{n}_{I=1} W_i$

Which means

Wetland Habitat EFI = $W_1 \, FCIAA_1 + W_2 \, FCIAA_2 + \ldots + W_n \, FCIAA_n / W_1 + W_2 + \ldots + W_n$

Where

W = Acres of wetland habitat type (e.g., palustrine emergent and palustrine scrub-shrub)

$(W_1 \, W_{2,\ldots} \, W_n)$

$FCIAA$ = FCI of Assessment Area (e.g., Deer Creek 1 (DC1) and Plum Creek 1 (PC1))

$(FCIAA_1, FCAA_2 \, ,\ldots \, FCAA_n)$

Appendix G contains a spreadsheet with the raw data generated from the GIS data, and a spreadsheet that contains the EFI calculations using the raw data.

All of the polygons mapped as lacustrine emergent wetlands were included in the fringe wetlands around the perimeter of Chatfield that were assigned the FCI for AA SPR5. As a result, because the FCIs for all lacustrine emergent wetland polygons are the same, the weighted average and EFI are 0.67.

Combining EFIs for All Three Target Resources

Combining the EFI's for each target resource described above results in the total EFIs by resource and habitat units as presented in Table 8.

Table 8. Ecological functional values for habitat attributes and EFIs for habitat types.

Chatfield EIS Mapping Habitat Unit	Preble's EFV				Bird EFV				Wetlands Functions Evaluated by FACWet							EFI
	Breed-ing	Win-ter	For-age	Cov-er	Specie s Rich-ness	Species Abun-dance	Sup-ports Sens-itive Specie s	Lim-ited Hab-itat (local or region-al)	Wild-life Habita t	Fish/ Aquatic Habitat	Flood Atten-uation	Short- and Long-Term Water Storage	Nutrient and Toxicant Removal	Sediment Retention Shoreline Stab.	Prod. Export Food Chain Support	EFI Average of EFV for each target resource)
Chatfield EIS Bird Habitat																
Shrub (riparian)					0.75	1	0.25	0.75								0.69
Trees					0.75	0.75	0.5	0.75								0.69
Upland					0.5	0.5	1	0.5								0.63
Wetland/Nonwoody					1	0.75	0.25	1								0.75
Mature cottonwood					0.75	0.75	0.5	1								0.75
Nonhabitat					0	0	0	0								0.00
Chatfield EIS Preble's Habitat																
High value riparian	1	1	1	1												1.00
Low value riparian	0.5	0.5	0.75	0.75												0.63
Upland	0.25	0.25	0.75	0.5												0.44
Nonhabitat	0	0	0	0												0.00
Chatfield EIS Wetland Habitat																
Lacustrine emergent																0.67
Palustrine aquatic bed																0.75
Palustrine emergent									**The FACWet method was used to determine composite EFIs for wetland habitat. EFVs were not calculated for wetland habitats. See the Wetland section for details.**							0.79
Palustrine forested																0.82
Palustrine scrub-shrub																0.79

Create an Overlay Map and Calculate Combined EFI (Step 4)

Using GIS, the individual habitat polygons of the three target resources can be overlapped and a combined EFI map generated. Three basic mapping assumptions became clear when habitat polygons were overlapped as depicted in the simplified example in Figure 11:

1. All habitat areas at Chatfield provide bird habitat.
2. Because the distribution of Preble's is restricted to the two main tributaries (South Platte River and Plum Creek) and the southern portions of the reservoir edge, Preble's habitat is a wholly contained subset of bird habitat.
3. Similarly, wetlands are a wholly contained subset of bird habitat and is largely a subset of Preble's habitat, but not all wetlands are Preble's habitat.

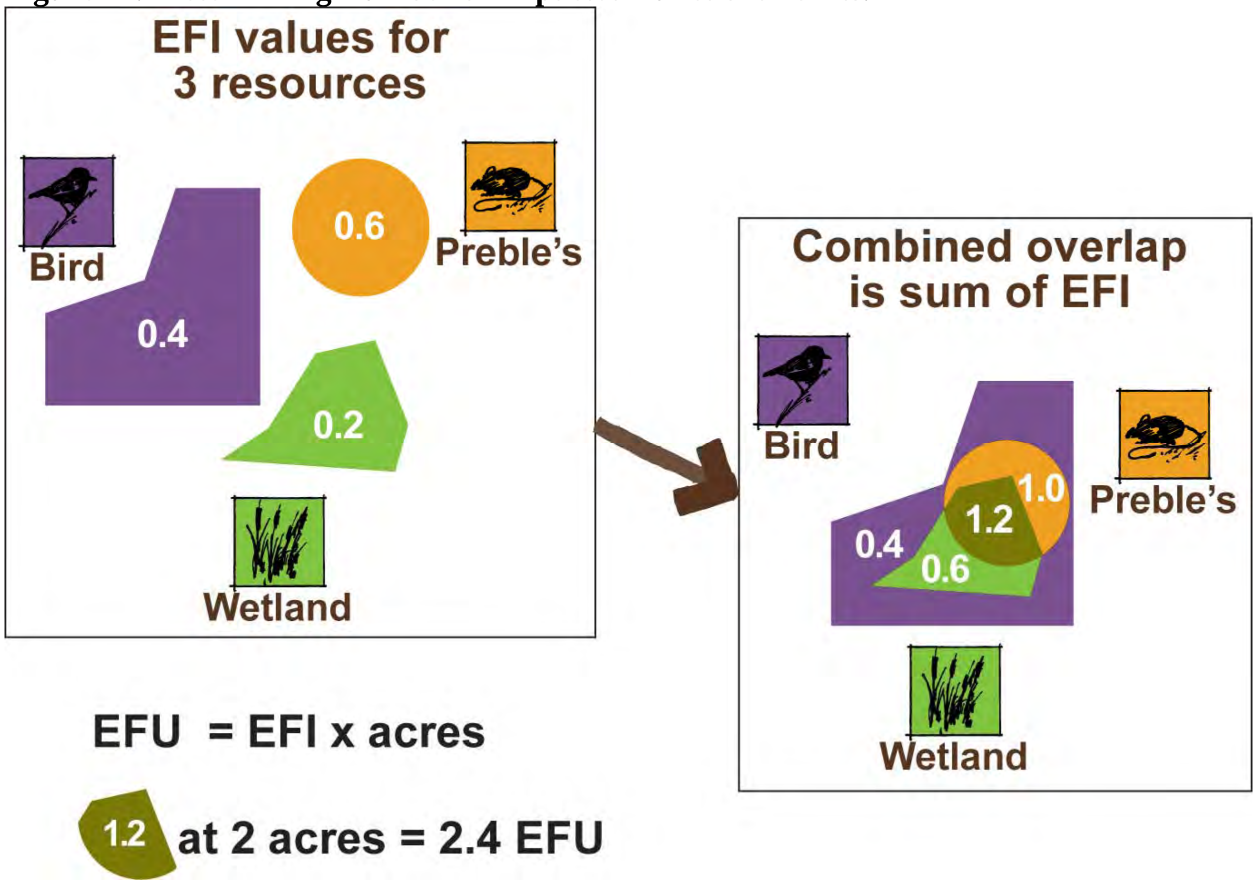
The individual EFIs for Preble's, birds, and wetland habitat in Figure 11 are 0.6, 0.4, and 0.2, respectively. When overlaid in GIS, there are some areas that overlap all three target resources, some areas that overlap two, and an area that only has bird habitat. In this example, the bird-only EFI remains at 0.4 EFI, bird combined with Preble's is 1.0 EFI, bird combined with wetlands is 0.6 EFI, and areas supporting ecological functions of all three resources is 1.2 EFI.

Calculate Impacts as Functional Units (Step 5)

The number of EFUs in a particular area is the product of the EFI of a polygon times the acreage of the area in question. For instance, if a particular Preble's habitat polygon has an EFI of 0.75 and the polygon is 10 acres, the polygon provides 7.5 EFUs for Preble's (10 acres x 0.75 = 7.5 EFUs). If 4 of those 10 acres are inundated, 3 EFUs would no longer be available (4 acres x 0.75 = 3 EFUs).

The total number of EFUs impacted by the selected alternative will be calculated based on the sum of impacted EFUs provided for each target resource. For example, if 100 acres are inundated and those 100 acres provide 200 EFUs for Preble's, 150 EFUs for birds, and 75 EFUs for wetlands, a total of 425 EFUs would be impacted.

Figure 11. Determining Number of Impacted Functional Units.



References

Audubon Colorado. 2009. Colorado's Important Bird Areas Program. Available at: http://iba.audubon.org/iba/viewState.do?state=US-CO. Last accessed: October 5, 2009.

Bakeman, M.E. and A. Deans. 1997. Habitat of the Preble's meadow jumping mouse at Rocky Flats, Colorado. Pp. 19-35 *in* Report on habitat findings on the Preble's meadow jumping mouse (M. Bakeman, ed.). Presented to the USFWS and CDOW. 91 pp.

Brinson, M. 1993. A hydrogeomorphic Classification for Wetlands. U.S. Army Corps of Engineers, Wetlands Research Program Technical Report WRP-DE-4. 103 pp. Available at: http://www.csu.edu/cerc/documents/HydrogeomorphicClassificationforWetlands.pdf. August.

Clippinger, N.W. 2002. Biogeography, community ecology, and habitat of Preble's meadow jumping mouse (*Zapus hudsonius preblei*) in Colorado. Ph.D. Dissertation, University of Colorado, Boulder.

Corn, J.G., C.A. Pague, A.R. Ellingson, M. Sherman, T. Zwiejacz, G. Kittel, and C. Fleming. 1995. Final report on the geographic extent of the Preble's meadow jumping mouse population on the United States Air Force Academy. Presented to the U.S. Air Force Academy, CO.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Dept. of Interior, Fish and Wildlife Service Office of Biological Services. Washington D.C. 79 pp.

Dharman, A.T. 2001. Movement patterns of Preble's meadow jumping mouse. M.S. Thesis. Colorado State University, Fort Collins, CO.

Farley, G.H., L.M. Ellis, J.N. Stuart, and N.J. Scott, Jr. 1994. Avian Species Richness in Different-Aged Stands of Riparian Forest along the Middle Rio Grande, New Mexico. *Conservation Biology*, Vol. 8, No. 4, pp. 1098-1108. December.

Galbraith, H., J. Price, M. Dixon, and J. Stromberg. 2004. Development of HSI models to evaluate risks to riparian wildlife habitat from climate change and urban sprawl. *in* Landscape Ecology and Wildlife Habitat Evaluation: Critical Information for Ecological Risk Assessment, Land-Use Management Activities, and Biodiversity Enhancement. ASTM STP 1458. L. Kapustka, H. Galbraith, M. Luxon, and G.R. Biddinger (eds.).

Gebhardt, K., E. Crowley, D. Prichard, and M. Stevenson. 2005. Riparian area management; riparian and wetland classification review and application. Technical Reference 1737-21. U.S. Department of the Interior, Bureau of Land Management, Denver, CO. BLM/ST/ST-05/002+1737. 26 pp.

Hubbard, J.P. 1971. The summer birds of the Gila Valley: biotic considerations. Pp. 128-134 in Riparian ecosystem and their management: reconciling conflicting uses

(R.R. Johnson, C.D. Ziebell, D.R. Patten, P.F. Folliot, and R.H. Hamre, tech coords.) USDA, Forest Service. General Technical Report RM-432.

Johnson, B., M. Beardsley, and J. Doran. 2009. The Functional Assessment of Colorado Wetlands (FACWet) Method – Version 1.0. Colorado Department of Transportation DTD Applied Research Branch. February. Available at: http://rydberg.biology.colostate.edu/facwet/FACWet_Version_1.0.pdf.

King, D.M. 1997. Comparing ecosystem services and values with illustrations for performing Habitat Equivalency Analysis. A report to the National Oceanographic and Atmospheric Administration, Damage Assessment and Restoration Program, Silver Spring, MD. Available at: http://www.darrp.noaa.gov/ library/pdf/kingpape.pdf.

Kingery, H.E. 1998. Colorado Breeding Bird Atlas. Colorado Breeding Bird Atlas Partnership and Colorado Division of Wildlife.

Meaney, C.A., N.W. Clippinger, A. Deans, and M. O’Shea-Stone. 1996. Second year survey for Preble’s meadow jumping mouse (*Zapus hudsonius preblei*) in Colorado. Prepared for Colorado Division of Wildlife.

Meaney, C.A., A. Deans, N.W. Clippinger, M. Rider, N. Daly, and M. O’Shea-Stone. 1997. Third year survey for Preble’s meadow jumping mouse (*Zapus hudsonius preblei*) in Colorado. Boulder (CO). 57pp.

NOAA (National Oceanic and Atmospheric Administration. 1995. Habitat Equivalency Analysis: An Overview. Revised 2000 and 2006. Available at: http://www.darrp.noaa.gov/library/pdf/heaoverv.pdf.

PTI Environmental Services. 1998. Preble’s meadow jumping mouse study at Rocky Flats Environmental Technology Site, Annual Report. Unpublished report to Rocky Flats Environmental Technology Site.

Ray, G. 2008. Habitat Equivalency Analysis: A potential tool for estimating environmental benefit. Engineer Research and Development Center (ERDC). ERDC TN-EMRRP-EI-02. Available at: http://el.erdc.usace.army.mil/elpubs/pdf/ei02.pdf.

Ryon, T.R. 1999. Travel distance and movement patterns of the Preble’s meadow jumping mouse (*Zapus hudsonius preblei*) at the Rocky flats Environmental Technology Site. Journal of Colorado-Wyoming Academy of Science 31:12.

Schorr, R.A. 2001. Meadow jumping mice (*Zapus hudsonius preblei*) on the U.S. Air Force Academy, El Paso County, Colorado. Colorado Natural Heritage Program unpublished report to the Natural Resources Branch, U.S. Air Force Academy. 55 pp.

Schorr, R.A. 2003. Meadow jumping mice (*Zapus hudsonius preblei*) on the U.S. Air Force Academy, El Paso County, Colorado: Populations, Movement and Habitat from 2000-2002. Colorado Natural Heritage Program unpublished report to the Natural Resources Branch, U.S. Air Force Academy. 25 pp.

Service (U.S. Fish and Wildlife Service). 1980. Ecological Services Manual; Habitat as a basis for environmental assessment. 101 ESM. September 15.

Service (U.S. Fish and Wildlife Service). 2002. Birds of conservation concern 2002. Division of Migratory Bird Management. Arlington, VA. 99 pp.

Service (U.S. Fish and Wildlife Service). 2003. Draft Preble's meadow jumping mouse *(Zapus hudsonius preblei)* recovery plan, Colorado. Region 6, Lakewood, CO.

Shenk, T.M. 1999. Preble's meadow jumping mouse conservation. Colorado Division of Wildlife Federal Aid Report WP-0662-T-1, Fort Collins, USA.

Shenk, T.M. and J.T. Eussen. 1999. Habitat use and distribution of Preble's meadow jumping mouse *(Zapus hudsonius preblei)* in Larimer and Weld counties, Colorado. Quarterly Report, January – March 1999, CDOW. Denver, CO.

Shenk, T.M. and M.M. Sivert. 1999a. Temporal and spatial variation in the demography of Preble's meadow jumping mouse (*Zapus hudsonius preblei*). Unpublished report of the Colorado Division of Wildlife.

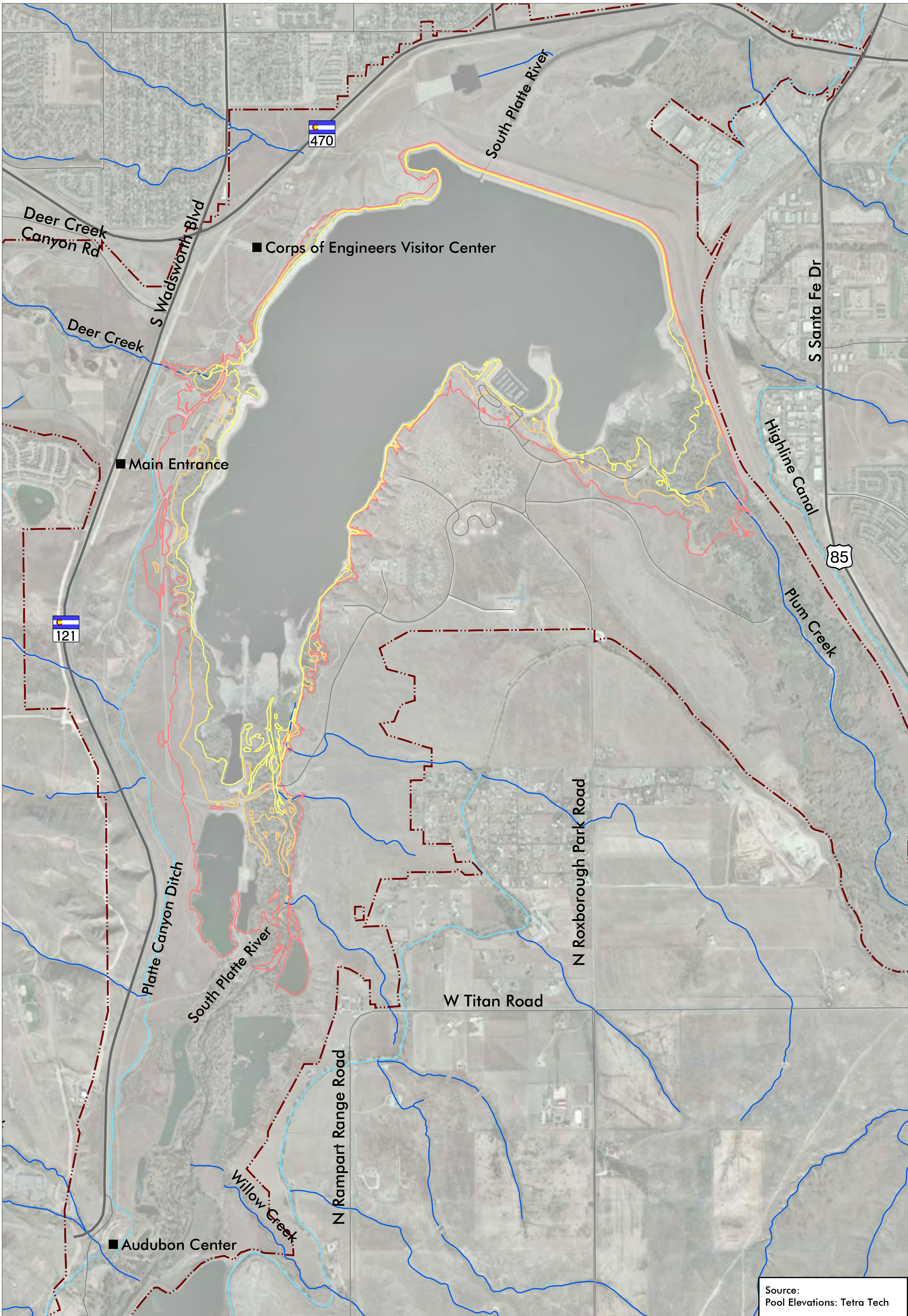
Shenk, T.M. and M.M. Sivert. 1999b. Movement patterns of Preble's meadow jumping mouse (*Zapus hudsonius preblei*) as they vary across time and space. Unpublished report of the Colorado Division of Wildlife.

Szaro, R.C. 1980. Factors influencing bird populations in southwestern riparian forests. pp. 403-418 in Workshop proceedings: management of western forests and grasslands for nongame birds (R.M. DeGraaf, tech coord.). USDA, Forest Service. General Technical Report INT-86.

Trainor. A.M., T.M. Shenk, and K.R. Wilson. 2007. Microhabitat of Preble's Meadow Jumping Mouse High Use Areas. Journal of Wildlife Management 71(2):469–477.

U.S. Geological Survey (USGS). 2008. Available at: http://www.mbr-pwrc.usgs.gov/cbc/cbcnew.html. Last accessed: Accessed December 2008.

List of Appendices and Figures



Chatfield Reallocation Study

Chatfield State Park
Stream
5432 Pool Elevation
Ditch
5437 Pool Elevation
5444 Pool Elevation

0 1,000 2,000 feet
1 inch = 2,000 feet
N

Figure 1

File: 4048 Figure 1.mxd (GS)
December 18, 2009

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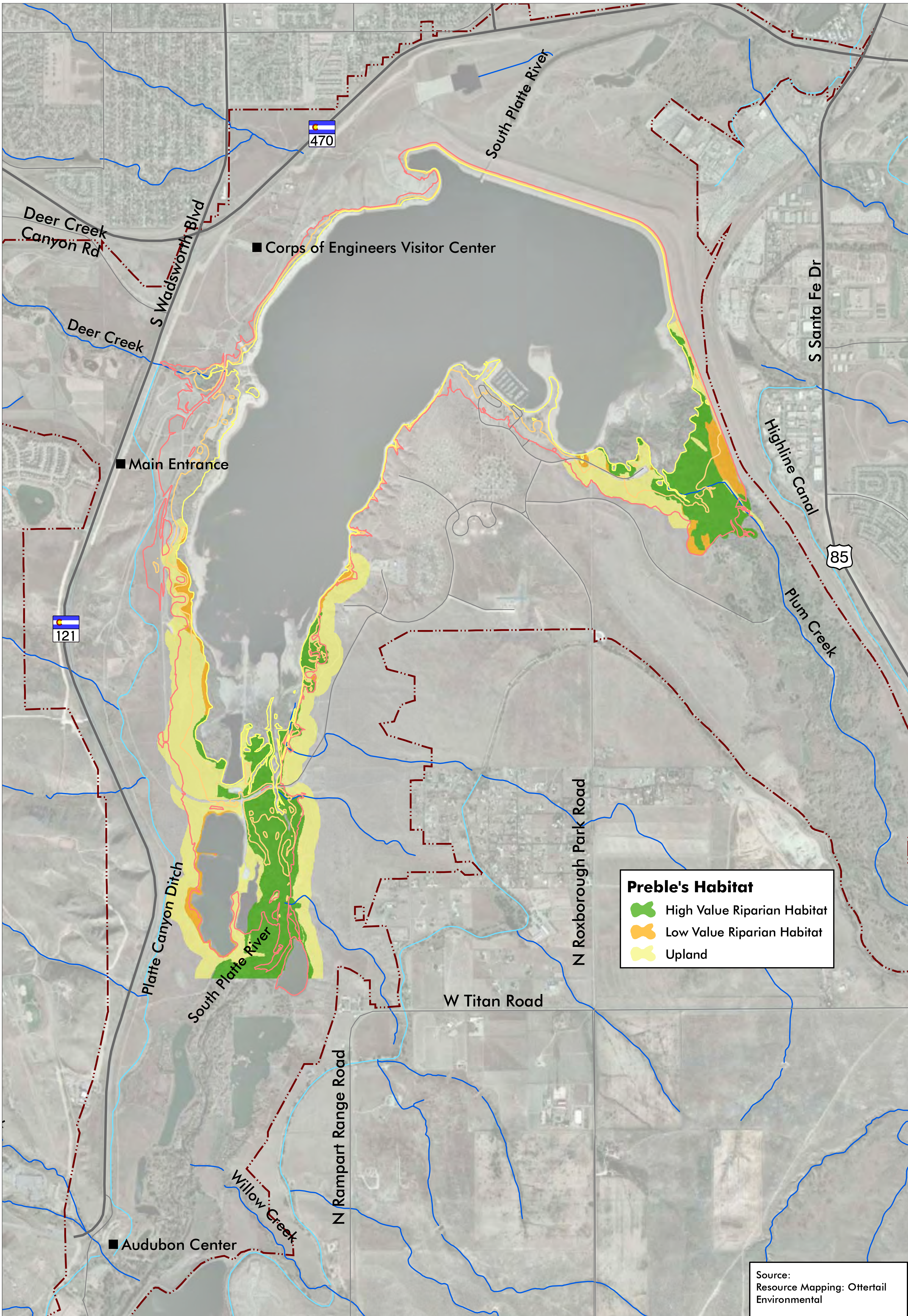
ERO Resources Corp.



Chatfield Reallocation Study

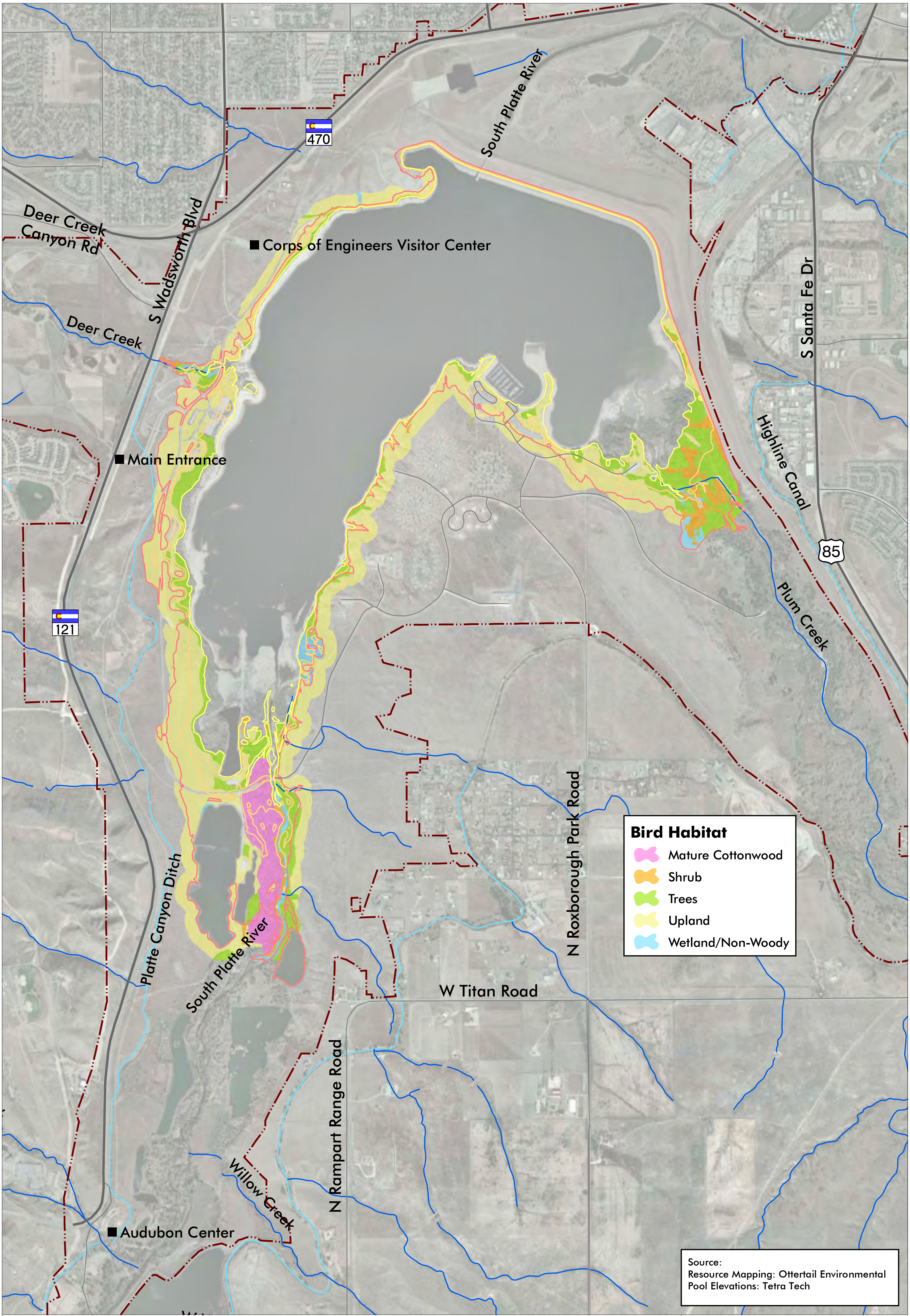
Chatfield State Park
5432 Pool Elevation
5437 Pool Elevation
5444 Pool Elevation
Stream
Ditch

0 1,000 2,000 feet
1 inch = 2,000 feet
N

Figure 3
Preble's Habitat

File: 4048 - Figure 3 PMJM.mxd (GS)
December 18, 2009

ERO Resources Corp.



Chatfield Reallocation Study

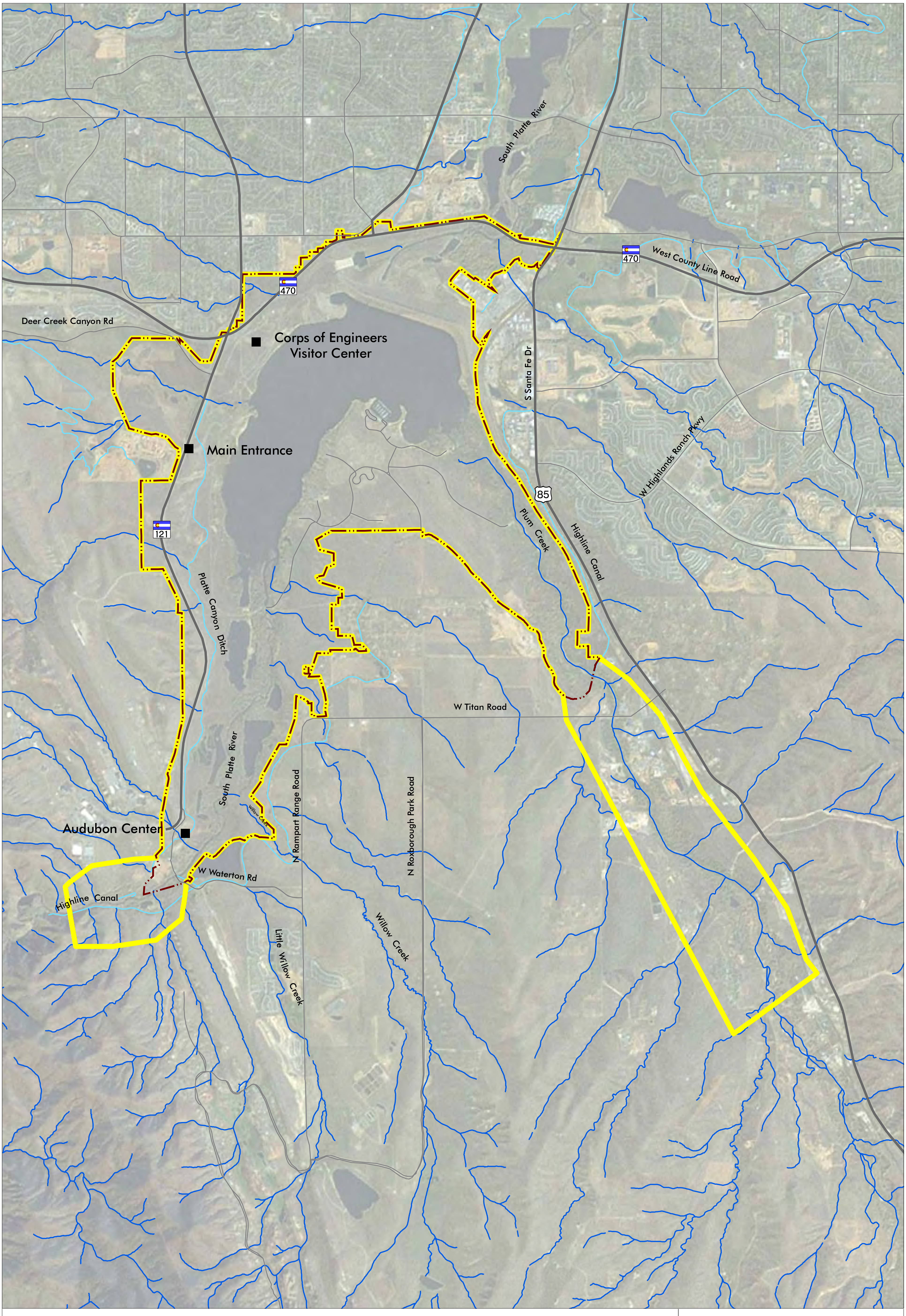
Chatfield State Park
Stream
5432 Pool Elevation
Ditch
5437 Pool Elevation
5444 Pool Elevation

0 1,000 2,000 feet
1 inch = 2,000 feet
N

Figure 4
Bird Habitat

File: 4048 - Figure 4 bird.mxd (GS)
December 18, 2009

ERO
ERO Resources Corp.



Chatfield Reallocation Study

- Chatfield State Park
- Boundary of Limited Habitat
- Stream
- Ditch

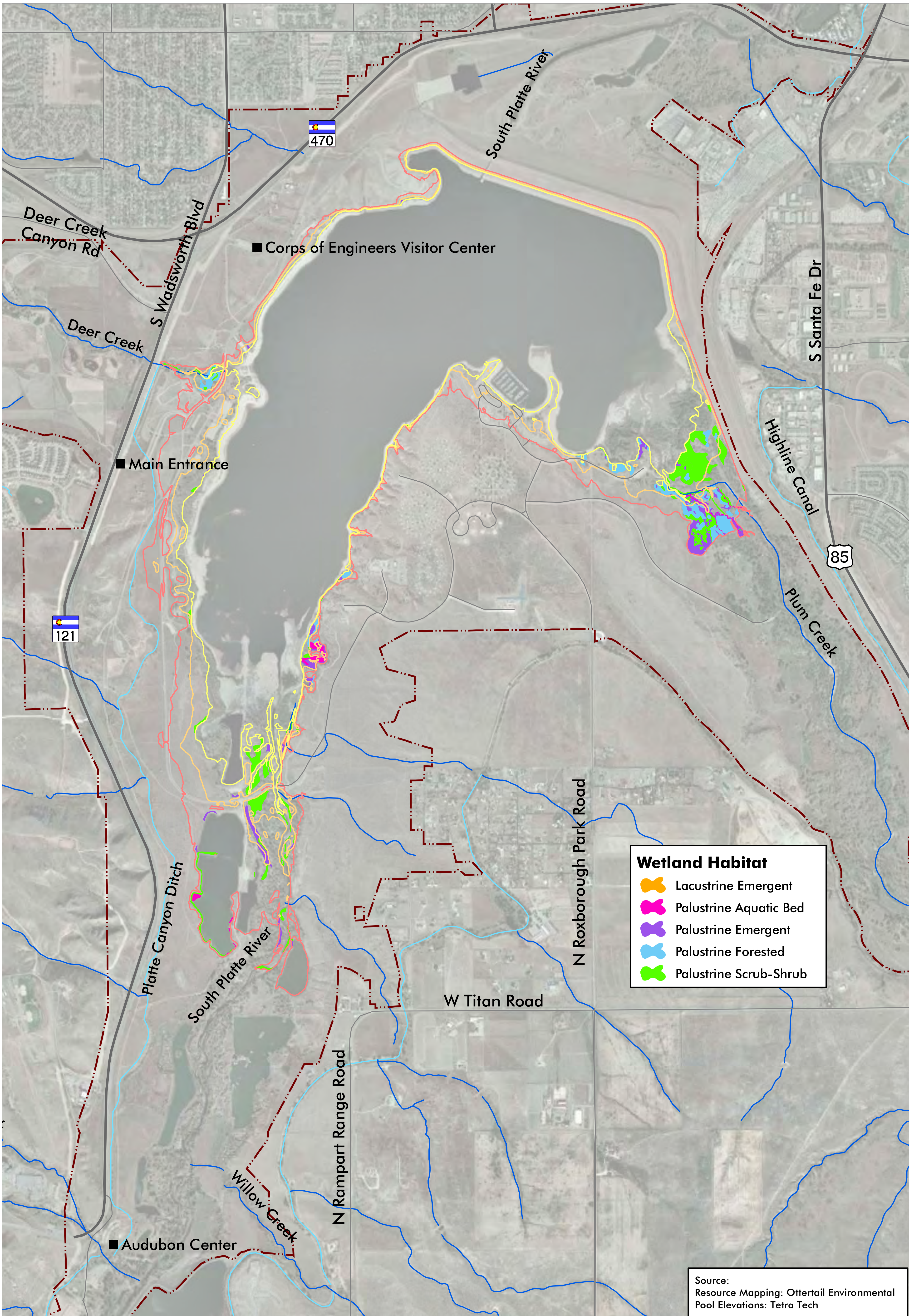
0 2,000 4,000 feet
1 inch = 4,000 feet

N

Figure 5
Bird Ecological Functions
Boundary of Limited Habitat
Assessment Area

File: 4048 -Figure 5 Bird Limited.mxd (GS)
December 18, 2009

ERO
ERO Resources Corp.



Chatfield Reallocation Study

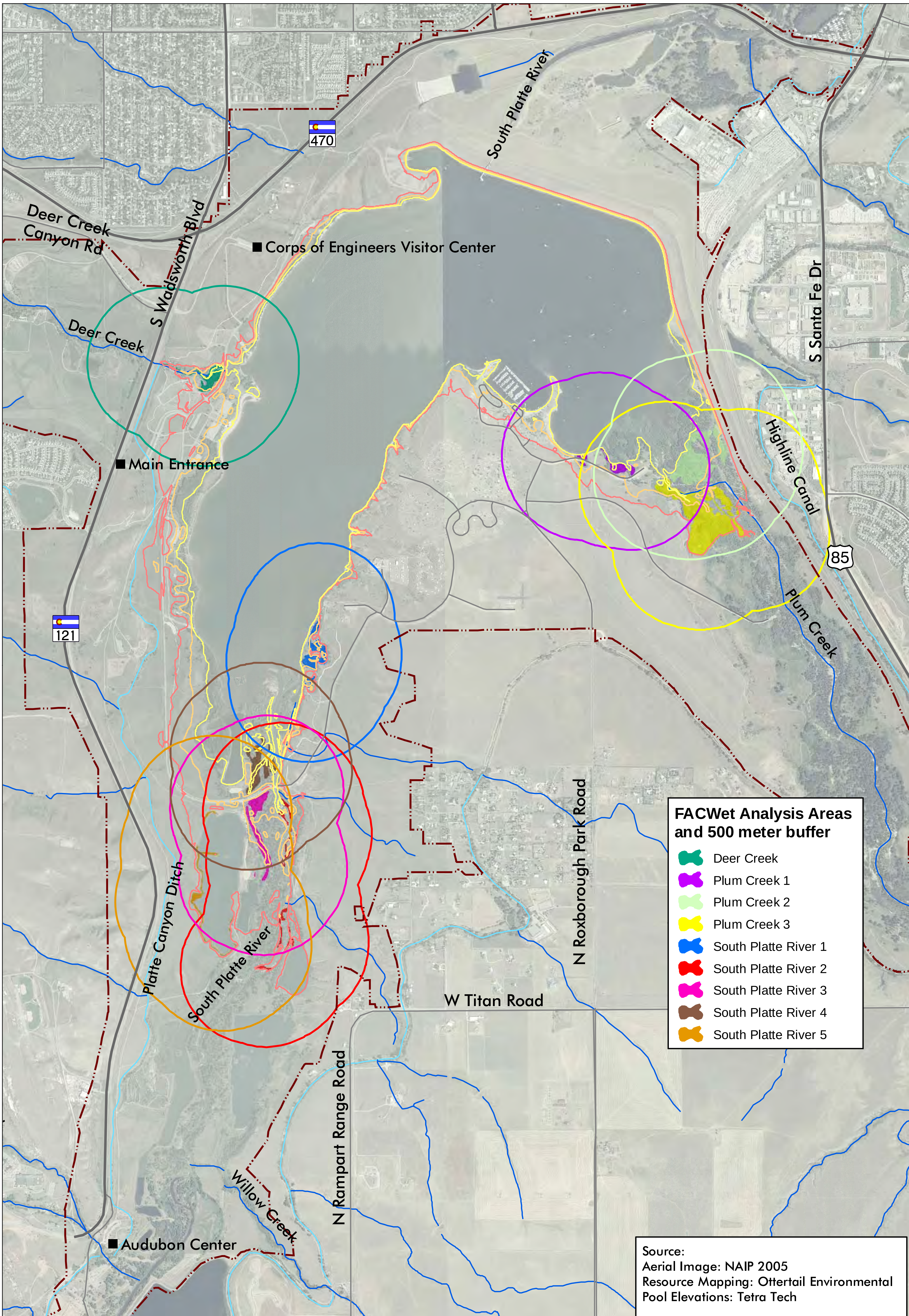
Chatfield State Park
5432 Pool Elevation
5437 Pool Elevation
5444 Pool Elevation
Stream
Ditch

0 1,000 2,000 feet
1 inch = 2,000 feet
N

Figure 6
Wetland Habitat

File: 4048 - Figure 6 Wetland.mxd (GS)
December 18, 2009

ERO
ERO Resources Corp.



Wetland Functional Assessment - Chatfield Reallocation Study

Chatfield State Park
5432 Pool Elevation
5437 Pool Elevation
5444 Pool Elevation
Stream
Ditch

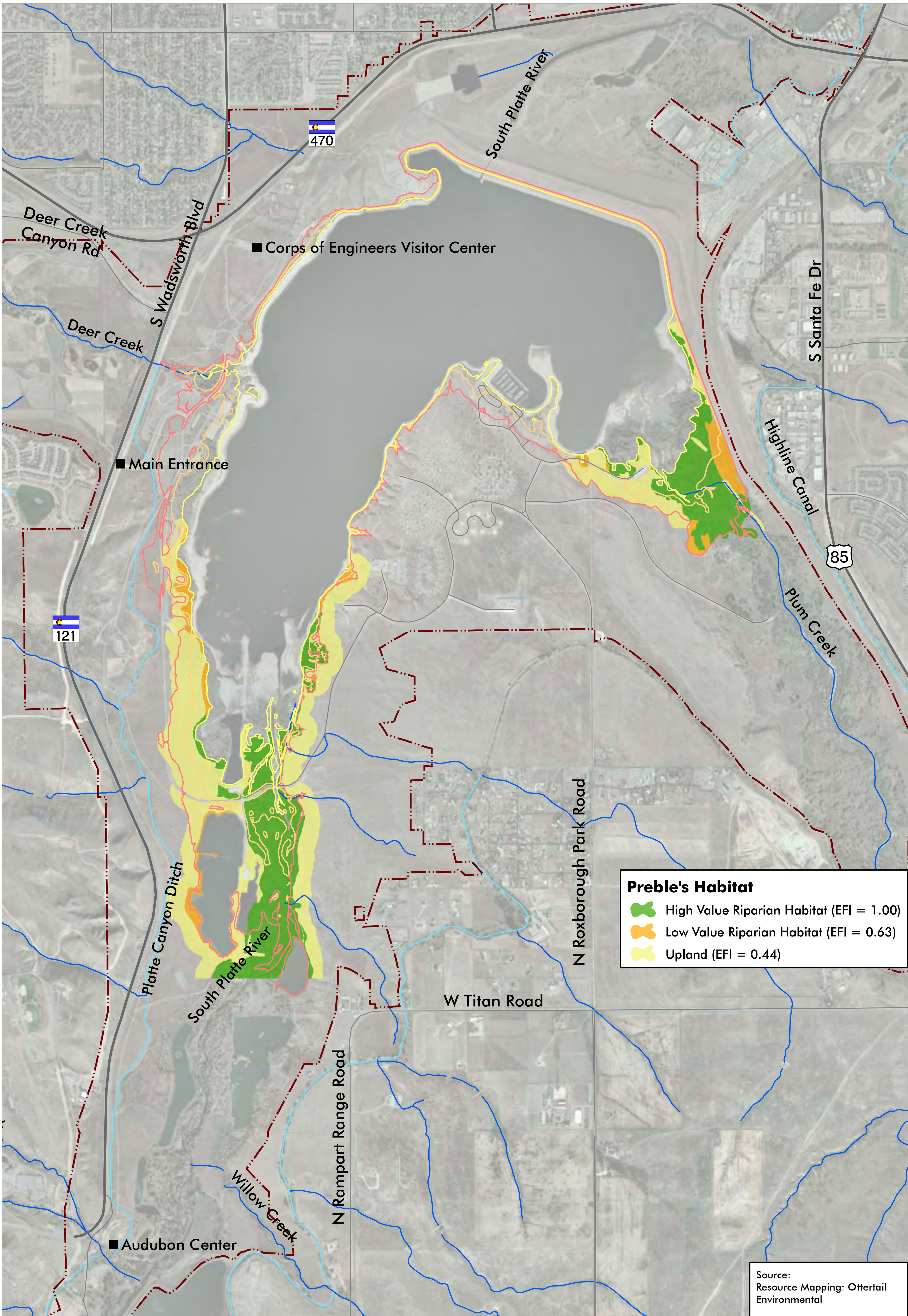
0 1,000 2,000 Feet

N

Figure 7
Overview of Assessment Areas

File: 4048 - Fig 7 FACwet OV.mxd (GS)
December 18, 2009

ERO Resources Corp.



Chatfield Reallocation Study

- Chatfield State Park
- 5432 Pool Elevation
- 5437 Pool Elevation
- 5444 Pool Elevation
- Stream
- Ditch

0 1,000 2,000 feet

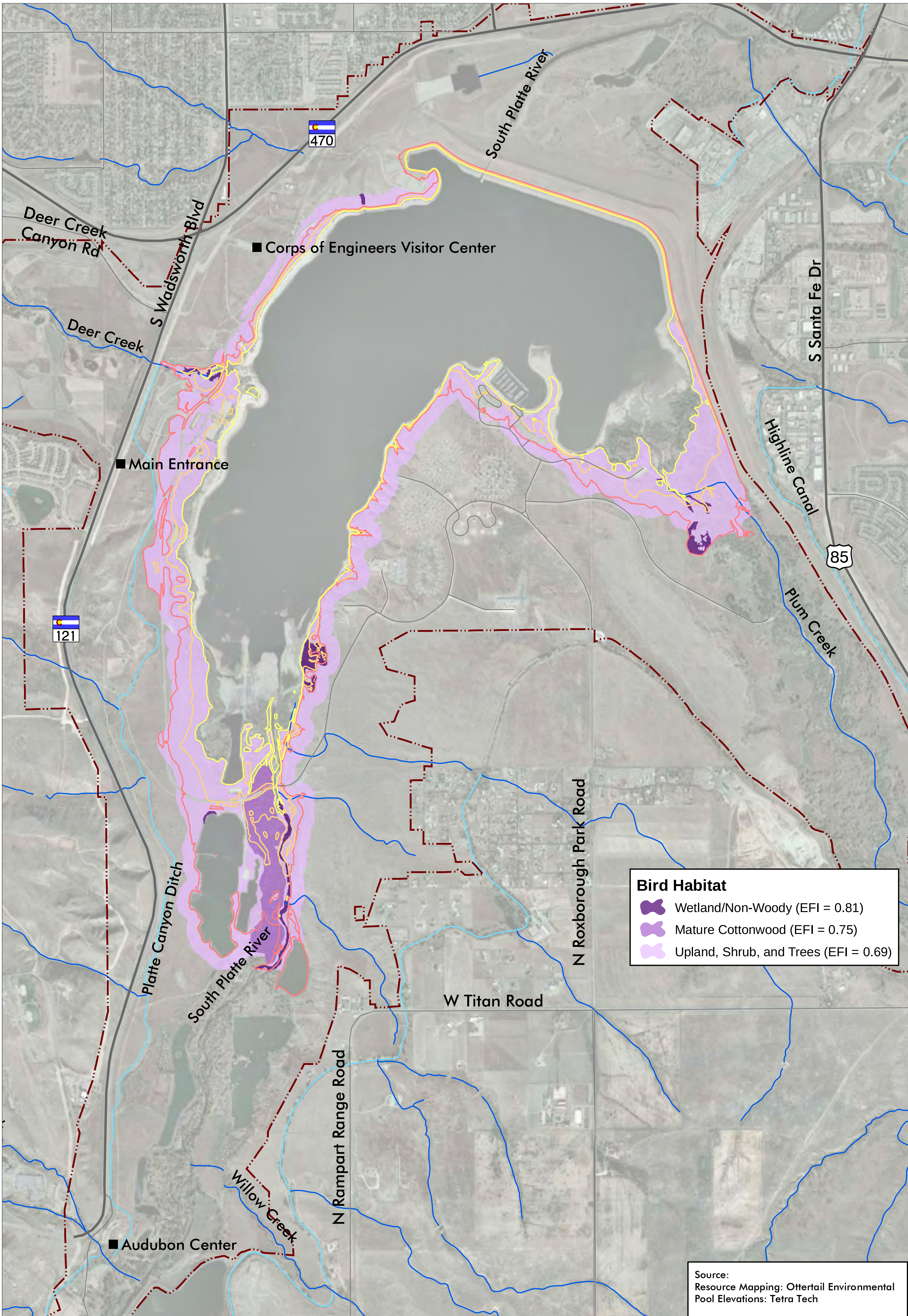
1 inch = 2,000 feet

N

Figure 8
Preble's Habitat and Ecological Function Index (EFI)

File: 4048 - Figure 8 PMJM EFI.mxd (GS)
December 18, 2009

ERO Resources Corp.



Chatfield Reallocation Study

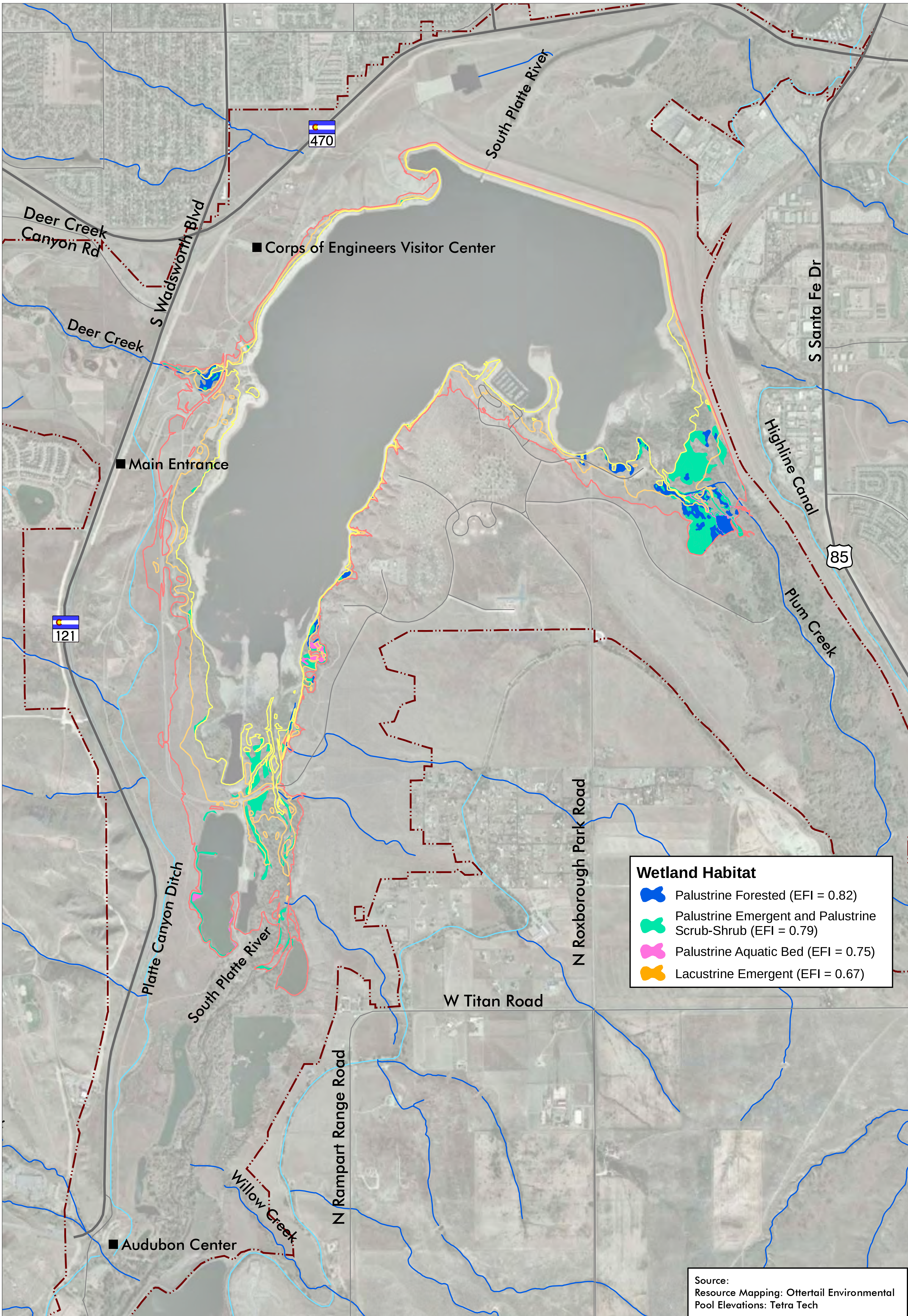
Chatfield State Park
5432 Pool Elevation
5437 Pool Elevation
5444 Pool Elevation
Stream
Ditch

0 1,000 2,000 feet
1 inch = 2,000 feet
N

Figure 9
Bird Habitat and Ecological Function Index (EFI)

File: 4048 - Figure 9 Bird EFI.mxd (GS)
December 18, 2009

ERO Resources Corp.



Chatfield Reallocation Study

- Chatfield State Park
- 5432 Pool Elevation
- 5437 Pool Elevation
- 5444 Pool Elevation
- Stream
- Ditch

0 1,000 2,000 feet
1 inch = 2,000 feet
N

Figure 10
Wetland Habitat and Ecological Function Index (EFI)

File: 4048 - Fig 10 Wetland EFI.mxd (GS)
December 18, 2009

ERO
ERO Resources Corp.

Appendix A - Standardizing Vegetation/Habitat Mapping

The first task of the EFA was to develop standardized habitat mapping for both on-site (within Chatfield State Park) and off-site areas. Initial habitat mapping for the three target resources was based on resource-specific mapping used in the FR/EIS. The upper limit of wetland mapping was the maximum proposed pool elevation of 5,444 feet (Figure 3). Preble's and bird habitat mapping extended approximately 50 feet above the maximum proposed pool elevation of 5,444 feet, but did not include all areas within Chatfield State Park or any off-site areas.

Mitigating impacts to the target resources from the proposed reallocation will involve a combination of on-site and off-site habitat creation, enhancement, and restoration and off-site habitat preservation. Effective mitigation will require standardized habitat mapping both within the new storage pool zone (between 5,432 and 5,444 feet) and within on-site and off-site mitigation sites. Extensive riparian mapping, based on satellite imagery, has been conducted in the entire South Platte River/Plum Creek watersheds by the Colorado Division of Wildlife (CDOW). Comparison of the Chatfield Reallocation habitat mapping and CDOW riparian mapping revealed considerable similarities between the two efforts. Standardizing CDOW riparian with Chatfield habitat mapping involved several steps:

1. Establish equivalencies between CDOW vegetation mapping categories and Chatfield vegetation and habitat mapping categories (Table 1).
2. Generate GIS overlay of expected overlap between site-specific Chatfield mapping categories and CDOW mapping categories for each of the target resources.
3. Correct inconsistencies.

Table A-1. Mapping category equivalencies between CDOW riparian mapping and Chatfield reallocation study target resource mapping.

CDOW Riparian Mapping Category (CDOW Map Code)	Chatfield Equivalent Habitat (Preble's)	Chatfield Equivalent Habitat (Wetlands)	Chatfield Equivalent Habitat (Birds)
Riparian Deciduous Trees			
Cottonwood (RT2)	High Value Riparian	Palustrine Forested	Mature Cottonwood
Riparian Shrubs			
General (RS)	High Value Riparian	Palustrine Scrub-Shrub	Wetland/Non-Woody
Willow (RS1)	High Value Riparian	Palustrine Scrub-Shrub, Palustrine Forested	Shrub
Riparian Herbaceous			
Cattails/Sedges/Rushes (with permanent standing water) (RH1)	Non-Habitat	Lacustrine Emergent	Wetland/Non-Woody
Sedges/Rushes/Mesic Grasses (waterlogged or moist soils) (RH2)	High Value Riparian	Palustrine Emergent	Wetland/Non-Woody
Other Riparian			
Unvegetated (NV)	Non-Habitat	Non-Habitat	Palustrine Aquatic Bed
Sandbar (SB)	Non-Habitat		Shoreline
Non-riparian			
Upland Grass (UG)	Upland		Upland
Irrigated Agriculture (AI, IA, IR)	Low Value Riparian		Upland

Data tables and GIS layers were created to correlate the similarities between habitat mapping of the target resources and CDOW riparian data. The data table and GIS mapping were verified with aerial photos to identify inconsistencies in the two mapping efforts and possible reasons for the inconsistencies. Most inconsistencies were related to the different dates of aerial photo/satellite imagery used for the two mapping efforts. Many areas identified as wetlands in the earlier CDOW mapping had developed into riparian shrublands at the time of the Chatfield Reallocation mapping. Once inconsistencies were reconciled, the correlation between FR/EIS mapping and CDOW riparian mapping was 95 percent for Preble's, 78 percent for birds, and 74 percent for wetlands.

Appendix B – Functional Assessment Committee Members

Chatfield Reallocation FR/EIS Functional Assessment Committee

The following people participated in person or via teleconference in one or more meetings to develop a functional approach to impact assessment for the Chatfield Reallocation FR/EIS.

Eric Laux – U.S. Army Corp of Engineers (Corps)
Betty Peake – Corps
Karen Sitoski – Corps
Scott Franklin – Corps
David Klute – Colorado Division of Wildlife (CDOW)
Tina Jackson – CDOW
Pete Plage – U.S. Fish and Wildlife Service
Cecily Mui – South Suburban Park and Recreation District/South Platte Park
Ann Bonnell – Audubon Society of Greater Denver/South Platte Group of the Sierra Club
Mike Mueller – Sierra Club
Ray Sperger - Chatfield Basin Conservation Network
Brooke Fox – Chatfield Basin Conservation Network
Tom Ryon – Ottertail Environmental
Rick McLoud – Centennial Water and Sanitation District
Steve Dougherty – ERO Resources Corp. (ERO)
Ron Beane – ERO
Jana Pederson – ERO
Mary L. Powell – ERO

Appendix C – FR/EIS Bird Point Counts

FR/EIS Bird Point Counts

Introduction

At the request of USFWS, biologists conducted point count surveys (50-meter radius) in three types of riparian habitats in June 2006. This information was used to better characterize breeding birds in riparian areas likely to be affected by the proposed project including herbaceous wetlands/non-woody areas, riparian shrublands, and cottonwood forest. Twelve point count stations (50-meter radius) were established in these three habitat types; each type having four stations each. Wetland/Non-woody areas included herbaceous wetlands, mudflats, and backwaters that were associated with riparian areas. Riparian shrublands included areas dominated by sandbar willow. Tree dominated areas included successional and mature forest types. Successional forest types included cottonwood, box elder, and narrow-leaf cottonwood forests that are even aged or simply smaller in stature. Mature forest types were comprised of large cottonwood trees that represent mature bottomland forest. The mature forests are restricted to areas along the South Platte River. Results of these point counts are provided below.

Appendix D – Bird Point Counts and Abundance Tables

Chatfield Migratory Bird Point Counts - 2006

Site: CHATB01 Habitat: Wetland
Start Time: 06:55 End Time: 07:10
Date: 6/20/06 Visit No: 1
Notes: NOFL and HOWR are calling only

	AMCR	AMGO	AMRE	AMRO	BASW	BBMA	BCCH	BEKI	BHCO	BGGN	BRBB	BTHU	BUOR	CAGO	CLSW	COFL	COSN	COYT	DCCO	DOWO	GBHE	GHOW	GRAC	GRCA	HOWR
<25 meters:																									
>25 meters:				1				1																	1
Total (n)	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
n-1	-1	-1	-1	0	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
n(n-1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Site: CHATB02 Habitat: Wetland
Start Time: 07:27 End Time: 07:42
Date: 6/20/06 Visit No: 1

	AMCR	AMGO	AMRE	AMRO	BASW	BBMA	BCCH	BEKI	BHCO	BGGN	BRBB	BTHU	BUOR	CAGO	CLSW	COFL	COSN	COYT	DCCO	DOWO	GBHE	GHOW	GRAC	GRCA	HOWR
<25 meters:																									
>25 meters:	1					3																			
Total (n)	1	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
n-1	0	-1	-1	-1	-1	2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
n(n-1)	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Site: CHATB03 Habitat: Shrub
Start Time: 08:10 End Time: 08:25
Date: 6/20/06 Visit No: 1
Notes: BTHU are females;
YBCH - heard near bridge

	AMCR	AMGO	AMRE	AMRO	BASW	BBMA	BCCH	BEKI	BHCO	BGGN	BRBB	BTHU	BUOR	CAGO	CLSW	COFL	COSN	COYT	DCCO	DOWO	GBHE	GHOW	GRAC	GRCA	HOWR
<25 meters:									1			2													2
>25 meters:		1																							
Total (n)	0	1	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
n-1	-1	0	-1	-1	-1	-1	-1	-1	0	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1
n(n-1)	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2

Site: CHATB04 Habitat: Tree
Start Time: 08:40 End Time: 08:55
Date: 6/20/06 Visit No: 1
Notes: NOFL, MODO, AMGO, REVI are
calling; ?'s next to BTHU and REVI

	AMCR	AMGO	AMRE	AMRO	BASW	BBMA	BCCH	BEKI	BHCO	BGGN	BRBB	BTHU	BUOR	CAGO	CLSW	COFL	COSN	COYT	DCCO	DOWO	GBHE	GHOW	GRAC	GRCA	HOWR
<25 meters:												1													2
>25 meters:		1																							
Total (n)	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
n-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1
n(n-1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2

Site: CHATB05 Habitat: Tree
Start Time: 09:08 End Time: 09:23
Date: 6/20/06 Visit No: 1

	AMCR	AMGO	AMRE	AMRO	BASW	BBMA	BCCH	BEKI	BHCO	BGGN	BRBB	BTHU	BUOR	CAGO	CLSW	COFL	COSN	COYT	DCCO	DOWO	GBHE	GHOW	GRAC	GRCA	HOWR
<25 meters:												2	1												4
>25 meters:							1						1												4
Total (n)	0	0	0	0	0	0	1	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	8
n-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	7
n(n-1)	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	56

Site: CHATB06 Habitat: Shrub
Start Time: 09:34 End Time: 09:49
Date: 6/20/06 Visit No: 1
Notes: ? Next to >25 meters for BTHU

	AMCR	AMGO	AMRE	AMRO	BASW	BBMA	BCCH	BEKI	BHCO	BGGN	BRBB	BTHU	BUOR	CAGO	CLSW	COFL	COSN	COYT	DCCO	DOWO	GBHE	GHOW	GRAC	GRCA	HOWR
<25 meters:				1								2													
>25 meters:		1		2		1						1													
Total (n)	0	1	0	3	0	1	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
n-1	-1	0	-1	2	-1	0	-1	-1	-1	-1	-1	2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
n(n-1)	0	0	0	6	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0

Site: CHATB07 Habitat: Tree
Start Time: 09:45 End Time: 10:00
Date: 6/20/06 Visit No: 1
Notes: Reed Canary Grass, Canada Thistle

	AMCR	AMGO	AMRE	AMRO	BASW	BBMA	BCCH	BEKI	BHCO	BGGN	BRBB	BTHU	BUOR	CAGO	CLSW	COFL	COSN	COYT	DCCO	DOWO	GBHE	GHOW	GRAC	GRCA	HOWR
<25 meters:																				1					
>25 meters:																								1	
Total (n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
n-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	0	-1
n(n-1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Site: CHATB08 Habitat: Tree
Start Time: 09:15 End Time: 9:30
Date: 6/20/06 Visit No: 1

	AMCR	AMGO	AMRE	AMRO	BASW	BBMA	BCCH	BEKI	BHCO	BGGN	BRBB	BTHU	BUOR	CAGO	CLSW	COFL	COSN	COYT	DCCO	DOWO	GBHE	GHOW	GRAC	GRCA	HOWR
<25 meters:												1													1
>25 meters:																									
Total (n)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
n-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
n(n-1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: Cottonwood

Site: CHATB09 Habitat: Shrub	**<25 meters:**				1																					1
Start Time: 08:35 End Time: 8:50	**>25 meters:**				1			1				1										1				1
	Total (n)	0	0	0	2	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	2
	n-1	-1	-1	-1	1	-1	-1	0	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	1
Date: 6/20/06 Visit No: 1	**n(n-1)**	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Notes: dry willows along old channel; weedy species																										
Site: CHATB10 Habitat: Willow Shrub	**<25 meters:**		1		1																					
Start Time: 08:10 End Time: 8:25	**>25 meters:**				1																					2
	Total (n)	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	n-1	-1	0	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1
Date: 6/20/06 Visit No: 1	**n(n-1)**	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Notes: willow shrubs along old channel; grasses - rush surrounded by trees																										
Site: CHATB11 Habitat: Wetland	**<25 meters:**																								1	
Start Time: 07:30 End Time: 7:45	**>25 meters:**											1														
	Total (n)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	n-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1
Date: 6/20/06 Visit No: 1	**n(n-1)**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes: Reed canary grass and some shrubs/ sm. Trees, opening in forest, canada thistle and stinging needle. Uak Hammer(?) gathering cattail fluff																										
Site: CHATB12 Habitat: Wetland	**<25 meters:**																		1							
Start Time: 07:05 End Time: 7:20	**>25 meters:**		1		1	1					1		1												2	1
	Total (n)	0	1	0	1	1	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	2	1
	n-1	-1	0	-1	0	0	-1	-1	-1	-1	0	-1	0	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	1	0
Date: 6/20/06 Visit No: 1	**n(n-1)**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
Notes: Reed canary grass and few shrubs																										
	Species N	1	5	0	9	1	4	2	1	1	1	2	10	2	0	0	0	0	1	0	1	1	0	0	4	19
Observed in Tree		0	1	0	0	0	0	1	0	0	0	0	4	2	0	0	0	0	0	0	1	0	0	0	1	11
Observed in Shrub		0	3	0	7	0	1	1	0	1	0	1	5	0	0	0	0	0	0	0	0	1	0	0	0	6
Observed in Wet		1	1	0	2	1	3	0	1	0	1	1	1	0	0	0	0	0	1	0	0	0	0	0	3	2

KILL	LEFL	MALL	MODO	NOFL	REVI	RWBL	SAPH	SOSP	SPSA	SPTO	STAR	TRSW	Uak Hammer	Un Sparrow	WAVE	WBNU	WHPE	WIFL	WWPE	YBCH	YEWA	SubTotal	Total N	Spp Rich	Sumn(n-1)	Simpson's
																		1			1	2				
1				1		1														1		7	9			
1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1		9	9		
0	-1	-1	-1	0	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0	0					
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				0	0
2						1			1													4				
				2		5						1									2	14	18			
2	0	0	0	2	0	6	0	0	1	0	0	1	0	0	0	0	0	0	0	0	2		18	8		
1	-1	-1	-1	1	-1	5	-1	-1	0	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	1					
2	0	0	0	2	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2				42	0.137255
																					3	8				
	l			1																1		3	11			
0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3		11	7		
-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	2					
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6				10	0.090909
	1				1														1	2	1	9				
			1	1																		3	12			
0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1		12	10		
-1	0	-1	0	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	1	0					
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0				4	0.030303
				1																	1	9				
				1															1	1		9	18			
0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1		18	8		
-1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0					
0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				62	0.202614
	1			1						1						2				1	2	11				
			1	1																		7	18			
0	1	0	1	2	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	1	2		18	11		
-1	0	-1	0	1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	1	-1	-1	-1	0	1					
0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2				18	0.058824
																					1	2				
								1												1	2	5	7			
0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	3		7	5		
-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	2					
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6				6	0.142857
								1													1	4				
			2																		2	4	8			
0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3		8	5		
-1	-1	-1	1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	2					
0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6				8	0.142857

																					2	4				
			1	1																1	1	9	13			
0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3		13	9		
-1	-1	-1	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	2					
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6				10	0.064103
																					2	4				
																					1	4	8			
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3		8	4		
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	2					
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6				10	0.178571
													1								2	4				
																			1	1	1	4	8			
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	3		8	6		
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	0	0	2					
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6				6	0.107143
																				1		2				
							1			1										1	3	14	16			
0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	2	3		16	12		
-1	-1	-1	-1	-1	-1	-1	0	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	2					
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6				10	0.041667
3	2	0	5	10	1	7	1	2	1	2	0	1	1	0	0	2	0	1	3	11	28	0	146			
0	1	0	3	3	1	0	0	2	0	0	0	0	0	0	0	0	0	0	2	4	8					
0	1	0	2	4	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	3	11					
3	0	0	0	3	0	7	1	0	1	1	0	1	1	0	0	0	0	1	1	4	9					

Chatfield Migratory Bird Point Counts - 2006

		AMCR	AMGO	AMRE	AMRO	BASW	BBMA	BCCH	BEKI	BHCO	BGGN	BRBB	BTHU	BUOR	CAGO	CLSW	COFL	COSN	COYT	DCCO	DOWO	GBHE	GHOW	GRAC	GRCA
		AMCR	AMGO		AMRO	BASW	BBMA	BCCH	BEKI	BHCO	BGGN	BRBB	BTHU	BUOR		CLSW			COYT	DCCO	DOWO	GBHE			
Site: CHATB01 Habitat: Wetland	<25 meters:																								
Start Time: 09:45 End Time: 10:00	>25 meters:		1																			1			
	Total (n)	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	n-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1
Date: 6/26/06 Visit No: 2	n(n-1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes: Site totally inundated reservoir water level rose																									
Site: CHATB02 Habitat: wetland	<25 meters:																								
Start Time: 09:20 End Time: 09:35	>25 meters:									2						2									
	Total (n)	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
	n-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-1	-1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Date: 6/27/06 Visit No: 2	n(n-1)	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
Notes: mudflat at beaver pond with bull rush cattils, rush, carex, swamp milkweed, some open water, many frogs - leopard																									
Site: CHATB03 Habitat: Shrub	<25 meters:		1										1												
Start Time: 08:35 End Time: 08:50	>25 meters:																								
	Total (n)	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	n-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Date: 6/27/06 Visit No: 2	n(n-1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes: plants: thick willow w/ site surrounded by NL and Plains cottonwoods but not mature trees, understory includes hemlock, canada thistle, cyncafil, virgninia creeper, and roa (?)																									
Site: CHATB04 Habitat: Tree	<25 meters:										1														
Start Time: 08:00 End Time: 08:15	>25 meters:		1		1																				
	Total (n)	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n-1	-1	0	-1	0	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Date: 6/27/06 Visit No: 2	n(n-1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes: many lg cottonwoods; box elder and NL cottonwoods - understory, wheat grass, canada thistle, snowberry, hemlock *BGGN had ?'s by it																									
Site: CHATB05 Habitat: Tree	<25 meters:																								
Start Time: 07:20 End Time: 07:35	>25 meters:				1																		1		
	Total (n)	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	n-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1
Date: 6/27/06 Visit No: 2	n(n-1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes: KIFI and WAVE btwn transects Plants: many lg mature cottonwoods, wheat grass, leafy spurge, snowberry, sm cottonwood saplings																									
Site: CHATB06 Habitat: Shrub	<25 meters:		1																						
Start Time: 06:55 End Time: 07:10	>25 meters:				1																				1
	Total (n)	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	n-1	-1	0	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
Date: 6/27/06 Visit No: 2	n(n-1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes: Plants: Hops, Plum, NL-Cottonwood, J Browne (?), Willows, Snowberry, p. ivy, L. spurge Un Sparrow-white fringe on tail feathers																									
Site: CHATB07 Habitat: Tree	<25 meters:																								
Start Time: 06:51 End Time:	>25 meters:		1												1										
	Total (n)	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	n-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Date: 6/27/06 Visit No: 2	n(n-1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site: CHATB08 Habitat: Tree	<25 meters:												2												
Start Time: 07:20 End Time: 07:35	>25 meters:		1												2										
	Total (n)	0	1	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0
	n-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Date: 6/27/06 Visit No: 2	n(n-1)	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0
Notes: CAGO and MALL are calling only																									
Site: CHATB09 Habitat: Willow Shrub	<25 meters:				1					8															
Start Time: 07:50 End Time: 08:05	>25 meters:									2															
	Total (n)	0	0	0	1	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n-1	-1	-1	-1	0	-1	-1	-1	-1	9	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Date: 6/27/06 Visit No: 2	n(n-1)	0	0	0	0	0	0	0	0	90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: NOWR in tree cavity; SOSP probable

Site: CHATB10 Habitat: Shrub
Start Time: 08:21 End Time: 08:36
Date: 6/27/06 Visit No: 2
Notes: BHCO is female

<25 meters:		4							1															
>25 meters:				1																			1	
Total (n)	0	4	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
n-1	-1	3	-1	0	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1
n(n-1)	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Site: CHATB11 Habitat: Wetland
Start Time: 09:08 End Time: 09:23
Date: 6/27/06 Visit No: 2

<25 meters:				1																				1
>25 meters:				1					2															
Total (n)	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
n-1	-1	-1	-1	1	-1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
n(n-1)	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Site: CHATB12 Habitat: Wetland
Start Time: 07:05 End Time: 7:20
Date: 6/26/06 Visit No: 2
Notes: AMRE ? Check song - calling only; COYE is yellow throat. Blue Grosbeak pair en route to site - near enclosure, Lark Sparrow pair en route from site near parking lot

<25 meters:				1								2						2						2
>25 meters:																								
Total (n)	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	2
n-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	1	-1	-1	-1	-1	-1	1	-1	-1	-1	-1	-1	1
n(n-1)	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	2

Species N	0	10	0	8	0	0	0	0	15	1	0	5	0	3	2	0	0	2	0	0	1	1	1	4
Observed in Tree	0	3	0	2	0	0	0	0	0	1	0	2	0	3	0	0	0	0	0	0	0	1	0	0
Observed in Shrub	0	6	0	3	0	0	0	0	11	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1
Observed in Wet	0	1	0	3	0	0	0	0	4	0	0	2	0	0	2	0	0	2	0	0	1	0	0	3

HOWR	KILL	LEFL	MALL	MODO	NOFL	REVI	RWBL	SAPH	SOSP	SPSA	SPTO	STAR	TRSW	Uak Hammer	Un Sparrow	WAVE	WBNU	WHPE	WIFL	WWPE	YBCH	YEWA					
HOWR	KILL	LEFL	MALL	MODO	NOFL	REVI	RWBL	SAPH	SOSP	SPSA	SPTO		TRSW	Uak Hammer			WBNU		WIFL	WWPE	YBCH	YEWA	SubTotal	Total N	Spp Rich	Sumn(n-1)	
																							0				
																		1					3	3			
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0		3	3		
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1					
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				0	0
	3						1			1													5				
	3						1		1	1											1		11	16			
0	6	0	0	0	0	0	2	0	1	2	0	0	0	0	0	0	0	0	0	0	1	0		16	7		
-1	5	-1	-1	-1	-1	-1	1	-1	0	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1					
0	30	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0				38	0.158333
4																	1					3	10				
1				2	1												1			1	1	1	8	18			
5	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	1	4		18	9		
4	-1	-1	-1	1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-1	-1	0	0	3					
20	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	12				36	0.117647
3																1					1	2	8				
1				2																	1	2	8	16			
4	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	4		16	8		
3	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	1	3					
12	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	12				28	0.116667
3																						2	5				
3				1																		2	8	13			
6	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4		13	5		
5	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	3					
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12				42	0.269231
2															2					1		2	8				
2																					1	4	9	17			
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	1	6		17	8		
3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-1	-1	-1	-1	0	0	5					
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	30				44	0.161765
																							0				
							1				1										2	1	7	7			
0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	2	1		7	6		
-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	0					
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0				2	0.047619
2																						2	6				
			1																		1		5	11			
2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2		11	7		
1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	1					
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2				8	0.072727
1																							10				
									1												1		4	14			
1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0		14	5		
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0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				90	0.494505

2									1											1		2	11					
				1	1															1			5		16			
2	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	2		16		10		
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2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2					18	0.075
												1									2	1	6					
				1																			4		10			
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																							7					
																						2	2		9			
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0	6	0	0	1	0	0	2	0	1	2	0	1	0	0	0	0	0	1	0	0	3	3						

Raw Data

Species	AMCR	AMGO	AMRE	AMRO	BASW	BBMA	BCCH	BEKI	BHCO	BGGN	BRBB	BTHU	BUOR	CAGO	CLSW	COSN
Session 1 N	1	5	0	9	1	4	2	1	1	1	2	10	2	0	0	0
Session 2 N	0	10	1	8	0	0	0	0	15	1	0	5	0	3	2	0
Obs in Tree	-	4	-	2	-	-	1	-	-	1	-	4	1	2	-	-
Obs in Shrub	-	5	-	6	-	1	1	-	3	-	1	3	-	-	-	-
Obs in Wet	1	2	1	4	1	1	-	1	2	1	1	2	-	-	1	-

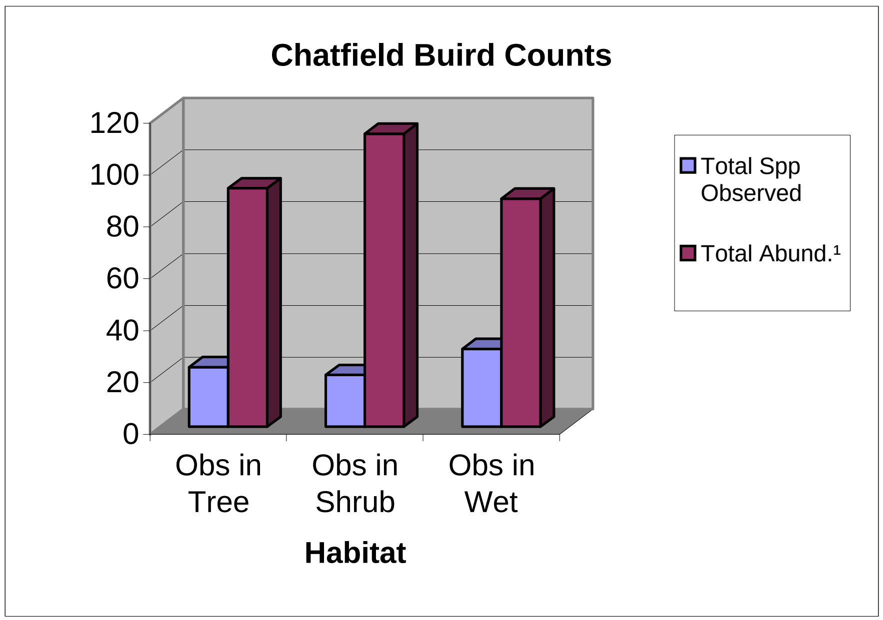
Raw Data

Species	AMCR	AMGO	AMRE	AMRO	BASW	BBMA	BCCH	BEKI	BHCO	BGGN	BRBB	BTHU	BUOR	CAGO	CLSW	COSN
Session 1 N	1	5		9	1	4	2	1	1	1	2	10	2			
Session 2 N		10		8					15	1		5		3	2	
Total	1	15		17	1	4	2	1	16	2	2	15	2	3	2	
Obs in Tree		4		2			1			1		6	2	3		
Obs in Shrub		9		10		1	1		12		1	6				
Obs in Wet	1	2		5	1	3		1	4	1	1	3			2	

	Total Spp Observed	Total Abund.[1]	# Species observed in single habitat
Obs in Tree	23	92	7
Obs in Shrub	20	113	2
Obs in Wet	30	88	12

[1] = Abundance per ha from TetraTech Table 3.3

	Abundance / (per ha)[1]
Obs in Tree	14.6
Obs in Shrub	18.3
Obs in Wet	14.2



Species in Single Habitat

Tree	Shrub	Wet
BUOR		BASW
DOWO		BEKI
GHOW		CLSW
REVI		COYT
WAVE		KILL
		SAPH
		SPSA
		TRSW
		WIFL
CAGO	GRAC	STAR
MALL	WBNU	WHPE
		AMCR

COYT	DCCO	DOWO	GBHE	GHOW	GRAC	GRCA	HOWR	KILL	LEFL	MALL	MODO	NOFL	REVI	RWBL	SAPH	SOSP	SPSA	SPTO
1	0	1	1	0	4	0	19	3	2	0	5	10	1	7	1	2	1	2
2	0	0	1	1	1	4	24	6	0	1	7	1	0	3	0	3	2	1
-	-	1	-	1	1	-	6	-	1	1	4	2	1	1	-	1	-	1
-	-	-	1	-	1	1	7	-	1	-	4	4	-	-	-	3	-	1
2	-	-	1	-	2	2	2	3	-	-	1	2	-	3	1	1	2	1

COYT	DCCO	DOWO	GBHE	GHOW	GRAC	GRCA	HOWR	KILL	LEFL	MALL	MODO	NOFL	REVI	RWBL	SAPH	SOSP	SPSA	SPTO
1		1	1			4	19	3	2		5	10	1	7	1	2	1	2
2			1	1	1	4	24	6		1	7	2		3		3	2	1
3		1	2	1	1	8	43	9	2	1	12	12	1	10	1	5	3	3
		1		1		1	23		1	1	6	3	1	1		2		1
			1		1	1	18		1		5	6				2		1
3			1			6	2	9			1	3		9	1	1	3	1

STAR	**TRSW**	**WAVE**	**WBNU**	**WHPE**	**WIFL**	**WWPE**	**YBCH**	**YEWA**
0	1	0	2	0	1	3	11	28
1	0	1	2	1	0	4	11	26
-	-	1	-	-	-	2	6	8
-	-	-		-	-	3	6	7
1	1	-	-	1	1	1	5	6

STAR	**TRSW**	**WAVE**	**WBNU**	**WHPE**	**WIFL**	**WWPE**	**YBCH**	**YEWA**	Total Spp Observed	Total Abundance
	1		2		1	3	11	28	33	145
1		1	2	1		4	11	26	28	148
1	1	1	4	1	1	7	22	54	41	293
		1				2	9	19	23	92
			4			4	6	23	20	113
1	1			1	1	1	7	12	30	88

Appendix E – Chatfield Sensitive Species Profiles

Chatfield Sensitive Species Profiles

Bald Eagle (*Haliaeetus leucocephalus*). The bald eagle is a large North American raptor with a historical distribution throughout most of the contiguous United States. As a result of population declines attributed to habitat loss, the use of organochlorine pesticides, and mortality from shooting, the bald eagle was listed as an endangered species in 1978. On August 8, 2007, the bald eagle was removed from the list of threatened and endangered species protected under the Endangered Species Act (ESA) (72 FR 37346, 2007). The bald eagle is currently listed as a Colorado threatened species. Bald eagle nesting has increased along the Colorado Front Range in recent years with most nesting pairs remaining near breeding territories year-round. The bald eagle is also migratory and common winter residents in Colorado

Typical bald eagle nesting habitat consists of forests or wooded areas that contain tall, aged, dying, and dead trees (Martell 1992). Most nesting in Colorado occurs near lakes or reservoirs and along rivers. The number of bald eagles in Colorado increases in winter, primarily along rivers, reservoirs, and eastern plains (Andrews and Righter 1992). This eagle feeds primarily on fish and waterbirds throughout the year, but also on small mammals, mammal carcasses, and prey stolen from other raptors (Buehler 2000). Prairie dogs provide a major food resource for bald eagles wintering along the Colorado Front Range (ESE 1988). The bald eagle frequently roosts at Chatfield in winter, foraging along the South Platte River and Plum Creek drainages and surrounding uplands. The eagle also has attempted to nest at the reservoir.

The bald eagle may occur in the Chatfield Basin during any season and within all habitat types.

Golden Eagle (*Aquila chrysaetos*). The U.S. Fish and Wildlife Service (Service) lists the golden eagle as a bird of conservation concern (BCC) in the Southern Rockies/Colorado Plateau region. The golden eagle occurs in Colorado year-round (Andrews and Righter 1992) and breeds in a variety of open and semi-open habitats including shrublands, grasslands, woodland-shrublands, and coniferous forests (Kochert et al. 2002). This species most often nests on cliffs and occasionally in large trees in farmland and riparian habitats (Kochert et al. 2002). In Colorado, the golden eagle nests primarily in grasslands near cliffs and avoids cultivated areas (Olendorff 1973 ;Kingery 1998). Breeding eagles will defend a territory area of approximately 7.7 to 14 square miles (20 to 30 square kilometers). Foraging typically occurs in open grasslands or shrubland over vast areas in search of prey that includes small rodents, rabbits, hares, and carrion, particularly in winter (Kochert et al. 2002; Kingery 1998). Northern breeders migrate thousands of miles to wintering grounds; southern pairs tend to be resident year-round (Kochert et al. 2002). Migrating eagles follow topographical features such as cliffs or ridgelines where available (Brodeur et al. 1996). The golden eagle prefers open habitats with native vegetation in winter and avoids urban, agricultural, and forested areas (Kochert et al. 2002; Fischer et al. 1984; Craig et al. 1986; Marzluff et al. 1997). Recent breeding bird surveys confirmed nests in canyon areas of Chatfield Reservoir and CBC frequently records golden eagles in the Chatfield Basin during winter.

The golden eagle was primarily considered to occur in the Chatfield Basin during any season within upland habitat .

Lewis's Woodpecker (*Melanerpes lewis*). The Lewis's woodpecker is currently listed as a BCC in the Southern Rockies/Colorado Plateau and Shortgrass Prairie regions. Lewis's woodpecker is distributed throughout the western United States. In Colorado, this species breeds along the Front Range, the Arkansas River watershed, San Juan basin, and near Grand Junction (Kingery 1998).

Important aspects of breeding habitat include an open canopy forest or tree clusters, including standing dead trees (snags), a brushy understory offering ground cover, dead or downed woody material, available perches, and abundant insects (Tobalske 1997). Three principal habitats are open ponderosa pine forest, open riparian woodland dominated by cottonwood, and logged or burned pine (*Pinus* spp.) forest (Tobalske 1997; Vierling 1997). Bird atlas data in Colorado found Lewis's woodpecker predominantly in riparian habitats nesting in old decadent cottonwoods (Kingery 1998). Nest cavities excavated in trunk or large branches of large, dead or decaying trees, which presumably increases ease of excavation (Thomas et al. 1979; Raphael and White 1984; Linder 1994; Tashiro-Vierling 1994). In Colorado plains and foothills areas, all nests were found in dead or decaying cottonwoods, typically in trees that are taller and larger in diameter than random trees (Tashiro-Vierling 1994; Vierling 1997). The Lewis's woodpecker is unusual among woodpeckers in that it forages on emergent (flying) insects rather than grubs and, therefore, prefers forests that are more open often perching near openings or in open canopy (Tobalske 1997).

The Lewis's woodpecker was primarily considered to occur in the Chatfield Basin during summer within riparian tree and mature cottonwood habitats .

Swainson's Hawk (*Buteo swainsoni*). The Swainson's hawk is currently listed as a BCC for the Southern Rockies/Colorado Plateau region. This hawk is a summer breeder in the Chatfield Basin typically nesting in arid grasslands, and agricultural areas with scattered trees and shrubs (Kingery 1998). This species typically nests in a solitary tree, bush, small grove, or line of trees along stream course (England et al. 1997). It sometimes nests on human-built structures such as power poles or transmission towers (Olendorff et al. 1981; James 1992). Swainson's hawk nests often appear more flimsy or ragged than that of other hawk nests. The species frequently nests in habitats attributable to human activity, such as shelterbelts (Olendorff 1973). When coexisting with red-tailed hawk, the Swainson's hawk uses smaller trees in smaller clumps than does Red-tailed (Murphy 1993). Swainson's forages in open stands of grass-dominated vegetation and sparse shrublands, feeding on rodents, rabbits and reptiles while breeding, then relies almost exclusively on insects when the not breeding (England et al. 1997).

The Swainson's hawk was primarily considered to occur in the Chatfield Basin during summer within upland and riparian tree habitat .

Burrowing Owl (*Athene cunicularia*). The western burrowing owl is currently listed as a BCC in the Southern Rockies/Colorado Plateau and Shortgrass Prairie regions and by the state of Colorado as a threatened species. Along the Front Range corridor, the burrowing owl has disappeared from much of its historical range (Kingery 1998).

The burrowing owl is a summer breeder in Colorado grasslands (Andrews and Righter 1992) that depends on vacant mammal burrows for nesting; however, this owl can excavate its own burrows in sandy soils (Kingery 1998). In general, the burrowing owl is found in grasslands with vegetation less than 4 inches high and a relatively large proportion of bare ground (Gillihan and Hutchings 2000). This species nests in burrows in grasslands, grazed pastures, dry shrublands, deserts, and grassy urban areas (Kingery 1998; Haug et al. 1993). In Colorado, the burrowing owl is usually associated with black-tailed prairie dog colonies (Kingery 1998; Andrews and Righter 1992). Over 70 percent of sightings reported by Colorado Breeding Bird Atlasers were in prairie dog colonies (Kingery 1998). The burrowing owl is an opportunistic predator, feeding on insects, small rodents, amphibians, reptiles, and occasionally small birds (Haug et al. 1993). The burrowing owl will forage in a wide variety of grasslands and agricultural areas, but avoids vegetation greater than 39 inches (1m) high (Haug and Oliphant 1990).

The western burrowing owl was primarily considered to occur in the Chatfield Basin during summer within upland habitat .

Ovenbird (*Seiurus aurocapilla*). The ovenbird is tracked by the Colorado Natural Heritage Program (CNHP) as a rare or imperiled species in Colorado. The ovenbird is a summer breeder in Colorado. In the eastern U.S., this species predominantly occurs in large tracts of tall deciduous or deciduous/coniferous forests where deciduous trees are the chief component. In Colorado, the ovenbird breeds in less typical habitats consisting of large contiguous woodlands, lowland riparian, aspen and conifer forests, but tends to avoid climax coniferous forests (Kingery 1998). The ovenbird is at the extreme southwestern edge of its range in Colorado and is only recorded in a small band along the Front Range.

Nests are built on the ground in deciduous woodlands where the growth of shrubs and small trees is sparse and the forest floor is open below. Nests are not found in patches of dense woody vegetation. Territories are generally found in contiguous, interior forested habitat at least 250 acres in size (Temple 1986; Robbins et al. 1989). Forest structure is an important component of territories with canopy heights between 52.5 and 72 feet (16–22 m) and a high degree of canopy closure (60 percent to 90 percent) (Van Horn and Donovan 1994). Smaller forest tracts area may not provide suitable habitat for breeding due to predation associated with forest edges (Porneluzi et al. 1993), isolation from other breeding Ovenbird populations (Whitcomb et al. 1981), and/or reduced habitat quality (Lynch and Whigam 1984).

The ovenbird was primarily considered to occur in the Chatfield Basin during summer within mature cottonwood habitat .

Red-eyed Vireo (*Vireo olivaceous*). The red-eyed vireo is tracked by the CNHP as a rare or imperiled species in Colorado. This species occurs in large cottonwood forests along the South Platte and Arkansas rivers and in deciduous forests of Front Range cities. This species is a rare summer breeder in Colorado, but is advancing along river courses and in metropolitan areas. The red-eyed vireo breeds in deciduous and mixed deciduous-coniferous forest with understory shrubs (Cimprich et al. 2000). The vireo is more abundant in forest interior than near edge although it is often found near small openings in forest canopy (Cimprich et al. 2000; Tyler 1950; Southern 1958; Crawford et al. 1981). Typically, the red-eyed vireo prefers shady forests with a high, well-developed closed canopy and a fairly open understory with scanty ground cover (Bushman and Therres 1988). The species is most often found in forest tracts greater than 37 acres (15-ha) but may occur in patches as small as a few acres (Bushman and Therres 1988). This species also can occur in residential areas and city parks where large trees grow (Tyler 1950; Graber et al. 1985).

The red-eyed vireo was primarily considered to occur in the Chatfield Basin during summer within mature cottonwood habitat .

Northern Harrier (*Circus cyaneus*). The northern harrier is currently listed as a BCC for the Southern Rockies/Colorado Plateau region. The northern harrier is a winter resident of the Chatfield Basin (Andrews and Righter 1992) foraging over open habitats including agricultural fields, open pasture and wetlands (NatureServe 2008), most often concentrating in areas with low vegetation (Macwhirter et al. 1996). A female harrier will defend winter foraging territories, but all harriers will roost communal on the ground in open habitats in winter (Bildstein 1988). The harrier often uses the same roost for several nights or for several months (NatureServe 2008), often returning to traditional roosts for decades (Bosakowski 1983). Roost sites may be abandoned during heavy snow or flooding (Bildstein 1979). The northern harrier is found within wetlands and open upland habitats within the Chatfield Basin in winter.

The northern harrier was primarily considered to occur in the Chatfield Basin during winter within wetland and upland habitats .

Ferruginous Hawk (*Buteo regalis*). The ferruginous hawk is currently listed as a BCC for the Southern Rockies/Colorado Plateau region and is a Colorado species of special concern. This species inhabits open prairie and desert habitats and is strongly associated with primary prey species such as ground squirrels and jackrabbits. The ferruginous hawk is a relatively common winter residents in eastern Colorado, particularly in association with the black-tailed prairie dog (Beane 1996). This species has been known to breed in scattered locations in eastern Colorado but not near the Chatfield Basin (Kingery 1998).

The ferruginous hawk was primarily considered to occur in the Chatfield Basin during any winter within upland habitat .

American Peregrine Falcon (*Falco peregrinus anatum*). The American peregrine falcon is currently listed as a BCC and as a Colorado species of concern. This falcon uses a variety of different habitats for nesting, hunting and migration, and wintering. The peregrines uses a wide variety of habitat and wintering peregrines may occur in habitat devoid of cliffs, along major river valleys and lake shores; pasture lands; and areas containing waterbirds or pigeons and doves and especially urban areas (White et al. 2002; Bird et al. 1996). Preferred hunting areas throughout the year include cropland, meadows, river bottoms, marshes, and lakes that attract abundant bird life. In winter, the peregrine falcon can be found within downtown Denver, along the foothills, and eastern plains of Colorado.

The American peregrine falcon was primarily considered to occur in the Chatfield Basin during migration within upland and wetland habitats .

Loggerhead Shrike (*Lanius ludovicianus*). The loggerhead shrike is currently listed as a BCC in some neighboring regions and nationally. BBS data suggest that this species has declined in abundance in Kansas and appear to be declining in South Dakota. However, shrike populations in Colorado, Nebraska, and Wyoming appear to have stabilized since 1980. Generally, the shrike is a rare to uncommon winter resident in Colorado, being found mainly at lower elevations in the southern and western portions of the state (Andrews and Righter 1992; Righter et al. 2004). Wintering habitat is similar to that utilized during the breeding season. Wintering shrike generally prefer native grasslands (Chavez-Ramirez et al. 1994), but can also be found in a wide variety of open habitats including native and non-native grasslands, sage scrub, and other areas with a scattering of bushes and trees and bare ground. The loggerhead shrike hunts from elevated perches in foraging areas comprised of open, short vegetation with some relatively bare areas (Pruitt 2000).

The loggerhead shrike was primarily considered to occur in the Chatfield Basin during migration within upland habitat .

Prairie Falcon (*Falco mexicanus*). The prairie falcon is currently listed as a BCC for the Southern Rockies/Colorado Plateau and Shortgrass Prairie regions. This swift, acrobatic falcon typically nests on cliff faces in open country below 10,000 feet (3048 m) (Kingery 1998). Migrants and winter residents occur mostly in grasslands, shrublands, and agricultural areas (Andrews and Righter 1992). The prairie falcon winters mainly in the Great Plains and Great Basin in grassland habitats and dry-farm wheat fields (White and Roseneau 1970). The species uses irrigated croplands and winter wheat fields in Colorado, and Wyoming (Enderson 1964; Beauvais et al. 1992). It also can be found near large cattle feedlots where European starlings (*Sturnus vulgaris*) concentrate (Steenhof 1998).

The prairie falcon was primarily considered to occur in the Chatfield Basin during migration within upland habitat .

Rufous Hummingbird (*Selasphorus rufus*). The rufous hummingbird is currently listed as a BCC in some neighboring regions and nationally. This species does not nest in Colorado (Kingery 1998), but is a common early summer and fall migrant in the foothills, lower mountain and mountain parks (Andrews and Righter 1992). In migration this species is found in montane meadows and disturbed areas with nectar-rich wild flowers.

The rufous hummingbird was primarily considered to occur in the Chatfield Basin during migration within wetland, riparian tree, shrub, and upland habitats .

Virginia's Warbler (*Vermivora virginiae*). The Virginia's warbler is currently listed as a BCC in some neighboring regions. This species nests in arid montane woodlands, oak thickets, piñon-juniper, and scrub shrub habitats (AOU 1998). In eastern Colorado, the Virginia's warbler nests in a narrow habitat band along the Front Range Foothills and Palmer Divide (Kingery 1998; Andrews and Righter 1992), and is typically a migrant to the Chatfield Basin. In migration and winter, the Virginia's warbler occurs in open woodlands, second growth, thickets, and arid scrub (Olsen and Martin 1999). This species also uses brushy and weedy habitats, such as scrub oak in winter (Dunn and Garrett 1997), and montane pine habitats, cottonwood and willow riparian areas as stopover habitat. Riparian corridors may be especially important to the Virginia's warbler, but little information available (Bailey and Niedrach 1965; Olsen and Martin 1999).

The Virginia's warbler was primarily considered to occur in the Chatfield Basin during migration within riparian tree, shrub, and mature cottonwood habitats.

Brewer's Sparrow (*Spizella breweri*). The Brewer's sparrow is currently listed as a BCC in some neighboring regions and nationally. This species is a rare nester along the Colorado Front Range (Kingery 1998), but is a common spring and fall migrant in the foothills, mountain parks, and on the eastern plains near the foothills (Andrews and Righter 1992). During migration, this species is found in sagebrush shrublands and brushy desert habitat, including desert scrub dominated by various saltbush species (Rotenberry et al. 1999).

The Brewer's sparrow was primarily considered to occur in the Chatfield Basin during migration within upland habitat.

Appendix E. References

American Ornithologists' Union. 1998. Forty-seventh supplement to the American Ornithologists' Union *Check-list of Nortb American Birds*. Auk 123:926-936.

Andrews, R.A. and R. Righter. 1992. Colorado Birds. Denver Museum of Natural History, Denver, CO.

Bailey, A. M. and R. J. Niedrach. 1965. Birds of Colorado. Denver Mus. of Nat. Hist., Denver, CO.

Beane, R.D. 1996. Raptor Habitat Relationships at the Rocky Mountain Arsenal National Wildlife Area. MSC. Thesis. University of Colorado at Denver. Denver, CO.

Beauvais, G., J. H. Enderson and A. J. Magro. 1992. Home range, habitat use and behavior of Prairie Falcons wintering in east-central Colorado. J. Raptor Res. 26: 13–18.

Bildstein, K. L. 1979.Fluctuations in the number of Northern Harriers (*Circus cyaneus hudsonius*) at communal roosts in south central Ohio. Raptor Res. 13: 40–46.

Bildstein, K. L. 1988. Northern Harrier *Circus cyaneus*. Pp. 251–303 *in* Handbook of North American birds (R. S. Palmer, ed.), vol. 4. Yale Univ. Press, New Haven, CT.

Bird, D., D. Varland and J. Negro. 1996. Raptors in human landscapes. Academic Press, New York.

Bosakowski, T. 1983. Density and roosting habits of Northern Harriers wintering in the Hackensack meadowlands. Rec. New Jersey Birds 9: 50–54.

Brodeur, S., R. Décarie, D. M. Bird and M. Fuller. 1996. Complete migration cycle of Golden Eagles breeding in northern Quebec. Condor 98: 293–299.

Buehler, D.A. 2000. Bald Eagle (*Haliaeetus leucocephalus*). *In* The Birds of North America, No. 506 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Bushman, E.S., and G.D. Therres. 1988.   Habitat management guidelines for forest interior breeding birds of coastal Maryland. Maryland Dept. Natural Resources, Wildlife Tech. Publ. 88-1. 50 pp

Chavez-Ramirez, F., E.E. Gawlik, F.G. Prieto, and R.D. Slack. 1994. Effects of habitat structure on patch use by loggerhead shrikes wintering in a natural grassland. Condor 96:228-231.

Cimprich, David A., Frank R. Moore and Michael P. Guilfoyle. 2000. Red-eyed Vireo (Vireo olivaceus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/527

Craig, E. H., T. H. Craig and L. R. Powers. 1986. Habitat use by wintering Golden Eagles and Rough-legged Hawks in southeastern Idaho. Raptor Res. 20: 69–71.

Crawford, H. S., R. G. Hooper and R. W. Titterington. 1981. Songbird population response to silvicultural practices in central Appalachian hardwoods. J. Wildl. Manage. 45: 680–692.

Dunn, J.L., and K.L. Garrett. 1997. A field guide to warblers of North America. Houghton Mifflin Company, Boston

Enderson, J. H. 1964. A study of the Prairie Falcon in the central Rocky Mountain region. Burnside, F.L. 1987. Long-distance movements by Loggerhead Shrikes. Journal of Field Ornithology 58:62-65.

England, A. Sidney, Marc J. Bechard and C. Stuart Houston. 1997. Swainson's Hawk (Buteo swainsoni), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/265

Environmental Science and Engineering (ESE). 1988. Bald Eagle Study Winters 1986-1987, 1987-1988 Final Report. Prepared for the Office of the Program Manager, Rocky Mountain Arsenal Contamination Cleanup.

Gillihan, S.C. and S.W. Hutchings. 2000. Best management practices for shortgrass prairie birds: a landowner's guide. Rocky Mountain Bird Observatory. Brighton, CO.

Graber, J. W., R. R. Graber and E. L. Kirk. 1985. Illinois birds: vireos. Biol. Notes no. 68. Illinois Nat. Hist. Surv., Urbana.

Haug, E.A. and L.W. Oliphant. 1990. Movements, activity patterns, and habitat use of burrowing owls in Saskatchewan. Journal of Wildlife Management 54:27-35.

Haug, E.A., B.A. Millsap, and M.S. Martell. 1993. Burrowing Owl (Speotyto cunicularia). *In* A. Poole and F. Gills (eds.). The Birds of North America, No. 61. The Academy of Natural Science, Philadelphia, and the American Ornithologists' Union, Washington, DC.

James, P. C. 1992. Urban-nesting of Swainson's Hawks in Saskatchewan. Condor 94: 773–774.

Kingery, H.E. 1998. Colorado Breeding Bird Atlas. Colorado Breeding Bird Atlas Partnership and Colorado Division of Wildlife.

Kochert, M. N., K. Steenhof, C. L. Mcintyre and E. H. Craig. 2002. Golden Eagle (Aquila chrysaetos), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/684

Linder, K. A. 1994. Habitat utilization and behavior of nesting Lewis's Woodpeckers (*Melanerpeslewis*) in the Laramie range, southeast Wyoming. M.S. thesis, Univ. of Wyoming, Laramie.

Lynch, J. and D. Whigam. 1984. Effects of forest fragmentation on breeding bird communities in Maryland, USA. Biol. Conserv. 28:287-324.

Macwhirter, R. Bruce and Keith L. Bildstein. 1996. Northern Harrier (Circus cyaneus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/210

Marzluff, J. M., S. T. Knick, M. S. Vekasy, L. S. Schueck and T. J. Zarriello. 1997. Spatial use and habitat selection of Golden Eagles in southwestern Idaho. Auk 114: 673–687.

Martell, M. 1992. Bald Eagle Winter Management Guidelines. USFWS, Reg. 3, Minneapolis, MN.

Murphy, R. K. 1993. History, nesting biology, and predation ecology of raptors in the Missouri Coteau of northwestern North Dakota. Ph.D. diss., Montana State Univ., Bozeman.

NatureServe. 2008. NatureServe Explorer: An online encyclopedia of life [web application]. Version 1.8. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: December 21, 2008).

Olendorff, R. R., A. D. Miller and R. N. Lehman. 1981. Suggested practices for raptor protection on power lines: the state of the art in 1981. Raptor Res. Rep. no. 4.

Olendorff, R. R. 1973. The ecology of the nesting birds of prey of northeastern Colorado. Tech. Rep. no. 211. U.S. Int. Biol. Prog., Grassland Biome, Fort Collins, CO.

Olson, C. R. and T. E. Martin. 1999. Virginia's Warbler (*Vermivora virginiae*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/477

Porneluzi, P., J. C. Bednarz, L. Goodrich, N. Zawada, and J. Hoover. 1993. Reproductive performance of territorial Ovenbirds occupying forest fragments and a contiguous forest in Pennsylvania. Conserv. Biol. 7:618-622.

Pruitt, L. 2000. Loggerhead Shrike Status Assessment. U.S. Fish and Wildlife Service, Fort Snelling, MN.

Raphael, M. G. and M. White. 1984. Use of snags by cavity-nesting birds in the Sierra Nevada. Wildl. Monogr. 86: 1–66.

Righter, R., R. Levad, C. Dexter, and K. Potter. 2004. Birds of western Colorado plateau and mesa country. Grand Valley Audubon Society, Grand Junction, CO.

Robbins, C. S., D. K. Dawson, and B. A. Dowell. 1989. Habitat area and requirements of breeding forest birds of the middle Atlantic states. Wildl. Monogr. 103:1-34.

Rotenberry, J. T., M. A. Patten and K. L. Preston. 1999. Brewer's Sparrow (Spizella breweri), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/390

Southern, W. E. 1958. Nesting of the Red-eyed Vireo in the Douglas Lake region, Michigan. Jack-Pine Warbler 36: 105–130 and 185–207.

Steenhof, Karen. 1998. Prairie Falcon (Falco mexicanus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/346

Tashiro-Vierling, K. Y. 1994. Population trends and ecology of the Lewis's Woodpecker (*Melanerpes lewis*) in southeastern Colorado. M.A. thesis, Univ. of Colorado, Boulder.

Temple, S. A. 1986. Predicting impacts of habitat fragmentation on forest birds: a comparison of two models. Pages 301-304 *in* Wildlife 2000: Modeling habitat relationships of terrestrial vertebrates. (Verner, J., M. L. Morrison, and C. J. Ralph, Eds.) Univ. Wisconsin Press, Madison.

Thomas, J. W., R. G. Anderson, C. Maser and E. L. Bull. 1979. Snags. Pp. 60–77 *in*Wildlife habitats in managed forests: the Blue Mountains of Oregon and Washington (J. W. Thomas, ed.). U.S. Dept. Agric., For. Serv. Agric. Handbook 553.

Tobalske, Bret W. 1997. Lewis's Woodpecker (Melanerpes lewis), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/284

Tyler, W. M. 1950. *Vireo olivaceus*(Linnaeus) Red-eyed Vireo. Pp. 335–348 *in* Life histories of North American wagtails, shrikes, vireos, and their allies (A. C. Bent, ed.). U.S. Natl. Mus. Bull. 197.

Van Horn, M. A. and T.M. Donovan. 1994. Ovenbird (Seiurus aurocapilla), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/088

Vierling, K. T. 1997. Habitat selection of Lewis's Woodpeckers in southeastern Colorado. Wilson Bull. 109: 121–130.

Whitcomb, R. F., C. S. Robbins, J. F. Lynch, B. L. Whitcomb, M. K. Klimkiewicz, and D. Bystrak. 1981. Effects of forest fragmentation on avifauna of the eastern deciduous forest. Pages 125-205 *in* Forest island dynamics in man-dominated landscapes. (Burgess, R. L. and D. L. Sharpe, Eds.) Springer-Verlag, New York.

White, C. M. and D. G. Roseneau. 1970. Observations on food, nesting, and winter populations of large North American falcons. Condor 72: 113–115.

White, C. M., N. J. Clum, T. J. Cade, and W. G. Hunt. 2002. Peregrine Falcon (*Falco peregrinus*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Laboratory of Ornithology; Retrieved from The Birds of North American Online database: http://bna.birds.cornell.edu/BNA/account/Peregrine_Falcon/.

Appendix F – Chatfield FACWet Figures and datasheets

ADMINISTRATIVE CHARACTERIZATION

General Information

		Date of Evaluation:	11/24/2008
Site Name or ID:	Deer Creek	Project Name:	Chatfield Reallocation Study
404 or Other Permit Application #:	NA	Lead Federal Agency:	US Army Corps of Engineers
Evaluator Name(s):	Mary L. Powell	Evaluator's professional position and organization:	Natural Resource Specialist, ERO Resources, Corp.

Location Information:

Site Location (Lat./Long. or UTM):	492679.3447 4377343.628	Geographic Datum Used (NAD 83 preferred):	AND 83
USGS Quadrangle Map:	Littleton Quadrangle	Map Scale: (Circle one)	**1:24,000** 1:100,000 Other 1:
Sub basin Name (8 digit HUC):	10190002	Wetland Ownership:	US Army Corps of Engineers

Project Information:

This evaluation is being performed at: *(Check applicable box)*
- [X] *Project Wetland*
- [ ] *Mitigation Site*

Purpose of Evaluation (check all applicable):
- [X] *Potentially Impacted Wetlands*
- [ ] *Mitigation; Pre-construction*
- [ ] *Mitigation; Post-construction*
- [ ] *Monitoring*
- [ ] *Other (Describe)*

Intent of Project: *(Check all applicable)* X Preservation X Restoration X Enhancement X Creation

Total Size of Wetland Involved: (Record Area, Check and Describe Measurement Method Used)	4.34 ac.	X	Measured using GIS.				
			Estimated				
Assessment Area (AA) Size (Record Area, check appropriate box. Additional spaces are used to record acreage when more than one AA is included in a single assessment)	ac.	X	Measured	ac.	ac.	ac.	ac.
			Estimated	ac.	ac.	ac.	ac.
Characteristics or Method used for AA boundary determination:	Extent of AA determined by wetland mapping performed by TetraTech for FR/EIS study. Wetlands of same wetland category were grouped together based logical location on landscape.						

Notes:	Wetland/riaprian complex along Deer Creek. Experiences some back up from the reservoir during high water.

ECOLOGICAL DESCRIPTION 1

Special Concerns

Check all that apply

- [ ] Organic soils including Histosols or Histic Epipedons are present in the AA (i.e., AA includes core fen habitat).
- [ ] Project will directly impact organic soil portions of the AA including areas possessing either Histosol soils or histic epipedons.
- [ ] Organic soils are known to occur anywhere within the contiguous wetland of which the AA is part.
- [ ] The wetland is a habitat oasis in an otherwise dry or urbanized landscape?
- [ ] Federally threatened or endangered species are **KNOWN** to occur in the AA? List Below.
- [ ] Federally threatened or endangered species are **SUSPECTED** to occur in the AA?
- [ ] Species of concern according to the Colorado Natural Heritage (CNHP) are known to occur in the AA?
- [ ] The site is located within a potential conservation area or element occurrence buffer area as determined by CNHP?
- [ ] Other special concerns (please describe)

HYDROGEOMORPHIC SETTING

- [X] AA wetland maintains its fundamental natural hydrogeomorphic characteristics
- [ ] AA wetland has been subject to change in HGM classes as a result of anthropogenic modification
If the above is checked, please describe the original wetland type if discernable using the table below.
- [ ] AA wetland was created from an upland setting.

Previous wetland typology

Historical Conditions				
Water source	Surface flow	Groundwater	Precipitation	Unknown
Hydrodynamics	Unidirectional	Vertical		
Geomorphic Setting (Narrative Description)				
Previous HGM Class	Riverine	Slope	Depressional	Lacustrine

Current Conditions

Describe the hydrogeomorphic setting of the wetland by circling all conditions that apply.

HGM Setting

Water source	**Surface flow**	**Groundwater**	Precipitation	Unknown		
Hydrodynamics	**Unidirectional**	Vertical				
Wetland Gradient	0 - 2%	**2-4%**	4-10%	>10%		
# Surface Inlets	Over-bank	0	1	**2**	3	>3
# Surface Outlets		0	**1**	2	3	>3
Geomorphic Setting (Narrative Description)	Wetland and riparian areas associated with Deer Creek. A road across the creek holds back water occassionaly and during high water in lake, water backs up the creek..					
HGM class	**Riverine**	Slope	Depressional	Lacustrine		

Notes (include information on charcteristics used to formulate reference standard): Reference standard is the condition of Deer Creek prior to construction of Wadsworth, Chatfield Reservoir, and park roads and trails. The wetlands near the reservoir were probably more restricted because groundwater associated high reservior levels and the road berm was not present.

ECOLOGICAL DESCRIPTION 2

Vegetation Habitat Description

*US FWS habitat classification according as reported in Cowardin et. al (1979) - See also Appendix *** of FACWet User Guide.*

System	Subsystem	Class	Subclass	Water Regime	Other Modifiers	% AA
Palustrine	Palustrine	Shrub-scrub	Persistent	Seasonally flooded		60%
Palustrine	Palustrine	Forested	Broad-leaved Decid.	Seasonally flooded		40%
Lacustrine Palustrine Riverine	Littoral; Limnoral Palustrine Lower perennial; Upper perennial; Intermittent	Rock Bot. (RB) Uncon Bottom(UB) Aquatic Bed(AB) Rocky Shore(RS) Uncon Shore(US) Emergent(EM) Shrub-scrub(SS) Forested (FO)	Floating vascular; Rooted vascular; Algal; Persistent; Non-Persistent; Broad-leaved deciduous; Needle-leaved evergreen; Cobble - gravel; Sand; Mud; Organic	**Examples** Temporarily flooded(A); Saturated(B); Seasonally flooded(C); Seas.-flood./sat.(E); Perm. flooded(F); Intermittently Flooded(G); Artificially Flooded(K); Sat./semiperm./Seas. (Y); Int. exposed/permenant(Z)	Hypersaline(7) ; Eusaline(8); Mixosaline(9); Fresh(0); Acid(a); Circumneutral(c); Alkaline/calcareous(i); Organic(g); Mineral(n); Beaver(b); Partially Drained/ditched(d); Farmed(f); Diked/impounded(h); Artificial Substrate(r); Spoil(s); Excavated(x)	

Site Map

Scale: 1 sq. =

Draw a sketch map of the site including relevant portions of the wetland, AA boundary, structures, habitat classes, and other significant features.

Variable 1: Habitat Connectivity - Neighboring Wetland Habitat Loss

This variable is a measure of how isolated from other naturally-occurring wetland or riparian habitat the AA has become as a result of the loss of that habitat. To score this variable, estimate the percent of naturally- occurring wetland/riparian habitat that has been lost (by filling, draining, development, or whatever means) within a 500-meter-wide belt surrounding the AA. This surrounding area is called the Habitat Connectivity Envelope (HCE). Historical photographs and NWI maps can be helpful in scoring this variable. In most cases the evaluator must use best professional judgment in estimating the amount of natural wetland loss. Evaluation of landforms and habitat patterns in the context of perceivable land use change should be used to steer estimates of the amount of wetland loss within the HCE. This variable is not meant to penalize AAs that are naturally isolated, or unique to the landscape. Rather, it should measure the degree to which natural habitat connectivity has been lost.

Rules for Scoring:

1. On the aerial photo outline the area that is within 500 meters of the AA.
2. Identify obvious natural barriers within 500 m of the AA boundary.
   - *Natural barriers include continuous cliff bands, deep open water, etc.*
3. Draw the **Habitat Connectivity Envelope**(HCE) on the aerial image.
   - *The HCE is all the area within 500 meters of the AA that is not separated from it by a natural barrier.*
4. Outline the current extent of naturally occurring wetland and riparian habitat. Then outline areas where the habitats appear to have historically occurred.
   - *Use your knowledge of the history of the area and evident land use change. Additional research could be utilized to increase the accuracy of this estimate including consideratation of floodplain maps, historical aerials, etc.*

Variable Score	Condition Category	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	*Wetland losses are absent or negligible or there is no evidence to suggest the native landscape within the HCE historically contained other wetland habitats*
<0.9 - 0.8	*Highly Functioning*	*More than 80% of historical wetland habitat area within the HCE is still present (less than 20% historical wetland habitat area lost).*
<0.8 - 0.7	*Functioning*	*80 to 60% of historical wetland habitat area within the HCE is still present (20% to 40% historical wetland habitat area lost).*
<0.7 - 0.6	*Functioning Impaired*	*Less than 60 to 30% of historical wetland habitat area within the HCE is still present (more than 30 to 70% historical wetland habitat area lost).*
<0.6	*Non-functioning*	*Less than 30% of the historical wetland habitat area from within the HCE is now no longer in existence (more than 70% historical wetland habitat area lost).*

Variable 1 Score 0.7

Notes: Areas of lost habitat are Wadsworth, park road, and below OHWM.

Variable 2: Habitat Connectivity - Migration/Dispersal Barriers

This variable is intended to rate the degree to which the AA has become isolated from existing neighboring wetland and riparian habitat by artificial barriers that inhibit migration or dispersal of organisms. On the aerial photograph, identify the man-made barriers within the HCE that intercede between the AA and surrounding wetlands and riparian areas, and identify them by type on the stressor list. Score this variable based on the barriers' impermeability to migration and dispersal and the amount of surrounding wetland/riparian habitat they affect.

Rules for Scoring:

1. On the aerial photo, outline all existing wetland and riparian habitat areas (WHAs) within the HCE.
2. Identify artificial barriers to dispersal and migration of organisms within the HCE that intercede between the AA and surrounding habitats. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.
3. Considering the composite effect of all of identified barriers to migration and dispersal (i.e., stressors), assign an overall variable score using the scoring guidelines.

Stressors = artificial barriers

✔	Stressors	Comments/description
X	Major Highway	Wadsworth, large fill across floodplain (high)
	Secondary Highway	
X	Tertiary Roadway	Interior park road (moderate)
	Railroad	
X	Bike Path	Soft-surface trail (low)
X	Urban Development	Parking lot and restroom (low)
	Agricultural Development	
X	Artificial Water Body	OHWM of Chatfield (high)
	Fence	
	Ditch or Aqueduct	
	Aquatic Organism Barriers	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	No appreciable barriers exist between the AA and other wetland and riparian habitats in th HCE; or there are no other wetland and riparian areas in the HCE.
<0.9 - 0.8	*Highly Functioning*	Barriers impeding migration/dispersal between the AA and up to 33% of surrounding WHA highly permeable and easily passed by most organisms. Examples could include gravel roads, minor levees, ditches or barbed-wire fences. More significant barriers (see "functioning category below) could affect migration to up to 10% of surrounding WHA.
<0.8 - 0.7	*Functioning*	Barriers to migration and dispersal retard the ability of many organisms/propagules to pass between the AA and up to 66% of WHA. Passage of organisms and propagules through such barriers is still possible, but it may be constrained to certain times of day, be slow, dangerous or require additional travel. Busy two-lane roads, culverted areas, small to medium artificial water bodies or small earthen dams would commonly rate a score in this range. More significant barriers (see "functioning impaired" category below) could affect migration to up to 10% of surrounding WHA.
<0.7 - 0.6	*Functioning Impaired*	Barriers to migration and dispersal preclude the passage of some types of organisms/propagules between the AA and up to 66% of surrounding WHA. Travel of those animals which can potential negotiate the barrier are strongly restricted and may include a high chance of mortality. Up to 33% of surrounding WHA could be functionally isolated from the AA.
<0.6	*Non-functioning*	AA is essentially isolated from surrounding WHA by impermeable migration and dispersal barriers. An interstate highway or concrete-lined water conveyance canal are examples of barriers which would generally create functional isolation between the AA and a WHA.

Variable 2 Score 0.55

Variable 3: Buffer Capacity

The buffer area is defined as a 250-meter-wide belt surrounding the perimeter of the AA. This variable is a measure of the capacity of that area to function as an effective buffer for the wetland against the deleterious effects of surrounding land use change. To score the variable, assume that the AA is 100% buffered except where land use changes inside the buffer area have diminished this quality. Identify these land use types as specific stressors in the list. For each stressor, rate severity and extent within the buffer area; then use this list to make an overall rating for the buffer's departure from reference conditions. When rating buffer capacity, consider both the intensity of the impact and the proximity of the stressor to the AA.

Rules for Scoring:

1. On the aerial photograph, outline the buffer area as the zone within 250 meters of the outer boundary of the AA.

2. Use the stressor list to record land use changes that affect buffering capacity within the buffer area. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.

3. Considering all of the identified stressors, their overall severity, extent and proximity to the AA assign an overall variable score using the scoring guidelines.

Stressors = Land Use Changes	✔	Stressors	Comments/description
		Industrial/commercial	
		Urban	
		Residential	
		Rural	
		Dryland Farming	
		Intensive Agriculture	
		Orchards or Nurseries	
		Livestock Grazing	
	X	Transportation Corridor	Wadsworth Blvd, interior park road, trail (moderate, high)
	X	Urban Parklands	Parking lots for trailheads and facilities (low, high)
		Dams/impoundments	
	x	Artificial Water body	Chatfield Reservoir (moderate, moderate)
		Physical Resource Extraction	
		Biological Resource Extraction	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	No appreciable land use change has been imposed within the TBA and it provides the full buffering capacity.
<0.9 - 0.8	*Highly Functioning*	Some land use change has occurred in the BA, but such changes little impair the area's ability to provide a buffering function, either because land use is not intensive, for example haying, light grazing, or nurseries, or more substantial changes occur in approximately less than 10% of the BA.
<0.8 - 0.7	*Functioning*	BA has been subjected to a marked shift in land use, however, the land retains much of its original buffering capacity. Moderate-intensity land uses such as dry-land farming, urban "green" corridors, or moderate cattle grazing would commonly be placed within this scoring range.
<0.7 - 0.6	*Functioning Impaired*	Land use within the BA has been substantial including the a moderate to high coverage (up to 50%) of impermeable surfaces, bare soil, or other artificial surface; considerable in-flow urban runoff or fertilizer-rich waters common. While, the buffering capacity of the land has been greatly diminished it is not extinguished. Intensively logged areas, low-density urban developments, some urban parklands and some cropping situations would commonly rate a score within this range.
<0.6	*Non-functioning*	The area within the BA provides essentially no buffering capacity. Many Commercial developments or highly urban landscapes would rate a score of less than 0.6.

Variable 3 score 0.7

Variable 4: Water Source

This variable is concerned with up-gradient hydrologic connectivity. It is a measure of the impacts to the AA's water source, including the ability of source water to perform work such as sediment transport, erosion, soil pore flushing, etc. To score this variable, identify stressors that alter the source of water to the AA, and record their presence on the stressor list. Stressors can impact water source by depletion, augmentation, or alteration of inflow timing or hydrodynamics. For riverine systems, this variable is primarily concerned with the connection of the channel to the floodplain.This variable is designed to assess water quantity, power and timing, not water quality. Water quality will be evaluated in Variable 7.

Scoring rules:

1. Use the stressor list and knowledge of the watershed to catalog type-specific impairments of the AA's water source. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.

2. Considering the composite effect of stressors on the water source, rate the condition of this variable with the aid of the scoring guidelines.

✔	Stressors	Comments/description
	Ditches or Drains (tile, etc.)	
	Dams	
X	Diversions	Small diversion at Hildebrand Ranch (low)
	Groundwater pumping	
	Draw-downs	
X	Culverts or Constrictions	Culvert at Wadsworth (high)
	Point Source (urban, ind., ag.)	
	Non-point Source	
	Increased Drainage Area	
	Storm Drain/Urban Runoff	
X	Impermeable Surface Runoff	Some runoff from Wads, park roads and parking lots (mod)
	Irrigation Return Flows	
	Mining/Natural Gas Extraction	
	Transbasin Diversion	
	Actively Managed Hydrology	

Variable Score	Condition Class	Depletion	Augmentation
1.0 - 0.9	*Reference Standard*	Unnatural drawdown events minor, rare or non-existent, very slight uniform depletion, or trivial alteration of hydrodynamics.	Unnatural high-water events minor, rare or non-existent, slight uniform increase in amount of inflow, or trivial alteration of hydrodynamics.
<0.9 - 0.8	*Highly Functioning*	Unnatural drawdown events occasional, short duration and/or mild; or uniform depletion up to 20%; or mild to moderate reduction of peak flows or natural capacity of water to perform work.	Occasional unnatural high-water events, short in duration and/or mild in intensity; or uniform augmentation up to 20%; or mild to moderate increase of peak flows or natural capacity of water to perform work.
<0.8 - 0.7	*Functioning*	Unnatural drawdown events common and of mild to moderate intensity and/or duration; or uniform depletion up to 50%; or moderate to substantial reduction of peak flows or natural capacity of water to perform work.	Common occurrence of unnatural high-water events, of a mild to moderate intensity and/or duration; or uniform augmentation up to 50%; or moderate to substantial reduction of peak flows or natural capacity of water to perform work.
<0.7 - 0.6	*Functioning Impaired*	Unnatural drawdown events occur frequently with a moderate to high intensity and/or duration; or uniform depletion up to 75%; or substantial reduction of peak flows or natural capacity of water to perform work. **Wetlands with actively managed or wholly artificial hydrology will usually score in this range or lower.**	Common occurrence of unnatural high-water events, some of which may be severe in nature or exist for a substantial portion of the growing season; or uniform augmentation more than 50% or natural capacity of water to perform work. **Wetlands with actively managed or wholly artificial hydrology will usually score in this range or lower.**
<0.6	*Non-functioning*	Water source diminished enough to threaten jurisdictional classification of the AA.	Frequency, duration or magnitude of unnaturally high-water great enough to change the fundamental characteristics of the wetland.

Variable 4 Score 0.9

Variable 5: Water Distribution

This variable is concerned with hydrologic connectivity within the AA. It is a measure of alteration to the spatial distribution of surface and groundwater within the AA. These alterations are manifested as local changes to the hydrograph and generally ***result*** *from geomorphic modifications. To score this variable, identify stressors that alter flow patterns and impact the hydrograph within portions of the AA, including localized increases or decreases to the depth or duration of the water table or surface water. In naturally confined rivers (i.e. canyons and gullies) floodplain width is generally very small, so these systems will tend to score high for this variable unless some gross stressor is present.*

Scoring rules:

1. Identify impacts to the natural distribution of water throughout the AA and catalog them in the stressor table.
2. Considering all of the stressors identified, assign an overall variable score using the scoring guidelines.

✔	Stressors	Comments/description
	Ditches	
	Ponding/Impoundment	
	Culverts	
	Road Grades	Interior park road acts as detention berm in high flows (mod)
	Channel Incision/Entrenchment	
	Hardened/Engineered Channel	
	Enlarged Channel	
	Artificial Banks/Shoreline	
	Weirs	
	Dikes/Levees/Berms	
	Diversions	
	Sediment/Fill Accumulation	

Variable Score	Condition Class	Non-riverine	Riverine
1.0 - 0.9	*Reference Standard*	Little or no alteration has been made to the way in which water is distributed throughout the wetland.	Natural active floodplain areas flood on a normal recurrence interval. No evidence of alteration of flooding and subirrigation duration and intensity.
<0.9 - 0.8	*Highly Functioning*	Less than 10% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in less than a 2 in. (5 cm) change in mean growing season water table elevation.	Channel-adjacent areas have occasional unnatural periods of drying or flooding; or uniform shift in the hydrograph less than typical root depth.
<0.8 - 0.7	*Functioning*	Between 10 and 33% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in a 4 in. (5 cm) or less change in mean growing season water table elevation.	In channel-adjacent area, periods of drying or flooding are common; or uniform shift in the hydrograph near root depth.
<0.7 - 0.6	*Functioning Impaired*	33 to 66% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in a 6 in. (15 cm) or less change in mean growing season water table elevation. Water table behavior must still meet jurisdictional criteria to merit this rating.	Adjacent to the channel, unnatural periods of drying or flooding are the norm; or uniform shift in the hydrograph greater than root depth.
<0.6	*Non-functioning*	More than 66% of the AA is affected by hydrologic alteration which changes the fundamental functioning of the wetland system	Historical active floodplain areas are almost never wetted from overbank flooding, and/or groundwater infiltration is effectively cut off.

Variable 5 Score 0.8

Variable 6: Water Outflow

This variable is concerned with down-gradient hydrologic connectivity and the flow of water (transporting materials and energy) out of the AA. It is a measure of impacts that affect the hydrologic outflow of water including the passage of water through its normal low- and high-flow surface outlets, and infiltration/groundwater recharge. In some cases, alteration of evapotranspiration rates may be significant enough of a factor to consider in scoring. Score this variable by identifying stressors that impact the means by which water is exported from the AA. In Variable 5, the stressors were evaluated in light of their impact on water distribution within the AA. To evaluate this variable focus on how water, energy and associated materials are exported out of the AA.

Scoring rules:

1. Identify impacts to the natural outflow of water from the AA and catalog them in the stressor table.

2.Considering all of the stressors identified, assign an overall variable score using the scoring guidelines. Take in to account the cumulative effect of stressors on the wetland's ability to export water and water-borne materials

✔	Stressors	Comments/description
	Ditches	
	Dikes/Levees	
	Road Grades	
	Culverts	
	Diversions	
X	Constrictions	Interior park road restricts outflow during storms events (mod)
	Channel Incision/Entrenchment	
	Hardened/Engineered Channel	
	Artificial Stream Banks	
	Weirs	
	Confined Bridge Openings	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stressors have little to no effect on the magnitude, timing or hydrodynamics of the AA water outflow regime.
<0.9 - 0.8	*Highly Functioning*	High- or low-water outflows are mildly to moderately affected, but at intermediate ("normal") lev flow continues essentially unaltered in quantity or character.
<0.8 - 0.7	*Functioning*	High- or low-water outflows are moderately affected, mild alteration of intermediate level outflow occurs; or hydrodynamics mildly to moderately affected.
<0.7 - 0.6	*Functioning Impaired*	Outflow at all stages is moderately impaired resulting in persistent flooding of portions of the AA or unnatural drainage; or outflow hydrodynamics significantly disrupted.
<0.6	*Non-functioning*	The natural outflow regime is severely disrupted. Down-gradient hydrologic connection severed or nearly so. Alterations may cause widespread unnatural persistent flooding or dewatering of the wetland system.

Variable 6 Score 0.85

Variable 7: Water and Soil Chemical Environment

This variable concerns the chemical environment of the soil and water media within the AA, including pollutants and water quality. The origin of pollutants may be in the AA or delivered from up-gradient or surrounding areas. Score this variable by listing indicators of chemical stress in the AA. Consider point source and non-point sources of pollution, as well as mechanical or hydrologic changes that alter the chemical environment. Because water quality frequently cannot be inferred directly, the presence of many stressors is identified via indirect indicators.

Scoring rules:

1. Stressors are grouped into categories which have a similar signature or set of causes.
2. Use the indicator list to identify each stressor impacting the chemical environment of the AA.
3. For each stressor category, determine the sub-variable score using the scoring guideline table provided on the second page of the scoring sheet.
   -If the AA is part of a water body that is recognized as impaired or recommended for TMDL development for one of the factors, then score that sub-variable 0.65 or lower.
4. Transcribe sub-variable scores to the following variable scoring page and compute the sum.
5. Determine the variable score by following the scoring guidelines.

Stressor Category	Stressor Indicator	✔	Comments	Sub-variable Score
Nutrient Enrichment/ Eutrophication/ Oxygen (D.O.)	Livestock			0.95
	Agricultural Runoff	X	Some from Chatfield Farm (L)	
	Septic/Sewage			
	Excessive Algae or Aquatic Veg.			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Sedimentation/ Turbidity	Excessive Erosion			0.95
	Excessive Deposition			
	Fine Sediment Plumes			
	Agricultural Runoff	X	Some from Chatfield Farm	
	Excessive Turbidity			
	Nearby Construction Site			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Toxic contamination/ pH	Recent Chemical Spills			0.87
	Nearby Industrial Sites			
	Road Drainage/Runoff	X	Wadsworth (mod)	
	Livestock			
	Agricultural Runoff	X	Chatfiield Farm (low)	
	Storm Water Runoff			
	Fish/Wildlife Impacts			
	Vegetation Impacts			
	Cumulative Watershed NPS			
	Acid Mine Drainage			
	Point Source Discharge			
	CDPHE Impairment/TMDL List			
Temperature	Excessive Temperature Regime			1.00
	Lack of Shading			
	Reservoir/Power Plant Discharge			
	Industrial Discharge			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Soil chemistry/ Redox potential	Unnatural Saturation/Desaturation	X	Backup from Chat (mod)	0.80
	Mechanical Soil Disturbance			
	Dumping/introduced Soil			
	CDPHE Impairment/TMDL List			

Variable 7: Water and Soil Chemical Environment

Sub-variable Scoring Guidelines

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stress indicators not present or trivial.
<0.9 - 0.8	*Highly Functioning*	Stress indicators scarcely present and mild, or otherwise not occurring in more than 10% of the AA.
<0.8 - 0.7	*Functioning*	Stress indicators present at mild to moderate levels, or otherwise not occurring in more than 33% of the AA.
<0.7 - 0.6	*Functioning Impaired*	Stress indicators present at moderate to high levels, or otherwise not occurring in more than 66% of the AA
<0.6	*Non-functioning*	Stress indicators strongly evident throughout the AA at levels which apparently alter the fundamental chemical environment of the wetland system

Input each factor score from the stressor list and calculate the sum.

Nutrient enrichment/ Eutrophication/ Oxygen (D.O.)		Sedimentation/ Turbidity		Toxic contamination/ pH		Temperature		Soil chemistry/ Redox potential		Sum of Sub-variable Scores
0.95	+	0.95	+	0.87	+	1.00	+	0.80	=	4.57

Use the table to score the Chemical Environment Variable circling the applicable scoring rules.

Variable Score	Condition Class	Scoring Rules: Single Factor		Scoring Rules: Composite Score
1.0 - 0.9	*Reference Standard*	No single factor scores < 0.9	or	The factor scores sum > 4.5
<0.9 - 0.8	*Highly Functioning*	Any single factor scores ≥ 0.8 but < 0.9	or	The factor scores sum >4.0 but ≤4.5
<0.8 - 0.7	*Functioning*	Any single factor scores ≥ 7.0 but < 0.8	or	The factor scores sum >3.5 but ≤ 4.0
<0.7 - 0.6	*Functioning Impaired*	Any single factor scores ≥ 0.6 but <0.7	or	The factor scores sum >3.0 but ≤3.5
< 0.6	*Non-functioning*	Any single factor scores < 0.6	or	The factor scores sum < 3.0

Variable 7 Score 0.9

Variable 8: Geomorphology

This variable is a measure of the degree to which the geomorphic setting has been altered within the AA. Changes to the surface configuration and natural topography constitute stressors. Such stressors may be observed in the form of fill, excavation, diking, sedimentation due to absence of flushing floods, etc. In riverine systems geomorphic changes to stream channel should be considered if the channel is within the AA. Alterations may include bed surface changes (embeddedness or morphology changes), stream bank instability, and stream channel reconfiguration. Geomorphic changes are usually ultimately manifested as changes to wetland hydrology and water relations with vegetation. Geomorphic alteration can also directly affect soil properties, such as near-surface texture, and the wetland chemical environment, such as the redox state or nutrient composition in the rooting zone. In rating this variable, do not include these resultant effects of geomorphic change; rather focus on the physical impacts within the footprint of the alteration. The effects of geomorphic change are addressed by other variables. All alterations to the geomorphology should be evaluated including small-scale impa

Scoring Rules:

1. Identify impacts to geomorphological setting and topography within the AA and record them on the stressor checklist.
2. Considering all of the stressors identified, assign an overall variable score using the scoring guidelines.

✔		Stressors	Comments
	General	Dredging/Excavation/Mining	
X	General	Fill, including dikes, road grades, etc	Wads, park road (high)
	General	Grading	Trail head parking and trails (mod)
	General	Compaction	
	General	Plowing/Disking	
	General	Excessive Sedimentation	
	General	Dumping	
	General	Hoof Shear/Pugging	
	General	Aggregate or Mineral Mining	
	General	Sand Accumulation	
	Channels Only	Channel Instability/Over Widening	
	Channels Only	Excessive Bank Erosion	
	Channels Only	Channelization	
	Channels Only	Reconfigured Stream Channels	
	Channels Only	Artificial Banks/Shoreline	
	Channels Only	Beaver Dam Removal	
	Channels Only	Substrate Embeddedness	
	Channels Only	Lack or Excess of Woody Debris	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Topography essentially unaltered from the natural state, or alterations don't appear to have a minimal effect on wetland functioning and condition. Patch or microtopographic complexity may be slightly altered, but native plant communities are still supported.
<0.9 - 0.8	*Highly Functioning*	Alterations to topography result in small but detectable changes to habitat conditions throughout all or most of the AA; or changes causing more significant impacts but affecting less than 10% of the AA.
<0.8 - 0.7	*Functioning*	Changes to AA topography may be pervasive but generally mild. May include patches of more significant habitat alteration; or more significant alteration affecting less than 20 % of the AA.
<0.7 - 0.6	*Functioning Impaired*	At least one important surface type or landform has been eliminated or created; microtopography has been moderately altered throughout most or all of the AA, or more severe alterations affect less than 50% AA. Evidence that widespread diminishment or alteration of native plant community exist due to physical habitat alterations. Most incidentally created wetland habitat such as that created by roadside ditches and the like would score in this range or lower.
<0.6	*Non-functioning*	Geomorphic alterations have rendered the AA essentially unusable by *characteristic* wildlife species, or the physical setting no longer supports native plant communities.

Variable 8 Score

0.8

Variable 9: Vegetation Structure and Complexity

This variable is a measure of the condition of the wetland's vegetation relative to its native state. It is particularly relevant to the wetland's ability to perform higher-order functions such as support of wildlife populations, although it also affects primary functions such as flood-flow attenuation. Score this variable by listing stressors that have affected the diversity, composition and cover of each vegetation cover class that would normally be present for the wetland type being assessed. For this variable, stressor severity is a measure of how much each vegetation stratum differs functionally from its natural condition.

Rules for Scoring:

1. Determine the number and types of vegetation layers present within the AA. Make a judgment as to whether additional layers were historically present using direct evidence such as stumps, root wads or historical photographs. Indirect evidence such as local knowledge and expert opinion can also be used in this determination. Check each present or suspected vegetation layer in the third row of the table.

2. Do not score vegetation layers that would not normally be present in the wetland type being assessed.

3. Estimate the percent coverage of each vegetation layer. Aerial photographs can be helpful for this but are not required.

4. Enter the percent cover values as decimals in the row of the stressor table labeled "Percent Cover of Layer". Note, percentages will often sum to more than 100% (1.0).

5. Determine the severity of stressors acting on each individual canopy layers, indicating their presence with checks in the appropriate boxes of the stressor table.

6. Determine the sub-variable score for each valid vegetation layer using the scoring guidelines on the second page of the scoring sheet. Enter each sub-variable score in the appropriate cell of the row labeled "Veg. Layer Sub-variable Score".

7. Add the "Veg. Layer Sub-variable Scores" and enter the sum in the labled cell to the right of the individual scores. Follow this same process for the "Percent Cover of Layer".

8. Divide the sum of "Veg. Layer Sub-variable Scores" by the total coverage of all layers scored. This product is the Variable 9 score. Enter this number in the labeled box at the bottom of this page.

	Vegetation Layers				
Layers Scored *(check boxes to right to indicate scored layers)*					
Stressor	**Tree**	**Shrub**	**Herb**	**Aquatic**	**Comments**
Noxious Weeds	X		X		Russian olive, thistle (moderate)
Exotic/Invasive spp.			X		Smooth brome, RCG (moderate)
Tree Harvest					
Brush Cutting/Shrub Removal					
Livestock Grazing					
Excessive Herbivory					
Mowing/Haying					
Herbicide					
Loss of Zonation/Homogenization					
Dewatering					
Over Saturation					

	Tree	Shrub	Herb	Aquatic	Total
Percent Cover of Layer	40.00 +	20.00 +	85.00 +	0.00	= 145
	x	x	x	x	÷
Veg. Layer Sub-variable Score	0.85	1	0.9	0	
	=	=	=	=	
Weighted Sub-variable Score	34.00 +	20.00 +	76.50 +		= 130.5

See sub-variable scoring guidelines on following page

Variable 9 Score 0.90

Sub-variable 9 Scoring Guidelines

Based on the list of stressors identified above, rate the severity of their cumulative effect on vegetation structure and complexity for each vegetation layer.

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stressors not present or with an intensity low enough as to not detectably affect the structure, diversity or composition of the vegetation layer.
<0.9 - 0.8	*Highly Functioning*	Stressors present at an intensity levels sufficient to cause detectable, but minor, changes in layer composition. Stress related change should generally be less than 10% for any given attribute (e.g., 10% cover of invasive, 10% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 33% if stressors are confined to patches comprising less than 10% of the wetland.
<0.8 - 0.7	*Functioning*	Stressors present with enough intensity to cause significant changes in the character of vegetation, including alteration of layer coverage, structure complexity and species composition. The vegetation layer retains its essential character though. AA's with a high proportion of non-native grasses will commonly fall in this class. Stress related change should generally be less than 33% for any given attribute (e.g., 33% cover of invasive, 33% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 66% if stressors are confined to patches comprising less than 25% of the wetland.
<0.7 - 0.6	*Functioning Impaired*	Stressor intensity severe enough to cause profound changes to the fundamental character of the vegetation layer. Stress-related change should generally be less than 66% for any given attribute (e.g 66% cover of invasive, 66% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 80% if stressors are confined to patches comprising less than 50% of the wetland.
<0.6	*Non-functioning*	Vegetation layer has been completely removed or altered to the extent that is no longer comparable to the natural structure, diversity and composition.

FACWet Score Card

Scoring Procedure:

1. Transcribe variable scores from each variable data sheet to the corresponding cell in the variable score table.
2. In each Functional Capacity Index (FCI) equation, enter the corresponding variable scores in the equation cells. Do not enter values in the crossed cells lacking labels.
3. Add the variable scores to calculate the total functional points achieved for each function.
4. Divide the total functional points achieved by the functional points possible. The typical number of total points possible is provided, howe if a variable is added or subtracted to FCI equation the total possible points must be adjusted
5. Calculate the Composite FCI, by adding the FCI scores and dividing by the total number of functions scored (usually 7).
6. If scoring is done directly in the Excel spreadsheet, all values will be transferred and calculated automatically.

VARIABLE SCORE TABLE

Buffer & Landscape Context	**Variable 1:**	**Habitat Connectivity - Neighboring Wetland Habitat Loss**	0.70
	Variable 2:	**Habitat Connectivity - Migration/Dispersal Barriers**	0.55
	Variable 3:	**Buffer Capacity**	0.70
Hydrology	**Variable 4:**	**Water Source**	0.90
	Variable 5:	**Water Distribution**	0.80
	Variable 6:	**Water Outflow**	0.85
Abiotic and Biotic Habitat	**Variable 7:**	**Chemical Environment**	0.90
	Variable 8:	**Geomorphology**	0.80
	Variable 9:	**Vegetation Structure and Complexity**	0.90

Functional Capacity Indices

Function							Total Functional Points		Functional Capacity Index
Function 1 -- Support of Characteristic Wildlife Habitat	$V1_{wetloss}$ +	$V2_{barriers}$ +	$V3_{buffer}$ +	$(2 \times V9_{veg})$					
	0.70 +	0.55 +	0.70 +	1.80 +	+		= 3.75	÷ 5	= 0.75
Function 2 -- Support of Characteristic Fish/aquatic Habitat	$(3 \times V4_{source})$ +	$(2 \times V5_{dist})$ +	$2 \times V6_{outflow}$ +	$V7_{chem}$ +	$V8_{geom}$				
	2.70 +	1.60 +	1.70 +	0.90 +	0.80 +		= 7.70	÷ 9	= 0.86
Function 3 -- Flood Attenuation	$V3_{buffer}$ +	$2 \times V4_{source}$ +	$(2 \times V5_{dist})$ +	$2 \times V6_{outflow}$ +	$V8_{geom}$ +	$V9_{veg}$			
	0.70 +	1.80 +	1.60 +	1.70 +	0.80 +	0.90	= 7.50	÷ 9	= 0.83
Function 4 -- Short- and Long-term Water Storage	V_{source} +	$(2 \times V5_{dist})$ +	$2 \times V6_{outflow})$	$V8_{geom}$					
	0.90 +	1.60 +	1.70 +	0.80 +	+		= 5.00	÷ 6	= 0.83
Function 5 -- Nutrient/Toxicant Removal	$(2 \times V5_{dist})$ +	$V7_{chem}$ +	$V8_{geom}$						
	1.60 +	0.90 +	0.80 +	+	+		= 3.30	÷ 4	= 0.83
Function 6 -- Sediment Retention/Shoreline Stabilization	$V3_{buffer}$ +	$(2 \times V8_{geo})$ +	$(2 \times V9_{veg})$						
	0.70 +	1.60 +	1.80 +	+	+		= 4.10	÷ 5	= 0.82
Function 7 -- Production Export/Food Chain Support	$V1_{wetloss}$ +	$2 \times V6_{outflow}$ +	$V7_{chem}$ +	$V8_{geo}$ +	$(2 \times V9_{veg})$				
	0.70 +	1.70 +	0.90 +	0.80 +	1.80 +		= 5.90	÷ 7	= 0.84

Sum of Individual FCI Scores **5.76**

Divide by the Number of Functions Scored (usually 7) **÷ 7**

Composite FCI Score **0.82**

ADMINISTRATIVE CHARACTERIZATION

General Information

		Date of Evaluation:	12/9/2008
Site Name or ID:	Plum Creek 1	Project Name:	Chatfield Reallocation FR/EIS
404 or Other Permit Application #:		Lead Federal Agency	U.S. Army Corps of Engineers
Evaluator Name(s):	Mary L. Powell	Evaluator's professional position and organization:	Natural Resource Specialist, ERO Resources, Corp.

Location Information:

Site Location (Lat./Long. or UTM):	495407.8166 4376719.371	Geographic Datum Used (NAD 83 preferred):	AND 83
USGS Quadrangle Map:	Littleton	Map Scale: (Circle one)	**1:24,000** 1:100,000 Other 1:
Sub basin Name (8 digit HUC):	10190002	Wetland Ownership:	U.S. Army Corps of Engineers

Project Information:

This evaluation is being performed at: *(Check applicable box)*

- [x] *Project Wetland*
- [ ] *Mitigation Site*

Purpose of Evaluation (check all applicable):

- [x] *Potentially Impacted Wetlands*
- [ ] *Mitigation; Pre-construction*
- [ ] *Mitigation; Post-construction*
- [ ] *Monitoring*
- [ ] *Other (Describe)*

Intent of Project: *(Check all applicable)* X Preservation X Restoration X Enhancement X Creation

Total Size of Wetland Involved: (Record Area, Check and Describe Measurement Method Used)	2.77 ac.	X Measured					
		Estimated					
Assessment Area (AA) Size (Record Area, check appropriate box. Additional spaces are used to record acreage when more than one AA is included in a single assessment)	ac.	X Measured	ac.	ac.	ac.	ac.
		Estimated	ac.	ac.	ac.	ac.
Characteristics or Method used for AA boundary determination:	Extent of AA determined by wetland mapping performed by TetraTech for FR/EIS study. Wetlands of same wetland category were grouped together based logical location on landscape.						

Notes:	Patches of wetlands/riparian habitat along shore of reservoir. Larger patch has some connection to Plum Creek corridor

ECOLOGICAL DESCRIPTION 1

Special Concerns

Check all that apply

- [ ] Organic soils including Histosols or Histic Epipedons are present in the AA (i.e., AA includes core fen habitat).
- [ ] Project will directly impact organic soil portions of the AA including areas possessing either Histosol soils or histic epipedons.
- [ ] Organic soils are known to occur anywhere within the contiguous wetland of which the AA is part.
- [ ] The wetland is a habitat oasis in an otherwise dry or urbanized landscape?
- [X] Federally threatened or endangered species are **KNOWN** to occur in the AA? List Below.
- [ ] Federally threatened or endangered species are **SUSPECTED** to occur in the AA?
- [ ] Species of concern according to the Colorado Natural Heritage (CNHP) are known to occur in the AA?
- [ ] The site is located within a potential conservation area or element occurrence buffer area as determined by CNHP?
- [ ] Other special concerns (please describe)

HYDROGEOMORPHIC SETTING

- [ ] AA wetland maintains its fundamental natural hydrogeomorphic characteristics
- [X] AA wetland has been subject to change in HGM classes as a result of anthropogenic modification

If the above is checked, please describe the original wetland type if discernable using the table below.

- [ ] AA wetland was created from an upland setting.

Historical Conditions

Previous wetland typology

Water source	**Surface flow**	**Groundwater**	Precipitation	Unknown
Hydrodynamics	**Unidirectional**	Vertical		
Geomorphic Setting (Narrative Description)	Some wetlands were probably not present or were likely associated with Plum Creek riparian corridor prior to reservoir.			
Previous HGM Class	**Riverine**	Slope	Depressional	Lacustrine

Current Conditions

Describe the hydrogeomorphic setting of the wetland by circling all conditions that apply.

HGM Setting

Water source	**Surface flow**	**Groundwater**	Precipitation	Unknown		
Hydrodynamics	Unidirectional	**Vertical**				
Wetland Gradient	**0 - 2%**	2-4%	4-10%	>10%		
# Surface Inlets	**Over-bank**	0	1	2	3	>3
# Surface Outlets	**Over-bank**	0	1	2	3	>3
Geomorphic Setting (Narrative Description)	Wetlands located at perimeter of Chatfield Reservoir. Wetlands may have been present prior to the reservoir, but their hydrology is now greatly influenced by reservoir levels.					
HGM class	Riverine	Slope	Depressional	**Lacustrine**		

Notes (include information on charcteristics used to formulate reference standard): Reference standard is riverine wetlands/riparian along Plum Creek prior to construction of Chatfield Dam. The reference standard assumes that the existing wetlands are more influenced by the lake than by Plum Creek.

ECOLOGICAL DESCRIPTION 2

Vegetation Habitat Description

*US FWS habitat classification according as reported in Cowardin et. al (1979) - See also Appendix *** of FACWet User Guide.*

System	Subsystem	Class	Subclass	Water Regime	Other Modifiers	% AA
Palustrine	Palustrine	Forested	Broad-leaved Decid.	Intermittently flooded		100
Lacustrine Palustrine Riverine	Littoral; Limnoral Palustrine Lower perennial; Upper perennial; Intermittent	Rock Bot. (RB) Uncon Bottom(UB) Aquatic Bed(AB) Rocky Shore(RS) Uncon Shore(US) Emergent(EM) Shrub-scrub(SS) Forested (FO)	Floating vascular; Rooted vascular; Algal; Persistent; Non-Persistent; Broad-leaved deciduous; Needle-leaved evergreen; Cobble - gravel; Sand; Mud; Organic	**Examples** Temporarily flooded(A); Saturated(B); Seasonally flooded(C); Seas.-flood./sat.(E); Perm. flooded(F); Intermittently Flooded(G); Artificially Flooded(K); Sat./semiperm./Seas. (Y); Int. exposed/permenant(Z)	Hypersaline(7) ; Eusaline(8); Mixosaline(9); Fresh(0); Acid(a); Circumneutral(c); Alkaline/calcareous(i); Organic(g); Mineral(n); Beaver(b); Partially Drained/ditched(d); Farmed(f); Diked/impounded(h); Artificial Substrate(r); Spoil(s); Excavated(x)	

Site Map

Scale: 1 sq. =

Draw a sketch map of the site including relevant portions of the wetland, AA boundary, structures, habitat classes, and other significant features.

Variable 1: Habitat Connectivity - Neighboring Wetland Habitat Loss

This variable is a measure of how isolated from other naturally-occurring wetland or riparian habitat the AA has become as a result of the loss of that habitat. To score this variable, estimate the percent of naturally- occurring wetland/riparian habitat that has been lost (by filling, draining, development, or whatever means) within a 500-meter-wide belt surrounding the AA. This surrounding area is called the Habitat Connectivity Envelope (HCE). Historical photographs and NWI maps can be helpful in scoring this variable. In most cases the evaluator must use best professional judgment in estimating the amount of natural wetland loss. Evaluation of landforms and habitat patterns in the context of perceivable land use change should be used to steer estimates of the amount of wetland loss within the HCE. This variable is not meant to penalize AAs that are naturally isolated, or unique to the landscape. Rather, it should measure the degree to which natural habitat connectivity has been lost.

Rules for Scoring:

1. On the aerial photo outline the area that is within 500 meters of the AA.
2. Identify obvious natural barriers within 500 m of the AA boundary.
   - *Natural barriers include continuous cliff bands, deep open water, etc.*
3. Draw the **Habitat Connectivity Envelope**(HCE) on the aerial image.
   - *The HCE is all the area within 500 meters of the AA that is not separated from it by a natural barrier.*
4. Outline the current extent of naturally occurring wetland and riparian habitat. Then outline areas where the habitats appear to have historically occurred.
   - *Use your knowledge of the history of the area and evident land use change. Additional research could be utilized to increase the accuracy of this estimate including consideratation of floodplain maps, historical aerials, etc.*

Variable Score	Condition Category	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	*Wetland losses are absent or negligible or there is no evidence to suggest the native landscape within the HCE historically contained other wetland habitats*
<0.9 - 0.8	*Highly Functioning*	*More than 80% of historical wetland habitat area within the HCE is still present (less than 20% historical wetland habitat area lost).*
<0.8 - 0.7	*Functioning*	*80 to 60% of historical wetland habitat area within the HCE is still present (20% to 40% historical wetland habitat area lost).*
<0.7 - 0.6	*Functioning Impaired*	*Less than 60 to 30% of historical wetland habitat area within the HCE is still present (more than 30 to 70% historical wetland habitat area lost).*
<0.6	*Non-functioning*	*Less than 30% of the historical wetland habitat area from within the HCE is now no longer in existence (more than 70% historical wetland habitat area lost).*

Variable 1 Score 0.9

Notes: Chatfield Reservoir has inundated portions of riparian corridor.

Variable 2: Habitat Connectivity - Migration/Dispersal Barriers

This variable is intended to rate the degree to which the AA has become isolated from existing neighboring wetland and riparian habitat by artificial barriers that inhibit migration or dispersal of organisms. On the aerial photograph, identify the man-made barriers within the HCE that intercede between the AA and surrounding wetlands and riparian areas, and identify them by type on the stressor list. Score this variable based on the barriers' impermeability to migration and dispersal and the amount of surrounding wetland/riparian habitat they affect.

Rules for Scoring:

1. On the aerial photo, outline all existing wetland and riparian habitat areas (WHAs) within the HCE.
2. Identify artificial barriers to dispersal and migration of organisms within the HCE that intercede between the AA and surrounding habitats. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.
3. Considering the composite effect of all of identified barriers to migration and dispersal (i.e., stressors), assign an overall variable score using the scoring guidelines.

Stressors = artificial barriers	✔	Stressors	Comments/description
		Major Highway	
		Secondary Highway	
	X	Tertiary Roadway	Interior park roads, parking lot (moderate)
		Railroad	
	X	Bike Path	Soft surface trail across rip. corridor, bridge over creek (mod)
		Urban Development	
		Agricultural Development	
	X	Artificial Water Body	Reservoir (high)
		Fence	
		Ditch or Aqueduct	
		Aquatic Organism Barriers	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	No appreciable barriers exist between the AA and other wetland and riparian habitats in th HCE; or there are no other wetland and riparian areas in the HCE.
<0.9 - 0.8	*Highly Functioning*	Barriers impeding migration/dispersal between the AA and up to 33% of surrounding WHA highly permeable and easily passed by most organisms. Examples could include gravel roads, minor levees, ditches or barbed-wire fences. More significant barriers (see "functioning category below) could affect migration to up to 10% of surrounding WHA.
<0.8 - 0.7	*Functioning*	Barriers to migration and dispersal retard the ability of many organisms/propagules to pass between the AA and up to 66% of WHA. Passage of organisms and propagules through such barriers is still possible, but it may be constrained to certain times of day, be slow, dangerous or require additional travel. Busy two-lane roads, culverted areas, small to medium artificial water bodies or small earthen dams would commonly rate a score in this range. More significant barriers (see "functioning impaired" category below) could affect migration to up to 10% of surrounding WHA.
<0.7 - 0.6	*Functioning Impaired*	Barriers to migration and dispersal preclude the passage of some types of organisms/propagules between the AA and up to 66% of surrounding WHA. Travel of those animals which can potential negotiate the barrier are strongly restricted and may include a high chance of mortality. Up to 33% of surrounding WHA could be functionally isolated from the AA.
<0.6	*Non-functioning*	AA is essentially isolated from surrounding WHA by impermeable migration and dispersal barriers. An interstate highway or concrete-lined water conveyance canal are examples of barriers which would generally create functional isolation between the AA and a WHA.

Variable 2 Score 0.7

Variable 3: Buffer Capacity

The buffer area is defined as a 250-meter-wide belt surrounding the perimeter of the AA. This variable is a measure of the capacity of that area to function as an effective buffer for the wetland against the deleterious effects of surrounding land use change. To score the variable, assume that the AA is 100% buffered except where land use changes inside the buffer area have diminished this quality. Identify these land use types as specific stressors in the list. For each stressor, rate severity and extent within the buffer area; then use this list to make an overall rating for the buffer's departure from reference conditions. When rating buffer capacity, consider both the intensity of the impact and the proximity of the stressor to the AA.

Rules for Scoring:

1. On the aerial photograph, outline the buffer area as the zone within 250 meters of the outer boundary of the AA.
2. Use the stressor list to record land use changes that affect buffering capacity within the buffer area. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.
3. Considering all of the identified stressors, their overall severity, extent and proximity to the AA assign an overall variable score using the scoring guidelines.

Stressors = Land Use Changes	✔	Stressors	Comments/description
		Industrial/commercial	
		Urban	
		Residential	
		Rural	
		Dryland Farming	
		Intensive Agriculture	
		Orchards or Nurseries	
		Livestock Grazing	
		Transportation Corridor	
		Urban Parklands	
		Dams/impoundments	
	X	Artificial Water body	Chatfield Reservoir (high)
		Physical Resource Extraction	
		Biological Resource Extraction	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	No appreciable land use change has been imposed within the TBA and it provides the full buffering capacity.
<0.9 - 0.8	*Highly Functioning*	Some land use change has occurred in the BA, but such changes little impair the area's ability to provide a buffering function, either because land use is not intensive, for example haying, light grazing, or nurseries, or more substantial changes occur in approximately less than 10% of the BA.
<0.8 - 0.7	*Functioning*	BA has been subjected to a marked shift in land use, however, the land retains much of its original buffering capacity. Moderate-intensity land uses such as dry-land farming, urban "green" corridors, or moderate cattle grazing would commonly be placed within this scoring range.
<0.7 - 0.6	*Functioning Impaired*	Land use within the BA has been substantial including the a moderate to high coverage (up to 50%) of impermeable surfaces, bare soil, or other artificial surface; considerable in-flow urban runoff or fertilizer-rich waters common. While, the buffering capacity of the land has been greatly diminished it is not extinguished. Intensively logged areas, low-density urban developments, some urban parklands and some cropping situations would commonly rate a score within this range.
<0.6	*Non-functioning*	The area within the BA provides essentially no buffering capacity. Many Commercial developments or highly urban landscapes would rate a score of less than 0.6.

Variable 3 score 0.73

Variable 4: Water Source

This variable is concerned with up-gradient hydrologic connectivity. It is a measure of the impacts to the AA's water source, including the ability of source water to perform work such as sediment transport, erosion, soil pore flushing, etc. To score this variable, identify stressors that alter the source of water to the AA, and record their presence on the stressor list. Stressors can impact water source by depletion, augmentation, or alteration of inflow timing or hydrodynamics. For riverine systems, this variable is primarily concerned with the connection of the channel to the floodplain.This variable is designed to assess water quantity, power and timing, not water quality. Water quality will be evaluated in Variable 7.

Scoring rules:

1. Use the stressor list and knowledge of the watershed to catalog type-specific impairments of the AA's water source. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.

2. Considering the composite effect of stressors on the water source, rate the condition of this variable with the aid of the scoring guidelines.

✔	Stressors	Comments/description
	Ditches or Drains (tile, etc.)	
X	Dams	High water augments supply (high)
	Diversions	
	Groundwater pumping	
X	Draw-downs	Reservoir (high)
	Culverts or Constrictions	
	Point Source (urban, ind., ag.)	
	Non-point Source	
	Increased Drainage Area	
	Storm Drain/Urban Runoff	
	Impermeable Surface Runoff	
	Irrigation Return Flows	
	Mining/Natural Gas Extraction	
	Transbasin Diversion	
	Actively Managed Hydrology	

Variable Score	Condition Class	Depletion	Augmentation
1.0 - 0.9	*Reference Standard*	Unnatural drawdown events minor, rare or non-existent, very slight uniform depletion, or trivial alteration of hydrodynamics.	Unnatural high-water events minor, rare or non-existent, slight uniform increase in amount of inflow, or trivial alteration of hydrodynamics.
<0.9 - 0.8	*Highly Functioning*	Unnatural drawdown events occasional, short duration and/or mild; or uniform depletion up to 20%; or mild to moderate reduction of peak flows or natural capacity of water to perform work.	Occasional unnatural high-water events, short in duration and/or mild in intensity; or uniform augmentation up to 20%; or mild to moderate increase of peak flows or natural capacity of water to perform work.
<0.8 - 0.7	*Functioning*	Unnatural drawdown events common and of mild to moderate intensity and/or duration; or uniform depletion up to 50%; or moderate to substantial reduction of peak flows or natural capacity of water to perform work.	Common occurrence of unnatural high-water events, of a mild to moderate intensity and/or duration; or uniform augmentation up to 50%; or moderate to substantial reduction of peak flows or natural capacity of water to perform work.
<0.7 - 0.6	*Functioning Impaired*	Unnatural drawdown events occur frequently with a moderate to high intensity and/or duration; or uniform depletion up to 75%; or substantial reduction of peak flows or natural capacity of water to perform work. **Wetlands with actively managed or wholly artificial hydrology will usually score in this range or lower.**	Common occurrence of unnatural high-water events, some of which may be severe in nature or exist for a substantial portion of the growing season; or uniform augmentation more than 50% or natural capacity of water to perform work. **Wetlands with actively managed or wholly artificial hydrology will usually score in this range or lower.**
<0.6	*Non-functioning*	Water source diminished enough to threaten jurisdictional classification of the AA.	Frequency, duration or magnitude of unnaturally high-water great enough to change the fundamental characteristics of the wetland.

Variable 4 Score 0.65

Variable 5: Water Distribution

This variable is concerned with hydrologic connectivity within the AA. It is a measure of alteration to the spatial distribution of surface and groundwater within the AA. These alterations are manifested as local changes to the hydrograph and generally ***result*** *from geomorphic modifications. To score this variable, identify stressors that alter flow patterns and impact the hydrograph within portions of the AA, including localized increases or decreases to the depth or duration of the water table or surface water. In naturally confined rivers (i.e. canyons and gullies) floodplain width is generally very small, so these systems will tend to score high for this variable unless some gross stressor is present.*

Scoring rules:

1. Identify impacts to the natural distribution of water throughout the AA and catalog them in the stressor table.
2. Considering all of the stressors identified, assign an overall variable score using the scoring guidelines.

✔	Stressors	Comments/description
	Ditches	
	Ponding/Impoundment	
	Culverts	
	Road Grades	
	Channel Incision/Entrenchment	
	Hardened/Engineered Channel	
	Enlarged Channel	
	Artificial Banks/Shoreline	Chatfield reservoir affects groundwater table and innudates areas (high)
	Weirs	
	Dikes/Levees/Berms	
	Diversions	
	Sediment/Fill Accumulation	

Variable Score	Condition Class	Non-riverine	Riverine
1.0 - 0.9	*Reference Standard*	Little or no alteration has been made to the way in which water is distributed throughout the wetland.	Natural active floodplain areas flood on a normal recurrence interval. No evidence of alteration of flooding and subirrigation duration and intensity.
<0.9 - 0.8	*Highly Functioning*	Less than 10% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in less than a 2 in. (5 cm) change in mean growing season water table elevation.	Channel-adjacent areas have occasional unnatural periods of drying or flooding; or uniform shift in the hydrograph less than typical root depth.
<0.8 - 0.7	*Functioning*	Between 10 and 33% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in a 4 in. (5 cm) or less change in mean growing season water table elevation.	In channel-adjacent area, periods of drying or flooding are common; or uniform shift in the hydrograph near root depth.
<0.7 - 0.6	*Functioning Impaired*	33 to 66% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in a 6 in. (15 cm) or less change in mean growing season water table elevation. Water table behavior must still meet jurisdictional criteria to merit this rating.	Adjacent to the channel, unnatural periods of drying or flooding are the norm; or uniform shift in the hydrograph greater than root depth.
<0.6	*Non-functioning*	More than 66% of the AA is affected by hydrologic alteration which changes the fundamental functioning of the wetland system	Historical active floodplain areas are almost never wetted from overbank flooding, and/or groundwater infiltration is effectively cut off.

Variable 5 Score | 0.65

Variable 6: Water Outflow

This variable is concerned with down-gradient hydrologic connectivity and the flow of water (transporting materials and energy) out of the AA. It is a measure of impacts that affect the hydrologic outflow of water including the passage of water through its normal low- and high-flow surface outlets, and infiltration/groundwater recharge. In some cases, alteration of evapotranspiration rates may be significant enough of a factor to consider in scoring. Score this variable by identifying stressors that impact the means by which water is exported from the AA. In Variable 5, the stressors were evaluated in light of their impact on water distribution within the AA. To evaluate this variable focus on how water, energy and associated materials are exported out of the AA.

Scoring rules:

1. Identify impacts to the natural outflow of water from the AA and catalog them in the stressor table.

2.Considering all of the stressors identified, assign an overall variable score using the scoring guidelines. Take in to account the cumulative effect of stressors on the wetland's ability to export water and water-borne materials

✔	Stressors	Comments/description
	Ditches	
	Dikes/Levees	
	Road Grades	
	Culverts	
	Diversions	
	Constrictions	
	Channel Incision/Entrenchment	
	Hardened/Engineered Channel	
	Artificial Stream Banks	
	Weirs	
	Confined Bridge Openings	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stressors have little to no effect on the magnitude, timing or hydrodynamics of the AA water outflow regime.
<0.9 - 0.8	*Highly Functioning*	High- or low-water outflows are mildly to moderately affected, but at intermediate ("normal") lev flow continues essentially unaltered in quantity or character.
<0.8 - 0.7	*Functioning*	High- or low-water outflows are moderately affected, mild alteration of intermediate level outflow occurs; or hydrodynamics mildly to moderately affected.
<0.7 - 0.6	*Functioning Impaired*	Outflow at all stages is moderately impaired resulting in persistent flooding of portions of the AA or unnatural drainage; or outflow hydrodynamics significantly disrupted.
<0.6	*Non-functioning*	The natural outflow regime is severely disrupted. Down-gradient hydrologic connection severed or nearly so. Alterations may cause widespread unnatural persistent flooding or dewatering of the wetland system.

Variable 6 Score 0.7

Variable 7: Water and Soil Chemical Environment

This variable concerns the chemical environment of the soil and water media within the AA, including pollutants and water quality. The origin of pollutants may be in the AA or delivered from up-gradient or surrounding areas. Score this variable by listing indicators of chemical stress in the AA. Consider point source and non-point sources of pollution, as well as mechanical or hydrologic changes that alter the chemical environment. Because water quality frequently cannot be inferred directly, the presence of many stressors is identified via indirect indicators.

Scoring rules:

1. Stressors are grouped into categories which have a similar signature or set of causes.
2. Use the indicator list to identify each stressor impacting the chemical environment of the AA.
3. For each stressor category, determine the sub-variable score using the scoring guideline table provided on the second page of the scoring sheet.
 -If the AA is part of a water body that is recognized as impaired or recommended for TMDL development for one of the factors, then score that sub-variable 0.65 or lower.
4. Transcribe sub-variable scores to the following variable scoring page and compute the sum.
5. Determine the variable score by following the scoring guidelines.

Stressor Category	Stressor Indicator	✔	Comments	Sub-variable Score
Nutrient Enrichment/ Eutrophication/ Oxygen (D.O.)	Livestock	X	Upstream livestock (low)	0.95
	Agricultural Runoff			
	Septic/Sewage			
	Excessive Algae or Aquatic Veg.			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Sedimentation/ Turbidity	Excessive Erosion			0.90
	Excessive Deposition	X	Delta formation (low)	
	Fine Sediment Plumes			
	Agricultural Runoff			
	Excessive Turbidity			
	Nearby Construction Site			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Toxic contamination/ pH	Recent Chemical Spills			0.90
	Nearby Industrial Sites	X	Titan Industrial Park (low)	
	Road Drainage/Runoff			
	Livestock	X	Upstream livestock (low)	
	Agricultural Runoff			
	Storm Water Runoff	X	Upstream development (low	
	Fish/Wildlife Impacts			
	Vegetation Impacts			
	Cumulative Watershed NPS			
	Acid Mine Drainage			
	Point Source Discharge			
	CDPHE Impairment/TMDL List			
Temperature	Excessive Temperature Regime			1.00
	Lack of Shading			
	Reservoir/Power Plant Discharge			
	Industrial Discharge			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Soil chemistry/ Redox potential	Unnatural Saturation/Desaturation	X	Reservoir effect	0.80
	Mechanical Soil Disturbance			
	Dumping/introduced Soil			
	CDPHE Impairment/TMDL List			

Variable 7: Water and Soil Chemical Environment

Sub-variable Scoring Guidelines

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stress indicators not present or trivial.
<0.9 - 0.8	*Highly Functioning*	Stress indicators scarcely present and mild, or otherwise not occurring in more than 10% of the AA.
<0.8 - 0.7	*Functioning*	Stress indicators present at mild to moderate levels, or otherwise not occurring in more than 33% of the AA.
<0.7 - 0.6	*Functioning Impaired*	Stress indicators present at moderate to high levels, or otherwise not occurring in more than 66% of the AA
<0.6	*Non-functioning*	Stress indicators strongly evident throughout the AA at levels which apparently alter the fundamental chemical environment of the wetland system

Input each factor score from the stressor list and calculate the sum.

Nutrient enrichment/ Eutrophication/ Oxygen (D.O.)		Sedimentation/ Turbidity		Toxic contamination/ pH		Temperature		Soil chemistry/ Redox potential		Sum of Sub-variable Scores
0.95	+	0.90	+	0.90	+	1.00	+	0.80	=	4.55

Use the table to score the Chemical Environment Variable circling the applicable scoring rules.

Variable Score	Condition Class	Scoring Rules		
		Single Factor		**Composite Score**
1.0 - 0.9	*Reference Standard*	No single factor scores < 0.9	or	The factor scores sum > 4.5
<0.9 - 0.8	*Highly Functioning*	Any single factor scores ≥ 0.8 but < 0.9	or	The factor scores sum >4.0 but ≤4.5
<0.8 - 0.7	*Functioning*	Any single factor scores ≥ 7.0 but < 0.8	or	The factor scores sum >3.5 but ≤ 4.0
<0.7 - 0.6	*Functioning Impaired*	Any single factor scores ≥ 0.6 but <0.7	or	The factor scores sum >3.0 but ≤3.5
< 0.6	*Non-functioning*	Any single factor scores < 0.6	or	The factor scores sum < 3.0

Variable 7 Score 0.9

Variable 8: Geomorphology

This variable is a measure of the degree to which the geomorphic setting has been altered within the AA. Changes to the surface configuration and natural topography constitute stressors. Such stressors may be observed in the form of fill, excavation, diking, sedimentation due to absence of flushing floods, etc. In riverine systems geomorphic changes to stream channel should be considered if the channel is within the AA. Alterations may include bed surface changes (embeddedness or morphology changes), stream bank instability, and stream channel reconfiguration. Geomorphic changes are usually ultimately manifested as changes to wetland hydrology and water relations with vegetation. Geomorphic alteration can also directly affect soil properties, such as near-surface texture, and the wetland chemical environment, such as the redox state or nutrient composition in the rooting zone. In rating this variable, do not include these resultant effects of geomorphic change; rather focus on the physical impacts within the footprint of the alteration. The effects of geomorphic change are addressed by other variables. All alterations to the geomorphology should be evaluated including small-scale impa

Scoring Rules:

1. Identify impacts to geomorphological setting and topography within the AA and record them on the stressor checklist.
2.Considering all of the stressors identified, assign an overall variable score using the scoring guidelines.

✔		Stressors	Comments
	General	Dredging/Excavation/Mining	
	General	Fill, including dikes, road grades, etc	
	General	Grading	
	General	Compaction	
	General	Plowing/Disking	
	General	Excessive Sedimentation	
	General	Dumping	
	General	Hoof Shear/Pugging	
	General	Aggregate or Mineral Mining	
X	General	Sand Accumulation	Delta formation at reservoir edge (moderate
	Channels Only	Channel Instability/Over Widening	
	Channels Only	Excessive Bank Erosion	
	Channels Only	Channelization	
	Channels Only	Reconfigured Stream Channels	
	Channels Only	Artificial Banks/Shoreline	
	Channels Only	Beaver Dam Removal	
	Channels Only	Substrate Embeddedness	
	Channels Only	Lack or Excess of Woody Debris	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Topography essentially unaltered from the natural state, or alterations don't appear to have a minimal effect on wetland functioning and condition. Patch or microtopographic complexity may be slightly altered, but native plant communities are still supported.
<0.9 - 0.8	*Highly Functioning*	Alterations to topography result in small but detectable changes to habitat conditions throughout all or most of the AA; or changes causing more significant impacts but affecting less than 10% of the AA.
<0.8 - 0.7	*Functioning*	Changes to AA topography may be pervasive but generally mild. May include patches of more significant habitat alteration; or more significant alteration affecting less than 20 % of the AA.
<0.7 - 0.6	*Functioning Impaired*	At least one important surface type or landform has been eliminated or created; microtopography has been moderately altered throughout most or all of the AA, or more severe alterations affect less than 50% AA. Evidence that widespread diminishment or alteration of native plant community exist due to physical habitat alterations. Most incidentally created wetland habitat such as that created by roadside ditches and the like would score in this range or lower.
<0.6	*Non-functioning*	Geomorphic alterations have rendered the AA essentially unusable by *characteristic* wildlife species, or the physical setting no longer supports native plant communities.

Variable 8 Score 0.95

Variable 9: Vegetation Structure and Complexity

This variable is a measure of the condition of the wetland's vegetation relative to its native state. It is particularly relevant to the wetland's ability to perform higher-order functions such as support of wildlife populations, although it also affects primary functions such as flood-flow attenuation. Score this variable by listing stressors that have affected the diversity, composition and cover of each vegetation cover class that would normally be present for the wetland type being assessed. For this variable, stressor severity is a measure of how much each vegetation stratum differs functionally from its natural condition.

Rules for Scoring:

1. Determine the number and types of vegetation layers present within the AA. Make a judgment as to whether additional layers were historically present using direct evidence such as stumps, root wads or historical photographs. Indirect evidence such as local knowledge and expert opinion can also be used in this determination. Check each present or suspected vegetation layer in the third row of the table.

2. Do not score vegetation layers that would not normally be present in the wetland type being assessed.

3. Estimate the percent coverage of each vegetation layer. Aerial photographs can be helpful for this but are not required.

4. Enter the percent cover values as decimals in the row of the stressor table labeled "Percent Cover of Layer". Note, percentages will often sum to more than 100% (1.0).

5. Determine the severity of stressors acting on each individual canopy layers, indicating their presence with checks in the appropriate boxes of the stressor table.

6. Determine the sub-variable score for each valid vegetation layer using the scoring guidelines on the second page of the scoring sheet. Enter each sub-variable score in the appropriate cell of the row labeled "Veg. Layer Sub-variable Score".

7. Add the "Veg. Layer Sub-variable Scores" and enter the sum in the labled cell to the right of the individual scores. Follow this same process for the "Percent Cover of Layer".

8. Divide the sum of "Veg. Layer Sub-variable Scores" by the total coverage of all layers scored. This product is the Variable 9 score. Enter this number in the labeled box at the bottom of this page.

	Vegetation Layers				
Layers Scored *(check boxes to right to indicate scored layers)*					
Stressor	**Tree**	**Shrub**	**Herb**	**Aquatic**	**Comments**
Noxious Weeds					
Exotic/Invasive spp.			X		Smooth brome
Tree Harvest					
Brush Cutting/Shrub Removal					
Livestock Grazing					
Excessive Herbivory					
Mowing/Haying					
Herbicide					
Loss of Zonation/Homogenization					
Dewatering					
Over Saturation					

Percent Cover of Layer	60.00	+	20.00	+	20.00	+	0.00	=	100	
	x		x		x		x			
Veg. Layer Sub-variable Score	1		1		0.9				÷	**See sub-variable scoring guidelines on following page**
	=		=		=		=			
Weighted Sub-variable Score	60.00	+	20.00	+	18.00	+		=	98	

Variable 9 Score 0.98

Sub-variable 9 Scoring Guidelines

Based on the list of stressors identified above, rate the severity of their cumulative effect on vegetation structure and complexity for each vegetation layer.

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stressors not present or with an intensity low enough as to not detectably affect the structure, diversity or composition of the vegetation layer.
<0.9 - 0.8	*Highly Functioning*	Stressors present at an intensity levels sufficient to cause detectable, but minor, changes in layer composition. Stress related change should generally be less than 10% for any given attribute (e.g., 10% cover of invasive, 10% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 33% if stressors are confined to patches comprising less than 10% of the wetland.
<0.8 - 0.7	*Functioning*	Stressors present with enough intensity to cause significant changes in the character of vegetation, including alteration of layer coverage, structure complexity and species composition. The vegetation layer retains its essential character though. AA's with a high proportion of non-native grasses will commonly fall in this class. Stress related change should generally be less than 33% for any given attribute (e.g., 33% cover of invasive, 33% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 66% if stressors are confined to patches comprising less than 25% of the wetland.
<0.7 - 0.6	*Functioning Impaired*	Stressor intensity severe enough to cause profound changes to the fundamental character of the vegetation layer. Stress-related change should generally be less than 66% for any given attribute (e.g 66% cover of invasive, 66% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 80% if stressors are confined to patches comprising less than 50% of the wetland.
<0.6	*Non-functioning*	Vegetation layer has been completely removed or altered to the extent that is no longer comparable to the natural structure, diversity and composition.

FACWet Score Card

Scoring Procedure:

1. Transcribe variable scores from each variable data sheet to the corresponding cell in the variable score table.
2. In each Functional Capacity Index (FCI) equation, enter the corresponding variable scores in the equation cells. Do not enter values in the crossed cells lacking labels.
3. Add the variable scores to calculate the total functional points achieved for each function.
4. Divide the total functional points achieved by the functional points possible. The typical number of total points possible is provided, howe if a variable is added or subtracted to FCI equation the total possible points must be adjusted
5. Calculate the Composite FCI, by adding the FCI scores and dividing by the total number of functions scored (usually 7).
6. If scoring is done directly in the Excel spreadsheet, all values will be transferred and calculated automatically.

VARIABLE SCORE TABLE

Buffer & Landscape Context	**Variable 1:**	**Habitat Connectivity - Neighboring Wetland Habitat Loss**	0.90
	Variable 2:	**Habitat Connectivity - Migration/Dispersal Barriers**	0.70
	Variable 3:	**Buffer Capacity**	0.73
Hydrology	**Variable 4:**	**Water Source**	0.65
	Variable 5:	**Water Distribution**	0.65
	Variable 6:	**Water Outflow**	0.70
Abiotic and Biotic Habitat	**Variable 7:**	**Chemical Environment**	0.90
	Variable 8:	**Geomorphology**	0.95
	Variable 9:	**Vegetation Structure and Complexity**	0.98

Functional Capacity Indices

Function 1 -- Support of Characteristic Wildlife Habitat

$V1_{wetloss}$	+ $V2_{barriers}$	+ $V3_{buffer}$	+ $(2 \times V9_{veg})$	+	+	= Total Functional Points	÷	= Functional Capacity Index
0.90	0.70	0.73	1.96			4.29	5	0.86

Function 2 -- Support of Characteristic Fish/aquatic Habitat

$(3 \times V4_{source})$	+ $(2 \times V5_{dist})$	+ $2 \times V6_{outflow}$	+ $V7_{chem}$	+ $V8_{geom}$	+	= Total Functional Points	÷	= Functional Capacity Index
1.95	1.30	1.40	0.90	0.95		6.50	9	0.72

Function 3 -- Flood Attenuation

$V3_{buffer}$	+ $2 \times V4_{source}$	+ $(2 \times V5_{dist})$	+ $2 \times V6_{outflow}$	+ $V8_{geom}$	+ $V9_{veg}$	= Total Functional Points	÷	= Functional Capacity Index
0.73	1.30	1.30	1.40	0.95	0.98	6.66	9	0.74

Function 4 -- Short- and Long-term Water Storage

V_{source}	+ $(2 \times V5_{dist})$	+ $2 \times V6_{outflow})$	$V8_{geom}$	+	+	= Total Functional Points	÷	= Functional Capacity Index
0.65	1.30	1.40	0.95			4.30	6	0.72

Function 5 -- Nutrient/Toxicant Removal

$(2 \times V5_{dist})$	+ $V7_{chem}$	+ $V8_{geom}$	+	+	+	= Total Functional Points	÷	= Functional Capacity Index
1.30	0.90	0.95				3.15	4	0.79

Function 6 -- Sediment Retention/Shoreline Stabilization

$V3_{buffer}$	+ $(2 \times V8_{geo})$	+ $(2 \times V9_{veg})$	+	+	+	= Total Functional Points	÷	= Functional Capacity Index
0.73	1.90	1.96				4.59	5	0.92

Function 7 -- Production Export/Food Chain Support

$V1_{wetloss}$	+ $2 \times V6_{outflow}$	+ $V7_{chem}$	+ $V8_{geo}$	+ $(2 \times V9_{veg})$	+	= Total Functional Points	÷	= Functional Capacity Index
0.90	1.40	0.90	0.95	1.96		6.11	7	0.87

Sum of Individual FCI Scores **5.62**

Divide by the Number of Functions Scored (usually 7) **÷ 7**

Composite FCI Score **0.80**

ADMINISTRATIVE CHARACTERIZATION

General Information

		Date of Evaluation:	12/9/2008
Site Name or ID:	Plum Creek 2	Project Name:	Chatfield Reallocation FR/EIS
404 or Other Permit Application #:		Lead Federal Agency	U.S. Army Corps of Engineers
Evaluator Name(s):	Mary L. Powell	Evaluator's professional position and organization:	Natural Resource Specialist, ERO Resources, Corp.

Location Information:

Site Location (Lat./Long. or UTM):	496027.2396 4376755.331	Geographic Datum Used (NAD 83 preferred):	AND 83
USGS Quadrangle Map:	Littleton	Map Scale: (Circle one)	**1:24,000** 1:100,000 Other 1:
Sub basin Name (8 digit HUC):	496027.2396 4376755.331	Wetland Ownership:	U.S. Army Corps of Engineers

Project Information:

This evaluation is being performed at: *(Check applicable box)*
- [x] *Project Wetland*
- [ ] *Mitigation Site*

Purpose of Evaluation (check all applicable):
- [x] *Potentially Impacted Wetlands*
- [ ] *Mitigation; Pre-construction*
- [ ] *Mitigation; Post-construction*
- [ ] *Monitoring*
- [ ] *Other (Describe)*

Intent of Project: *(Check all applicable)* X Preservation X Restoration X Enhancement X Creation

Total Size of Wetland Involved: (Record Area, Check and Describe Measurement Method Used)	16.50 ac.	X	Measured				
			Estimated				
Assessment Area (AA) Size (Record Area, check appropriate box. Additional spaces are used to record acreage when more than one AA is included in a single assessment)	ac.	X	Measured	ac.	ac.	ac.	ac.
			Estimated	ac.	ac.	ac.	ac.
Characteristics or Method used for AA boundary determination:	Extent of AA determined by wetland mapping performed by TetraTech for FR/EIS study. Wetlands of same wetland category were grouped together based logical location on landscape.						
Notes:							

ECOLOGICAL DESCRIPTION 1

Special Concerns

Check all that apply

- [ ] Organic soils including Histosols or Histic Epipedons are present in the AA (i.e., AA includes core fen habitat).
- [ ] Project will directly impact organic soil portions of the AA including areas possessing either Histosol soils or histic epipedons.
- [ ] Organic soils are known to occur anywhere within the contiguous wetland of which the AA is part.
- [ ] The wetland is a habitat oasis in an otherwise dry or urbanized landscape?
- [X] Federally threatened or endangered species are **KNOWN** to occur in the AA? List Below.
- [ ] Federally threatened or endangered species are **SUSPECTED** to occur in the AA?
- [ ] Species of concern according to the Colorado Natural Heritage (CNHP) are known to occur in the AA?
- [ ] The site is located within a potential conservation area or element occurrence buffer area as determined by CNHP?
- [ ] Other special concerns (please describe)

HYDROGEOMORPHIC SETTING

- [X] AA wetland maintains its fundamental natural hydrogeomorphic characteristics
- [ ] AA wetland has been subject to change in HGM classes as a result of anthropogenic modification

If the above is checked, please describe the original wetland type if discernable using the table below.

- [ ] AA wetland was created from an upland setting.

Previous wetland typology

Historical Conditions				
Water source	Surface flow	Groundwater	Precipitation	Unknown
Hydrodynamics	Unidirectional	Vertical		
Geomorphic Setting (Narrative Description)				
Previous HGM Class	Riverine	Slope	Depressional	Lacustrine

Current Conditions

Describe the hydrogeomorphic setting of the wetland by circling all conditions that apply.

HGM Setting

Water source	**Surface flow**	**Groundwater**	Precipitation	Unknown			
Hydrodynamics	**Unidirectional**	Vertical					
Wetland Gradient	**0 - 2%**	2-4%	4-10%	>10%			
# Surface Inlets	Over-bank	0	**1**	2	3	>3	
# Surface Outlets	**Overbank**	0	1	2	3	>3	
Geomorphic Setting (Narrative Description)	Wetlands located slightly above OHW of Chatfield Reservoir. Wetlands were probably present prior to the reservoir, but their subsurface hydrology is now influenced by reservoir levels.						
HGM class	**Riverine**	Slope	Depressional	Lacustrine			

Notes (include information on charcteristics used to formulate reference standard): Reference standard is Plum Creek prior to construction of Chatfield Dam. The reference standard assumes that groundwater hydrograph in the riparian corridor at this location had different seasonal fluctuations than it currently does.

ECOLOGICAL DESCRIPTION 2

Vegetation Habitat Description

*US FWS habitat classification according as reported in Cowardin et. al (1979) - See also Appendix *** of FACWet User Guide.*

System	Subsystem	Class	Subclass	Water Regime	Other Modifiers	% AA
Riverine	Palustrine	Shrub-scrub	Persistent	Intermittently flooded		85
Riverine	Palustrine	Forested	Broad-leaved Decid.	Intermittently flooded		10
Riverine	Palustrine	Emergent	Persistent	Intermittently flooded		5
Lacustrine Palustrine Riverine	Littoral; Limnoral Palustrine Lower perennial; Upper perennial; Intermittent	Rock Bot. (RB) Uncon Bottom(UB) Aquatic Bed(AB) Rocky Shore(RS) Uncon Shore(US) Emergent(EM) Shrub-scrub(SS) Forested (FO)	Floating vascular; Rooted vascular; Algal; Persistent; Non-Persistent; Broad-leaved deciduous; Needle-leaved evergreen; Cobble - gravel; Sand; Mud; Organic	**Examples** Temporarily flooded(A); Saturated(B); Seasonally flooded(C); Seas.-flood./sat.(E); Perm. flooded(F); Intermittently Flooded(G); Artificially Flooded(K); Sat./semiperm./Seas. (Y); Int. exposed/permenant(Z)	Hypersaline(7) ; Eusaline(8); Mixosaline(9); Fresh(0); Acid(a); Circumneutral(c); Alkaline/calcareous(i); Organic(g); Mineral(n); Beaver(b); Partially Drained/ditched(d); Farmed(f); Diked/impounded(h); Artificial Substrate(r); Spoil(s); Excavated(x)	

Site Map

Scale: 1 sq. =

Draw a sketch map of the site including relevant portions of the wetland, AA boundary, structures, habitat classes, and other significant features.

Variable 1: Habitat Connectivity - Neighboring Wetland Habitat Loss

This variable is a measure of how isolated from other naturally-occurring wetland or riparian habitat the AA has become as a result of the loss of that habitat. To score this variable, estimate the percent of naturally- occurring wetland/riparian habitat that has been lost (by filling, draining, development, or whatever means) within a 500-meter-wide belt surrounding the AA. This surrounding area is called the Habitat Connectivity Envelope (HCE). Historical photographs and NWI maps can be helpful in scoring this variable. In most cases the evaluator must use best professional judgment in estimating the amount of natural wetland loss. Evaluation of landforms and habitat patterns in the context of perceivable land use change should be used to steer estimates of the amount of wetland loss within the HCE. This variable is not meant to penalize AAs that are naturally isolated, or unique to the landscape. Rather, it should measure the degree to which natural habitat connectivity has been lost.

Rules for Scoring:

1. On the aerial photo outline the area that is within 500 meters of the AA.

2. Identify obvious natural barriers within 500 m of the AA boundary.

   - Natural barriers include continuous cliff bands, deep open water, etc.

3. Draw the **Habitat Connectivity Envelope**(HCE) on the aerial image.

   - The HCE is all the area within 500 meters of the AA that is not separated from it by a natural barrier.

4. Outline the current extent of naturally occurring wetland and riparian habitat. Then outline areas where the habitats appear to have historically occurred.

   - Use your knowledge of the history of the area and evident land use change. Additional research could be utilized to increase the accuracy of this estimate including consideratation of floodplain maps, historical aerials, etc.

Variable Score	Condition Category	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	*Wetland losses are absent or negligible or there is no evidence to suggest the native landscape within the HCE historically contained other wetland habitats*
<0.9 - 0.8	*Highly Functioning*	*More than 80% of historical wetland habitat area within the HCE is still present (less than 20% historical wetland habitat area lost).*
<0.8 - 0.7	*Functioning*	*80 to 60% of historical wetland habitat area within the HCE is still present (20% to 40% historical wetland habitat area lost).*
<0.7 - 0.6	*Functioning Impaired*	*Less than 60 to 30% of historical wetland habitat area within the HCE is still present (more than 30 to 70% historical wetland habitat area lost).*
<0.6	*Non-functioning*	*Less than 30% of the historical wetland habitat area from within the HCE is now no longer in existence (more than 70% historical wetland habitat area lost).*

Variable 1 Score 0.92

Notes: Chatfield Reservoir has inundated portions of riparian corridor.

Variable 2: Habitat Connectivity - Migration/Dispersal Barriers

This variable is intended to rate the degree to which the AA has become isolated from existing neighboring wetland and riparian habitat by artificial barriers that inhibit migration or dispersal of organisms. On the aerial photograph, identify the man-made barriers within the HCE that intercede between the AA and surrounding wetlands and riparian areas, and identify them by type on the stressor list. Score this variable based on the barriers' impermeability to migration and dispersal and the amount of surrounding wetland/riparian habitat they affect.

Rules for Scoring:

1. On the aerial photo, outline all existing wetland and riparian habitat areas (WHAs) within the HCE.

2. Identify artificial barriers to dispersal and migration of organisms within the HCE that intercede between the AA and surrounding habitats. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.

3. Considering the composite effect of all of identified barriers to migration and dispersal (i.e., stressors), assign an overall variable score using the scoring guidelines.

Stressors = artificial barriers

✔	Stressors	Comments/description
	Major Highway	
	Secondary Highway	
X	Tertiary Roadway	Interior park roads, parking lot (moderate)
X	Railroad	BNSF (high)
X	Bike Path	Soft surface trail across rip. corridor, bridge over creek (mod)
	Urban Development	
	Agricultural Development	
X	Artificial Water Body	Reservoir (high)
	Fence	
X	Ditch or Aqueduct	Highline Canal (low)
	Aquatic Organism Barriers	
X		Dam (moderate)

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	No appreciable barriers exist between the AA and other wetland and riparian habitats in th HCE; or there are no other wetland and riparian areas in the HCE.
<0.9 - 0.8	*Highly Functioning*	Barriers impeding migration/dispersal between the AA and up to 33% of surrounding WHA highly permeable and easily passed by most organisms. Examples could include gravel roads, minor levees, ditches or barbed-wire fences. More significant barriers (see "functioning category below) could affect migration to up to 10% of surrounding WHA.
<0.8 - 0.7	*Functioning*	Barriers to migration and dispersal retard the ability of many organisms/propagules to pass between the AA and up to 66% of WHA. Passage of organisms and propagules through such barriers is still possible, but it may be constrained to certain times of day, be slow, dangerous or require additional travel. Busy two-lane roads, culverted areas, small to medium artificial water bodies or small earthen dams would commonly rate a score in this range. More significant barriers (see "functioning impaired" category below) could affect migration to up to 10% of surrounding WHA.
<0.7 - 0.6	*Functioning Impaired*	Barriers to migration and dispersal preclude the passage of some types of organisms/propagules between the AA and up to 66% of surrounding WHA. Travel of those animals which can potential negotiate the barrier are strongly restricted and may include a high chance of mortality. Up to 33% of surrounding WHA could be functionally isolated from the AA.
<0.6	*Non-functioning*	AA is essentially isolated from surrounding WHA by impermeable migration and dispersal barriers. An interstate highway or concrete-lined water conveyance canal are examples of barriers which would generally create functional isolation between the AA and a WHA.

Variable 2 Score 0.57

Variable 3: Buffer Capacity

The buffer area is defined as a 250-meter-wide belt surrounding the perimeter of the AA. This variable is a measure of the capacity of that area to function as an effective buffer for the wetland against the deleterious effects of surrounding land use change. To score the variable, assume that the AA is 100% buffered except where land use changes inside the buffer area have diminished this quality. Identify these land use types as specific stressors in the list. For each stressor, rate severity and extent within the buffer area; then use this list to make an overall rating for the buffer's departure from reference conditions. When rating buffer capacity, consider both the intensity of the impact and the proximity of the stressor to the AA.

Rules for Scoring:

1. On the aerial photograph, outline the buffer area as the zone within 250 meters of the outer boundary of the AA.

2. Use the stressor list to record land use changes that affect buffering capacity within the buffer area. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.

3. Considering all of the identified stressors, their overall severity, extent and proximity to the AA assign an overall variable score using the scoring guidelines.

Stressors = Land Use Changes	✓	Stressors	Comments/description
	X	Industrial/commercial	Light industry to east (moderate)
		Urban	
		Residential	
		Rural	
		Dryland Farming	
		Intensive Agriculture	
		Orchards or Nurseries	
		Livestock Grazing	
	X	Transportation Corridor	Railroad (moderate)
		Urban Parklands	
	X	Dams/impoundments	Chatfield Dam (moderate)
	x	Artificial Water body	Chatfield Reservoir (high)
		Physical Resource Extraction	
		Biological Resource Extraction	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	No appreciable land use change has been imposed within the TBA and it provides the full buffering capacity.
<0.9 - 0.8	*Highly Functioning*	Some land use change has occurred in the BA, but such changes little impair the area's ability to provide a buffering function, either because land use is not intensive, for example haying, light grazing, or nurseries, or more substantial changes occur in approximately less than 10% of the BA.
<0.8 - 0.7	*Functioning*	BA has been subjected to a marked shift in land use, however, the land retains much of its original buffering capacity. Moderate-intensity land uses such as dry-land farming, urban "green" corridors, or moderate cattle grazing would commonly be placed within this scoring range.
<0.7 - 0.6	*Functioning Impaired*	Land use within the BA has been substantial including the a moderate to high coverage (up to 50%) of impermeable surfaces, bare soil, or other artificial surface; considerable in-flow urban runoff or fertilizer-rich waters common. While, the buffering capacity of the land has been greatly diminished it is not extinguished. Intensively logged areas, low-density urban developments, some urban parklands and some cropping situations would commonly rate a score within this range.
<0.6	*Non-functioning*	The area within the BA provides essentially no buffering capacity. Many Commercial developments or highly urban landscapes would rate a score of less than 0.6.

Variable 3 score 0.68

Variable 4: Water Source

This variable is concerned with up-gradient hydrologic connectivity. It is a measure of the impacts to the AA's water source, including the ability of source water to perform work such as sediment transport, erosion, soil pore flushing, etc. To score this variable, identify stressors that alter the source of water to the AA, and record their presence on the stressor list. Stressors can impact water source by depletion, augmentation, or alteration of inflow timing or hydrodynamics. For riverine systems, this variable is primarily concerned with the connection of the channel to the floodplain.This variable is designed to assess water quantity, power and timing, not water quality. Water quality will be evaluated in Variable 7.

Scoring rules:

1. Use the stressor list and knowledge of the watershed to catalog type-specific impairments of the AA's water source. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.

2. Considering the composite effect of stressors on the water source, rate the condition of this variable with the aid of the scoring guidelines.

✔	Stressors	Comments/description
	Ditches or Drains (tile, etc.)	
	Dams	
	Diversions	
	Groundwater pumping	
	Draw-downs	
	Culverts or Constrictions	
	Point Source (urban, ind., ag.)	
	Non-point Source	
	Increased Drainage Area	
	Storm Drain/Urban Runoff	
	Impermeable Surface Runoff	
	Irrigation Return Flows	
	Mining/Natural Gas Extraction	
	Transbasin Diversion	
X	Actively Managed Hydrology	Groundwater fluctuations associated with reservoir operations may affect

Variable Score	Condition Class	Depletion	Augmentation
1.0 - 0.9	*Reference Standard*	Unnatural drawdown events minor, rare or non-existent, very slight uniform depletion, or trivial alteration of hydrodynamics.	Unnatural high-water events minor, rare or non-existent, slight uniform increase in amount of inflow, or trivial alteration of hydrodynamics.
<0.9 - 0.8	*Highly Functioning*	Unnatural drawdown events occasional, short duration and/or mild; or uniform depletion up to 20%; or mild to moderate reduction of peak flows or natural capacity of water to perform work.	Occasional unnatural high-water events, short in duration and/or mild in intensity; or uniform augmentation up to 20%; or mild to moderate increase of peak flows or natural capacity of water to perform work.
<0.8 - 0.7	*Functioning*	Unnatural drawdown events common and of mild to moderate intensity and/or duration; or uniform depletion up to 50%; or moderate to substantial reduction of peak flows or natural capacity of water to perform work.	Common occurrence of unnatural high-water events, of a mild to moderate intensity and/or duration; or uniform augmentation up to 50%; or moderate to substantial reduction of peak flows or natural capacity of water to perform work.
<0.7 - 0.6	*Functioning Impaired*	Unnatural drawdown events occur frequently with a moderate to high intensity and/or duration; or uniform depletion up to 75%; or substantial reduction of peak flows or natural capacity of water to perform work. **Wetlands with actively managed or wholly artificial hydrology will usually score in this range or lower.**	Common occurrence of unnatural high-water events, some of which may be severe in nature or exist for a substantial portion of the growing season; or uniform augmentation more than 50% or natural capacity of water to perform work. **Wetlands with actively managed or wholly artificial hydrology will usually score in this range or lower.**
<0.6	*Non-functioning*	Water source diminished enough to threaten jurisdictional classification of the AA.	Frequency, duration or magnitude of unnaturally high-water great enough to change the fundamental characteristics of the wetland.

Variable 4 Score | 0.7

Variable 5: Water Distribution

This variable is concerned with hydrologic connectivity within the AA. It is a measure of alteration to the spatial distribution of surface and groundwater within the AA. These alterations are manifested as local changes to the hydrograph and generally ***result*** *from geomorphic modifications. To score this variable, identify stressors that alter flow patterns and impact the hydrograph within portions of the AA, including localized increases or decreases to the depth or duration of the water table or surface water. In naturally confined rivers (i.e. canyons and gullies) floodplain width is generally very small, so these systems will tend to score high for this variable unless some gross stressor is present.*

Scoring rules:

1. Identify impacts to the natural distribution of water throughout the AA and catalog them in the stressor table.
2. Considering all of the stressors identified, assign an overall variable score using the scoring guidelines.

✔	Stressors	Comments/description
	Ditches	
	Ponding/Impoundment	
	Culverts	
	Road Grades	
	Channel Incision/Entrenchment	
	Hardened/Engineered Channel	
	Enlarged Channel	
	Artificial Banks/Shoreline	Chatfield reservoir affects groundwater table and innudates some areas in AA
	Weirs	
	Dikes/Levees/Berms	
	Diversions	
	Sediment/Fill Accumulation	

Variable Score	Condition Class	Non-riverine	Riverine
1.0 - 0.9	*Reference Standard*	Little or no alteration has been made to the way in which water is distributed throughout the wetland.	Natural active floodplain areas flood on a normal recurrence interval. No evidence of alteration of flooding and subirrigation duration and intensity.
<0.9 - 0.8	*Highly Functioning*	Less than 10% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in less than a 2 in. (5 cm) change in mean growing season water table elevation.	Channel-adjacent areas have occasional unnatural periods of drying or flooding; or uniform shift in the hydrograph less than typical root depth.
<0.8 - 0.7	*Functioning*	Between 10 and 33% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in a 4 in. (5 cm) or less change in mean growing season water table elevation.	In channel-adjacent area, periods of drying or flooding are common; or uniform shift in the hydrograph near root depth.
<0.7 - 0.6	*Functioning Impaired*	33 to 66% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in a 6 in. (15 cm) or less change in mean growing season water table elevation. Water table behavior must still meet jurisdictional criteria to merit this rating.	Adjacent to the channel, unnatural periods of drying or flooding are the norm; or uniform shift in the hydrograph greater than root depth.
<0.6	*Non-functioning*	More than 66% of the AA is affected by hydrologic alteration which changes the fundamental functioning of the wetland system	Historical active floodplain areas are almost never wetted from overbank flooding, and/or groundwater infiltration is effectively cut off.

Variable 5 Score 0.73

Variable 6: Water Outflow

This variable is concerned with down-gradient hydrologic connectivity and the flow of water (transporting materials and energy) out of the AA. It is a measure of impacts that affect the hydrologic outflow of water including the passage of water through its normal low- and high-flow surface outlets, and infiltration/groundwater recharge. In some cases, alteration of evapotranspiration rates may be significant enough of a factor to consider in scoring. Score this variable by identifying stressors that impact the means by which water is exported from the AA. In Variable 5, the stressors were evaluated in light of their impact on water distribution within the AA. To evaluate this variable focus on how water, energy and associated materials are exported out of the AA.

Scoring rules:

1. Identify impacts to the natural outflow of water from the AA and catalog them in the stressor table.

2.Considering all of the stressors identified, assign an overall variable score using the scoring guidelines. Take in to account the cumulative effect of stressors on the wetland's ability to export water and water-borne materials

✔	Stressors	Comments/description
	Ditches	
	Dikes/Levees	
	Road Grades	
	Culverts	
	Diversions	
X	Constrictions	Pedestrian bridge over creek (low)
	Channel Incision/Entrenchment	
	Hardened/Engineered Channel	
	Artificial Stream Banks	
	Weirs	
	Confined Bridge Openings	
X		Changes in groundwater alter how water moves out of AA (high)

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stressors have little to no effect on the magnitude, timing or hydrodynamics of the AA water outflow regime.
<0.9 - 0.8	*Highly Functioning*	High- or low-water outflows are mildly to moderately affected, but at intermediate ("normal") lev flow continues essentially unaltered in quantity or character.
<0.8 - 0.7	*Functioning*	High- or low-water outflows are moderately affected, mild alteration of intermediate level outflow occurs; or hydrodynamics mildly to moderately affected.
<0.7 - 0.6	*Functioning Impaired*	Outflow at all stages is moderately impaired resulting in persistent flooding of portions of the AA or unnatural drainage; or outflow hydrodynamics significantly disrupted.
<0.6	*Non-functioning*	The natural outflow regime is severely disrupted. Down-gradient hydrologic connection severed or nearly so. Alterations may cause widespread unnatural persistent flooding or dewatering of the wetland system.

Variable 6 Score 0.65

Variable 7: Water and Soil Chemical Environment

This variable concerns the chemical environment of the soil and water media within the AA, including pollutants and water quality. The origin of pollutants may be in the AA or delivered from up-gradient or surrounding areas. Score this variable by listing indicators of chemical stress in the AA. Consider point source and non-point sources of pollution, as well as mechanical or hydrologic changes that alter the chemical environment. Because water quality frequently cannot be inferred directly, the presence of many stressors is identified via indirect indicators.

Scoring rules:

1. Stressors are grouped into categories which have a similar signature or set of causes.
2. Use the indicator list to identify each stressor impacting the chemical environment of the AA.
3. For each stressor category, determine the sub-variable score using the scoring guideline table provided on the second page of the scoring sheet.
 -If the AA is part of a water body that is recognized as impaired or recommended for TMDL development for one of the factors, then score that sub-variable 0.65 or lower.
4. Transcribe sub-variable scores to the following variable scoring page and compute the sum.
5. Determine the variable score by following the scoring guidelines.

Stressor Category	Stressor Indicator	✔	Comments	Sub-variable Score
Nutrient Enrichment/ Eutrophication/ Oxygen (D.O.)	Livestock	X	Upstream livestock (low)	0.95
	Agricultural Runoff			
	Septic/Sewage			
	Excessive Algae or Aquatic Veg.			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Sedimentation/ Turbidity	Excessive Erosion			0.90
	Excessive Deposition	X	Delta formation (moderate)	
	Fine Sediment Plumes			
	Agricultural Runoff			
	Excessive Turbidity			
	Nearby Construction Site			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Toxic contamination/ pH	Recent Chemical Spills			0.85
	Nearby Industrial Sites	X	Titan Industrial Park (low)	
	Road Drainage/Runoff			
	Livestock	X	Upstream livestock (low)	
	Agricultural Runoff			
	Storm Water Runoff	X	Upstream development (low)	
	Fish/Wildlife Impacts			
	Vegetation Impacts			
	Cumulative Watershed NPS			
	Acid Mine Drainage			
	Point Source Discharge			
	CDPHE Impairment/TMDL List			
Temperature	Excessive Temperature Regime			1.00
	Lack of Shading			
	Reservoir/Power Plant Discharge			
	Industrial Discharge			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Soil chemistry/ Redox potential	Unnatural Saturation/Desaturation	X	Reservoir effect	0.80
	Mechanical Soil Disturbance			
	Dumping/introduced Soil			
	CDPHE Impairment/TMDL List			

Variable 7: Water and Soil Chemical Environment

Sub-variable Scoring Guidelines

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stress indicators not present or trivial.
<0.9 - 0.8	*Highly Functioning*	Stress indicators scarcely present and mild, or otherwise not occurring in more than 10% of the AA.
<0.8 - 0.7	*Functioning*	Stress indicators present at mild to moderate levels, or otherwise not occurring in more than 33% of the AA.
<0.7 - 0.6	*Functioning Impaired*	Stress indicators present at moderate to high levels, or otherwise not occurring in more than 66% of the AA
<0.6	*Non-functioning*	Stress indicators strongly evident throughout the AA at levels which apparently alter the fundamental chemical environment of the wetland system

Input each factor score from the stressor list and calculate the sum.

Nutrient enrichment/ Eutrophication/ Oxygen (D.O.)		Sedimentation/ Turbidity		Toxic contamination/ pH		Temperature		Soil chemistry/ Redox potential		Sum of Sub-variable Scores
0.95	+	0.90	+	0.85	+	1.00	+	0.80	=	4.50

Use the table to score the Chemical Environment Variable circling the applicable scoring rules.

Variable Score	Condition Class	Scoring Rules		
		Single Factor		**Composite Score**
1.0 - 0.9	*Reference Standard*	No single factor scores < 0.9	or	The factor scores sum > 4.5
<0.9 - 0.8	*Highly Functioning*	Any single factor scores ≥ 0.8 but < 0.9	or	The factor scores sum >4.0 but ≤4.5
<0.8 - 0.7	*Functioning*	Any single factor scores ≥ 7.0 but < 0.8	or	The factor scores sum >3.5 but ≤ 4.0
<0.7 - 0.6	*Functioning Impaired*	Any single factor scores ≥ 0.6 but <0.7	or	The factor scores sum >3.0 but ≤3.5
< 0.6	*Non-functioning*	Any single factor scores < 0.6	or	The factor scores sum < 3.0

Variable 7 Score 0.9

Variable 8: Geomorphology

This variable is a measure of the degree to which the geomorphic setting has been altered within the AA. Changes to the surface configuration and natural topography constitute stressors. Such stressors may be observed in the form of fill, excavation, diking, sedimentation due to absence of flushing floods, etc. In riverine systems geomorphic changes to stream channel should be considered if the channel is within the AA. Alterations may include bed surface changes (embeddedness or morphology changes), stream bank instability, and stream channel reconfiguration. Geomorphic changes are usually ultimately manifested as changes to wetland hydrology and water relations with vegetation. Geomorphic alteration can also directly affect soil properties, such as near-surface texture, and the wetland chemical environment, such as the redox state or nutrient composition in the rooting zone. In rating this variable, do not include these resultant effects of geomorphic change; rather focus on the physical impacts within the footprint of the alteration. The effects of geomorphic change are addressed by other variables. All alterations to the geomorphology should be evaluated including small-scale impacts such as pugging, hoof sheer, and sedimentation whic

Scoring Rules:

1. Identify impacts to geomorphological setting and topography within the AA and record them on the stressor checklist.
2. Considering all of the stressors identified, assign an overall variable score using the scoring guidelines.

✔		Stressors	Comments
	General	Dredging/Excavation/Mining	
	General	Fill, including dikes, road grades, etc.	
	General	Grading	
	General	Compaction	
	General	Plowing/Disking	
	General	Excessive Sedimentation	
	General	Dumping	
	General	Hoof Shear/Pugging	
	General	Aggregate or Mineral Mining	
X	General	Sand Accumulation	Delta formation at reservoir edge (moderate)
	Channels Only	Channel Instability/Over Widening	
	Channels Only	Excessive Bank Erosion	
	Channels Only	Channelization	
	Channels Only	Reconfigured Stream Channels	
	Channels Only	Artificial Banks/Shoreline	
	Channels Only	Beaver Dam Removal	
	Channels Only	Substrate Embeddedness	
	Channels Only	Lack or Excess of Woody Debris	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Topography essentially unaltered from the natural state, or alterations don't appear to have a minimal effect on wetland functioning and condition. Patch or microtopographic complexity may be slightly altered, but native pl communities are still supported.
<0.9 - 0.8	*Highly Functioning*	Alterations to topography result in small but detectable changes to habitat conditions throughout all or most of the AA; or changes causing more significant impacts but affecting less than 10% of the AA.
<0.8 - 0.7	*Functioning*	Changes to AA topography may be pervasive but generally mild. May include patches of more significant habitat alteration; or more significant alteration affecting less than 20 % of the AA.
<0.7 - 0.6	*Functioning Impaired*	At least one important surface type or landform has been eliminated or created; microtopography has been moderately altered throughout most or all of the AA, or more severe alterations affect less than 50% AA. Evidence that widespread diminishment or alteration of native plant community exist due to physical habitat alterations. Most incidentally created wetland habitat such as that created by roadside ditches and the like would score in this range or lower.
<0.6	*Non-functioning*	Geomorphic alterations have rendered the AA essentially unusable by *characteristic* wildlife species, or the physical setting no longer supports native plant communities.

Variable 8 Score 0.95

Variable 9: Vegetation Structure and Complexity

This variable is a measure of the condition of the wetland's vegetation relative to its native state. It is particularly relevant to the wetland's ability to perform higher-order functions such as support of wildlife populations, although it also affects primary functions such as flood-flow attenuation. Score this variable by listing stressors that have affected the diversity, composition and cover of each vegetation cover class that would normally be present for the wetland type being assessed. For this variable, stressor severity is a measure of how much each vegetation stratum differs functionally from its natural condition.

Rules for Scoring:

1. Determine the number and types of vegetation layers present within the AA. Make a judgment as to whether additional layers were historically present using direct evidence such as stumps, root wads or historical photographs. Indirect evidence such as local knowledge and expert opinion can also be used in this determination. Check each present or suspected vegetation layer in the third row of the table.

2. Do not score vegetation layers that would not normally be present in the wetland type being assessed.

3. Estimate the percent coverage of each vegetation layer. Aerial photographs can be helpful for this but are not required.

4. Enter the percent cover values as decimals in the row of the stressor table labeled "Percent Cover of Layer". Note, percentages will often sum to more than 100% (1.0).

5. Determine the severity of stressors acting on each individual canopy layers, indicating their presence with checks in the appropriate boxes of the stressor table.

6. Determine the sub-variable score for each valid vegetation layer using the scoring guidelines on the second page of the scoring sheet. Enter each sub-variable score in the appropriate cell of the row labeled "Veg. Layer Sub-variable Score".

7. Add the "Veg. Layer Sub-variable Scores" and enter the sum in the labled cell to the right of the individual scores. Follow this same process for the "Percent Cover of Layer".

8. Divide the sum of "Veg. Layer Sub-variable Scores" by the total coverage of all layers scored. This product is the Variable 9 score. Enter this number in the labeled box at the bottom of this page.

	Vegetation Layers				
Layers Scored *(check boxes to right to indicate scored layers)*					
Stressor	**Tree**	**Shrub**	**Herb**	**Aquatic**	**Comments**
Noxious Weeds					
Exotic/Invasive spp.			X		Some reed canarygrass, smooth brome
Tree Harvest					
Brush Cutting/Shrub Removal					
Livestock Grazing					
Excessive Herbivory					
Mowing/Haying					
Herbicide					
Loss of Zonation/Homogenization					
Dewatering					
Over Saturation					

	Tree		Shrub		Herb		Aquatic		Total
Percent Cover of Layer	20.00	+	60.00	+	20.00	+	0.00	=	100
	x		x		x		x		÷
Veg. Layer Sub-variable Score	1		1		0.9				
	=		=		=		=		
Weighted Sub-variable Score	20.00	+	60.00	+	18.00	+		=	98

See sub-variable scoring guidelines on following page

Variable 9 Score 0.98

Sub-variable 9 Scoring Guidelines

Based on the list of stressors identified above, rate the severity of their cumulative effect on vegetation structure and complexity for each vegetation layer.

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stressors not present or with an intensity low enough as to not detectably affect the structure, diversity or composition of the vegetation layer.
<0.9 - 0.8	*Highly Functioning*	Stressors present at an intensity levels sufficient to cause detectable, but minor, changes in layer composition. Stress related change should generally be less than 10% for any given attribute (e.g., 10% cover of invasive, 10% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 33% if stressors are confined to patches comprising less than 10% of the wetland.
<0.8 - 0.7	*Functioning*	Stressors present with enough intensity to cause significant changes in the character of vegetation, including alteration of layer coverage, structure complexity and species composition. The vegetation layer retains its essential character though. AA's with a high proportion of non-native grasses will commonly fall in this class. Stress related change should generally be less than 33% for any given attribute (e.g., 33% cover of invasive, 33% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 66% if stressors are confined to patches comprising less than 25% of the wetland.
<0.7 - 0.6	*Functioning Impaired*	Stressor intensity severe enough to cause profound changes to the fundamental character of the vegetation layer. Stress-related change should generally be less than 66% for any given attribute (e.g 66% cover of invasive, 66% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 80% if stressors are confined to patches comprising less than 50% of the wetland.
<0.6	*Non-functioning*	Vegetation layer has been completely removed or altered to the extent that is no longer comparable to the natural structure, diversity and composition.

FACWet Score Card

Scoring Procedure:

1. Transcribe variable scores from each variable data sheet to the corresponding cell in the variable score table.
2. In each Functional Capacity Index (FCI) equation, enter the corresponding variable scores in the equation cells. Do not enter values in the crossed cells lacking labels.
3. Add the variable scores to calculate the total functional points achieved for each function.
4. Divide the total functional points achieved by the functional points possible. The typical number of total points possible is provided, howe if a variable is added or subtracted to FCI equation the total possible points must be adjusted
5. Calculate the Composite FCI, by adding the FCI scores and dividing by the total number of functions scored (usually 7).
6. If scoring is done directly in the Excel spreadsheet, all values will be transferred and calculated automatically.

VARIABLE SCORE TABLE

Buffer & Landscape Context	**Variable 1:**	**Habitat Connectivity - Neighboring Wetland Habitat Loss**	0.92
	Variable 2:	**Habitat Connectivity - Migration/Dispersal Barriers**	0.57
	Variable 3:	**Buffer Capacity**	0.68
Hydrology	**Variable 4:**	**Water Source**	0.70
	Variable 5:	**Water Distribution**	0.73
	Variable 6:	**Water Outflow**	0.65
Abiotic and Biotic Habitat	**Variable 7:**	**Chemical Environment**	0.90
	Variable 8:	**Geomorphology**	0.95
	Variable 9:	**Vegetation Structure and Complexity**	0.98

Functional Capacity Indices

Function	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6	Total Functional Points	÷	Functional Capacity Index
Function 1 -- Support of Characteristic Wildlife Habitat	$V1_{wetloss}$	$V2_{barriers}$	$V3_{buffer}$	$(2 \times V9_{veg})$					
	0.92	0.57	0.68	1.96			4.13	5	0.83
Function 2 -- Support of Characteristic Fish/aquatic Habitat	$(3 \times V4_{source})$	$(2 \times V5_{dist})$	$2 \times V6_{outflow}$	$V7_{chem}$	$V8_{geom}$				
	2.10	1.46	1.30	0.90	0.95		6.71	9	0.75
Function 3 -- Flood Attenuation	$V3_{buffer}$	$2 \times V4_{source}$	$(2 \times V5_{dist})$	$2 \times V6_{outflow}$	$V8_{geom}$	$V9_{veg}$			
	0.68	1.40	1.46	1.30	0.95	0.98	6.77	9	0.75
Function 4 -- Short- and Long-term Water Storage	V_{source}	$(2 \times V5_{dist})$	$2 \times V6_{outflow})$	$V8_{geom}$					
	0.70	1.46	1.30	0.95			4.41	6	0.74
Function 5 -- Nutrient/Toxicant Removal	$(2 \times V5_{dist})$	$V7_{chem}$	$V8_{geom}$						
	1.46	0.90	0.95				3.31	4	0.83
Function 6 -- Sediment Retention/Shoreline Stabilization	$V3_{buffer}$	$(2 \times V8_{geo})$	$(2 \times V9_{veg})$						
	0.68	1.90	1.96				4.54	5	0.91
Function 7 -- Production Export/Food Chain Support	$V1_{wetloss}$	$2 \times V6_{outflow}$	$V7_{chem}$	$V8_{geo}$	$(2 \times V9_{veg})$				
	0.92	1.30	0.90	0.95	1.96		6.03	7	0.86

Sum of Individual FCI Scores **5.66**

Divide by the Number of Functions Scored (usually 7) **÷ 7**

Composite FCI Score **0.81**

ADMINISTRATIVE CHARACTERIZATION

General Information

		Date of Evaluation:	12/9/2008
Site Name or ID:	Plum Creek 3	Project Name:	Chatfield Reallocation FR/EIS
404 or Other Permit Application #:		Lead Federal Agency	U.S. Army Corps of Engineers
Evaluator Name(s):	Mary L. Powell	Evaluator's professional position and organization:	Natural Resource Specialist, ERO Resources, Corp.

Location Information:

Site Location (Lat./Long. or UTM):	496074.7429 4376389.91	Geographic Datum Used (NAD 83 preferred):	AND 83
USGS Quadrangle Map:	Littleton	Map Scale: (Circle one)	**1:24,000** 1:100,000 Other 1:
Sub basin Name (8 digit HUC):	10190002	Wetland Ownership:	U.S. Army Corps of Engineers

Project Information:

This evaluation is being performed at: *(Check applicable box)*
- [x] *Project Wetland*
- [ ] *Mitigation Site*

Purpose of Evaluation (check all applicable):
- [x] *Potentially Impacted Wetlands*
- [ ] *Mitigation; Pre-construction*
- [ ] *Mitigation; Post-construction*
- [ ] *Monitoring*
- [ ] *Other (Describe)*

Intent of Project: *(Check all applicable)* X Preservation X Restoration X Enhancement X Creation

Total Size of Wetland Involved: (Record Area, Check and Describe Measurement Method Used)	29.24 ac.	X	Measured				
			Estimated				
Assessment Area (AA) Size (Record Area, check appropriate box. Additional spaces are used to record acreage when more than one AA is included in a single assessment)	ac.	X	Measured	ac.	ac.	ac.	ac.
			Estimated	ac.	ac.	ac.	ac.
Characteristics or Method used for AA boundary determination:	Extent of AA determined by wetland mapping performed by TetraTech for FR/EIS study. Wetlands of same wetland category were grouped together based logical location on landscape.						
Notes:							

ECOLOGICAL DESCRIPTION 1

Special Concerns

Check all that apply

- [ ] Organic soils including Histosols or Histic Epipedons are present in the AA (i.e., AA includes core fen habitat).
- [ ] Project will directly impact organic soil portions of the AA including areas possessing either Histosol soils or histic epipedons.
- [ ] Organic soils are known to occur anywhere within the contiguous wetland of which the AA is part.
- [ ] The wetland is a habitat oasis in an otherwise dry or urbanized landscape?
- [X] Federally threatened or endangered species are **KNOWN** to occur in the AA? List Below.
- [ ] Federally threatened or endangered species are **SUSPECTED** to occur in the AA?
- [ ] Species of concern according to the Colorado Natural Heritage (CNHP) are known to occur in the AA?
- [ ] The site is located within a potential conservation area or element occurrence buffer area as determined by CNHP?
- [ ] Other special concerns (please describe)

HYDROGEOMORPHIC SETTING

- [X] AA wetland maintains its fundamental natural hydrogeomorphic characteristics
- [ ] AA wetland has been subject to change in HGM classes as a result of anthropogenic modification

If the above is checked, please describe the original wetland type if discernable using the table below.

- [ ] AA wetland was created from an upland setting.

Previous wetland typology	Historical Conditions				
	Water source	Surface flow	Groundwater	Precipitation	Unknown
	Hydrodynamics	Unidirectional	Vertical		
	Geomorphic Setting (Narrative Description)				
	Previous HGM Class	Riverine	Slope	Depressional	Lacustrine

Current Conditions

Describe the hydrogeomorphic setting of the wetland by circling all conditions that apply.

HGM Setting	**Water source**	**Surface flow**	**Groundwater**	Precipitation	Unknown			
	Hydrodynamics	**Unidirectional**	**Vertical**					
	Wetland Gradient	**0 - 2%**	2-4%	4-10%	>10%			
	# Surface Inlets	**Over-bank**	0	**1**	2	3	>3	
	# Surface Outlets	**Overbank**	0	1	2	3	>3	
	Geomorphic Setting (Narrative Description)	Wetlands located slightly above OHW of Chatfield Reservoir. Wetlands were probably present prior to the reservoir, but their subsurface hydrology is now influenced by reservoir levels. Groundwater and pool saturate/innundate						
	HGM class	**Riverine**	Slope	Depressional	Lacustrine			

Notes (include information on charcteristics used to formulate reference standard): Reference standard is Plum Creek prior to construction of Chatfield Dam. The reference standard assumes that groundwater hydrograph in the riparian corridor at this location had different seasonal fluctuations than it currently does, which may affect species composition.

ECOLOGICAL DESCRIPTION 2

Vegetation Habitat Description

*US FWS habitat classification according as reported in Cowardin et. al (1979) - See also Appendix *** of FACWet User Guide.*

System	Subsystem	Class	Subclass	Water Regime	Other Modifiers	% AA
Palustrine	Palustrine	Shrub-scrub	Persistent	Intermittently flooded		20
Palustrine	Palustrine	Forested	Broad-leaved Decid.	Intermittently flooded		40
Palustrine	Palustrine	Emergent	Persistent	Intermittently flooded		15
Riverine	Lower Per.	Aquatic Bed	Sand	Int. Exp./Permenant		<5

Lacustrine	Littoral; Limnoral	Rock Bot. (RB) Uncon Bottom(UB) Aquatic Bed(AB) Rocky Shore(RS) Uncon Shore(US) Emergent(EM) Shrub-scrub(SS) Forested (FO)	Floating vascular; Rooted vascular; Algal; Persistent; Non-Persistent; Broad-leaved deciduous; Needle-leaved evergreen; Cobble - gravel; Sand; Mud; Organic	**Examples** Temporarily flooded(A); Saturated(B); Seasonally flooded(C); Seas.-flood./sat.(E); Perm. flooded(F); Intermittently Flooded(G); Artificially Flooded(K); Sat./semiperm./Seas. (Y); Int. exposed/permenant(Z)	Hypersaline(7) ; Eusaline(8); Mixosaline(9); Fresh(0); Acid(a); Circumneutral(c); Alkaline/calcareous(i); Organic(g); Mineral(n); Beaver(b); Partially Drained/ditched(d); Farmed(f); Diked/impounded(h); Artificial Substrate(r); Spoil(s); Excavated(x)
Palustrine	Palustrine				
Riverine	Lower perennial; Upper perennial; Intermittent				

Site Map

Scale: 1 sq. =

Draw a sketch map of the site including relevant portions of the wetland, AA boundary, structures, habitat classes, and other significant features.

Variable 1: Habitat Connectivity - Neighboring Wetland Habitat Loss

This variable is a measure of how isolated from other naturally-occurring wetland or riparian habitat the AA has become as a result of the loss of that habitat. To score this variable, estimate the percent of naturally- occurring wetland/riparian habitat that has been lost (by filling, draining, development, or whatever means) within a 500-meter-wide belt surrounding the AA. This surrounding area is called the Habitat Connectivity Envelope (HCE). Historical photographs and NWI maps can be helpful in scoring this variable. In most cases the evaluator must use best professional judgment in estimating the amount of natural wetland loss. Evaluation of landforms and habitat patterns in the context of perceivable land use change should be used to steer estimates of the amount of wetland loss within the HCE. This variable is not meant to penalize AAs that are naturally isolated, or unique to the landscape. Rather, it should measure the degree to which natural habitat connectivity has been lost.

Rules for Scoring:

1. On the aerial photo outline the area that is within 500 meters of the AA.
2. Identify obvious natural barriers within 500 m of the AA boundary.
   - *Natural barriers include continuous cliff bands, deep open water, etc.*
3. Draw the **Habitat Connectivity Envelope**(HCE) on the aerial image.
   - *The HCE is all the area within 500 meters of the AA that is not separated from it by a natural barrier.*
4. Outline the current extent of naturally occurring wetland and riparian habitat. Then outline areas where the habitats appear to have historically occurred.
   - *Use your knowledge of the history of the area and evident land use change. Additional research could be utilized to increase the accuracy of this estimate including consideratation of floodplain maps, historical aerials, etc.*

Variable Score	Condition Category	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	*Wetland losses are absent or negligible or there is no evidence to suggest the native landscape within the HCE historically contained other wetland habitats*
<0.9 - 0.8	*Highly Functioning*	*More than 80% of historical wetland habitat area within the HCE is still present (less than 20% historical wetland habitat area lost).*
<0.8 - 0.7	*Functioning*	*80 to 60% of historical wetland habitat area within the HCE is still present (20% to 40% historical wetland habitat area lost).*
<0.7 - 0.6	*Functioning Impaired*	*Less than 60 to 30% of historical wetland habitat area within the HCE is still present (more than 30 to 70% historical wetland habitat area lost).*
<0.6	*Non-functioning*	*Less than 30% of the historical wetland habitat area from within the HCE is now no longer in existence (more than 70% historical wetland habitat area lost).*

Variable 1 Score 0.95

Notes: Chatfield Reservoir has inundated portions of riparian corridor.

Variable 2: Habitat Connectivity - Migration/Dispersal Barriers

This variable is intended to rate the degree to which the AA has become isolated from existing neighboring wetland and riparian habitat by artificial barriers that inhibit migration or dispersal of organisms. On the aerial photograph, identify the man-made barriers within the HCE that intercede between the AA and surrounding wetlands and riparian areas, and identify them by type on the stressor list. Score this variable based on the barriers' impermeability to migration and dispersal and the amount of surrounding wetland/riparian habitat they affect.

Rules for Scoring:

1. On the aerial photo, outline all existing wetland and riparian habitat areas (WHAs) within the HCE.
2. Identify artificial barriers to dispersal and migration of organisms within the HCE that intercede between the AA and surrounding habitats. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.
3. Considering the composite effect of all of identified barriers to migration and dispersal (i.e., stressors), assign an overall variable score using the scoring guidelines.

	✓	Stressors	Comments/description
Stressors = artificial barriers		Major Highway	
		Secondary Highway	
	X	Tertiary Roadway	Interior park roads, parking lot (moderate)
	X	Railroad	BNSF (high)
	X	Bike Path	Soft surface trail across rip. corridor, bridge over creek (mod)
		Urban Development	
		Agricultural Development	
	X	Artificial Water Body	Reservoir (High)
		Fence	
	X	Ditch or Aqueduct	Highline Canal (Low)
		Aquatic Organism Barriers	
	X		Dam (Moderate)

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	No appreciable barriers exist between the AA and other wetland and riparian habitats in th HCE; or there are no other wetland and riparian areas in the HCE.
<0.9 - 0.8	*Highly Functioning*	Barriers impeding migration/dispersal between the AA and up to 33% of surrounding WHA highly permeable and easily passed by most organisms. Examples could include gravel roads, minor levees, ditches or barbed-wire fences. More significant barriers (see "functioning category below) could affect migration to up to 10% of surrounding WHA.
<0.8 - 0.7	*Functioning*	Barriers to migration and dispersal retard the ability of many organisms/propagules to pass between the AA and up to 66% of WHA. Passage of organisms and propagules through such barriers is still possible, but it may be constrained to certain times of day, be slow, dangerous or require additional travel. Busy two-lane roads, culverted areas, small to medium artificial water bodies or small earthen dams would commonly rate a score in this range. More significant barriers (see "functioning impaired" category below) could affect migration to up to 10% of surrounding WHA.
<0.7 - 0.6	*Functioning Impaired*	Barriers to migration and dispersal preclude the passage of some types of organisms/propagules between the AA and up to 66% of surrounding WHA. Travel of those animals which can potential negotiate the barrier are strongly restricted and may include a high chance of mortality. Up to 33% of surrounding WHA could be functionally isolated from the AA.
<0.6	*Non-functioning*	AA is essentially isolated from surrounding WHA by impermeable migration and dispersal barriers. An interstate highway or concrete-lined water conveyance canal are examples of barriers which would generally create functional isolation between the AA and a WHA.

Variable 2 Score 0.57

Variable 3: Buffer Capacity

The buffer area is defined as a 250-meter-wide belt surrounding the perimeter of the AA. This variable is a measure of the capacity of that area to function as an effective buffer for the wetland against the deleterious effects of surrounding land use change. To score the variable, assume that the AA is 100% buffered except where land use changes inside the buffer area have diminished this quality. Identify these land use types as specific stressors in the list. For each stressor, rate severity and extent within the buffer area; then use this list to make an overall rating for the buffer's departure from reference conditions. When rating buffer capacity, consider both the intensity of the impact and the proximity of the stressor to the AA.

Rules for Scoring:

1. On the aerial photograph, outline the buffer area as the zone within 250 meters of the outer boundary of the AA.

2. Use the stressor list to record land use changes that affect buffering capacity within the buffer area. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.

3. Considering all of the identified stressors, their overall severity, extent and proximity to the AA assign an overall variable score using the scoring guidelines.

Stressors = Land Use Changes

✔	Stressors	Comments/description
X	Industrial/commercial	Light industry to east (low)
	Urban	
	Residential	
	Rural	
	Dryland Farming	
	Intensive Agriculture	
	Orchards or Nurseries	
	Livestock Grazing	
X	Transportation Corridor	Railroad (moderate)
	Urban Parklands	
X	Dams/impoundments	Chatfield Dam (moderate)
x	Artificial Water body	Chatfield Reservoir (high)
	Physical Resource Extraction	
	Biological Resource Extraction	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	No appreciable land use change has been imposed within the TBA and it provides the full buffering capacity.
<0.9 - 0.8	*Highly Functioning*	Some land use change has occurred in the BA, but such changes little impair the area's ability to provide a buffering function, either because land use is not intensive, for example haying, light grazing, or nurseries, or more substantial changes occur in approximately less than 10% of the BA.
<0.8 - 0.7	*Functioning*	BA has been subjected to a marked shift in land use, however, the land retains much of its original buffering capacity. Moderate-intensity land uses such as dry-land farming, urban "green" corridors, or moderate cattle grazing would commonly be placed within this scoring range.
<0.7 - 0.6	*Functioning Impaired*	Land use within the BA has been substantial including the a moderate to high coverage (up to 50%) of impermeable surfaces, bare soil, or other artificial surface; considerable in-flow urban runoff or fertilizer-rich waters common. While, the buffering capacity of the land has been greatly diminished it is not extinguished. Intensively logged areas, low-density urban developments, some urban parklands and some cropping situations would commonly rate a score within this range.
<0.6	*Non-functioning*	The area within the BA provides essentially no buffering capacity. Many Commercial developments or highly urban landscapes would rate a score of less than 0.6.

Variable 3 score 0.72

Variable 4: Water Source

This variable is concerned with up-gradient hydrologic connectivity. It is a measure of the impacts to the AA's water source, including the ability of source water to perform work such as sediment transport, erosion, soil pore flushing, etc. To score this variable, identify stressors that alter the source of water to the AA, and record their presence on the stressor list. Stressors can impact water source by depletion, augmentation, or alteration of inflow timing or hydrodynamics. For riverine systems, this variable is primarily concerned with the connection of the channel to the floodplain.This variable is designed to assess water quantity, power and timing, not water quality. Water quality will be evaluated in Variable 7.

Scoring rules:

1. Use the stressor list and knowledge of the watershed to catalog type-specific impairments of the AA's water source. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.

2. Considering the composite effect of stressors on the water source, rate the condition of this variable with the aid of the scoring guidelines.

✔	Stressors	Comments/description
	Ditches or Drains (tile, etc.)	
	Dams	
	Diversions	
	Groundwater pumping	
	Draw-downs	
	Culverts or Constrictions	
	Point Source (urban, ind., ag.)	
	Non-point Source	
	Increased Drainage Area	
	Storm Drain/Urban Runoff	
	Impermeable Surface Runoff	
	Irrigation Return Flows	
	Mining/Natural Gas Extraction	
	Transbasin Diversion	
X	Actively Managed Hydrology	Groundwater fluctuations associated with reservoir operations may affect

Variable Score	Condition Class	Depletion	Augmentation
1.0 - 0.9	*Reference Standard*	Unnatural drawdown events minor, rare or non-existent, very slight uniform depletion, or trivial alteration of hydrodynamics.	Unnatural high-water events minor, rare or non-existent, slight uniform increase in amount of inflow, or trivial alteration of hydrodynamics.
<0.9 - 0.8	*Highly Functioning*	Unnatural drawdown events occasional, short duration and/or mild; or uniform depletion up to 20%; or mild to moderate reduction of peak flows or natural capacity of water to perform work.	Occasional unnatural high-water events, short in duration and/or mild in intensity; or uniform augmentation up to 20%; or mild to moderate increase of peak flows or natural capacity of water to perform work.
<0.8 - 0.7	*Functioning*	Unnatural drawdown events common and of mild to moderate intensity and/or duration; or uniform depletion up to 50%; or moderate to substantial reduction of peak flows or natural capacity of water to perform work.	Common occurrence of unnatural high-water events, of a mild to moderate intensity and/or duration; or uniform augmentation up to 50%; or moderate to substantial reduction of peak flows or natural capacity of water to perform work.
<0.7 - 0.6	*Functioning Impaired*	Unnatural drawdown events occur frequently with a moderate to high intensity and/or duration; or uniform depletion up to 75%; or substantial reduction of peak flows or natural capacity of water to perform work. **Wetlands with actively managed or wholly artificial hydrology will usually score in this range or lower.**	Common occurrence of unnatural high-water events, some of which may be severe in nature or exist for a substantial portion of the growing season; or uniform augmentation more than 50% or natural capacity of water to perform work. **Wetlands with actively managed or wholly artificial hydrology will usually score in this range or lower.**
<0.6	*Non-functioning*	Water source diminished enough to threaten jurisdictional classification of the AA.	Frequency, duration or magnitude of unnaturally high-water great enough to change the fundamental characteristics of the wetland.

Variable 4 Score 0.87

Variable 5: Water Distribution

This variable is concerned with hydrologic connectivity within the AA. It is a measure of alteration to the spatial distribution of surface and groundwater within the AA. These alterations are manifested as local changes to the hydrograph and generally ***result*** *from geomorphic modifications. To score this variable, identify stressors that alter flow patterns and impact the hydrograph within portions of the AA, including localized increases or decreases to the depth or duration of the water table or surface water. In naturally confined rivers (i.e. canyons and gullies) floodplain width is generally very small, so these systems will tend to score high for this variable unless some gross stressor is present.*

Scoring rules:

1. Identify impacts to the natural distribution of water throughout the AA and catalog them in the stressor table.
2. Considering all of the stressors identified, assign an overall variable score using the scoring guidelines.

✔	Stressors	Comments/description
	Ditches	
	Ponding/Impoundment	
	Culverts	
	Road Grades	
	Channel Incision/Entrenchment	
	Hardened/Engineered Channel	
	Enlarged Channel	
	Artificial Banks/Shoreline	
	Weirs	
	Dikes/Levees/Berms	
	Diversions	
	Sediment/Fill Accumulation	
		Chatfield reservoir affects groundwater table

Variable Score	Condition Class	Non-riverine	Riverine
1.0 - 0.9	*Reference Standard*	Little or no alteration has been made to the way in which water is distributed throughout the wetland.	Natural active floodplain areas flood on a normal recurrence interval. No evidence of alteration of flooding and subirrigation duration and intensity.
<0.9 - 0.8	*Highly Functioning*	Less than 10% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in less than a 2 in. (5 cm) change in mean growing season water table elevation.	Channel-adjacent areas have occasional unnatural periods of drying or flooding; or uniform shift in the hydrograph less than typical root depth.
<0.8 - 0.7	*Functioning*	Between 10 and 33% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in a 4 in. (5 cm) or less change in mean growing season water table elevation.	In channel-adjacent area, periods of drying or flooding are common; or uniform shift in the hydrograph near root depth.
<0.7 - 0.6	*Functioning Impaired*	33 to 66% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in a 6 in. (15 cm) or less change in mean growing season water table elevation. Water table behavior must still meet jurisdictional criteria to merit this rating.	Adjacent to the channel, unnatural periods of drying or flooding are the norm; or uniform shift in the hydrograph greater than root depth.
<0.6	*Non-functioning*	More than 66% of the AA is affected by hydrologic alteration which changes the fundamental functioning of the wetland system	Historical active floodplain areas are almost never wetted from overbank flooding, and/or groundwater infiltration is effectively cut off.

Variable 5 Score 0.8

Variable 6: Water Outflow

This variable is concerned with down-gradient hydrologic connectivity and the flow of water (transporting materials and energy) out of the AA. It is a measure of impacts that affect the hydrologic outflow of water including the passage of water through its normal low- and high-flow surface outlets, and infiltration/groundwater recharge. In some cases, alteration of evapotranspiration rates may be significant enough of a factor to consider in scoring. Score this variable by identifying stressors that impact the means by which water is exported from the AA. In Variable 5, the stressors were evaluated in light of their impact on water distribution within the AA. To evaluate this variable focus on how water, energy and associated materials are exported out of the AA.

Scoring rules:

1. Identify impacts to the natural outflow of water from the AA and catalog them in the stressor table.

2.Considering all of the stressors identified, assign an overall variable score using the scoring guidelines. Take in to account the cumulative effect of stressors on the wetland's ability to export water and water-borne materials

✔	Stressors	Comments/description
	Ditches	
	Dikes/Levees	
	Road Grades	
	Culverts	
	Diversions	
	Constrictions	
	Channel Incision/Entrenchment	
	Hardened/Engineered Channel	
	Artificial Stream Banks	
	Weirs	
	Confined Bridge Openings	
X		Unnaturally high water table alters flows out (high)

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stressors have little to no effect on the magnitude, timing or hydrodynamics of the AA water outflow regime.
<0.9 - 0.8	*Highly Functioning*	High- or low-water outflows are mildly to moderately affected, but at intermediate ("normal") lev flow continues essentially unaltered in quantity or character.
<0.8 - 0.7	*Functioning*	High- or low-water outflows are moderately affected, mild alteration of intermediate level outflo occurs; or hydrodynamics mildly to moderately affected.
<0.7 - 0.6	*Functioning Impaired*	Outflow at all stages is moderately impaired resulting in persistent flooding of portions of the A or unnatural drainage; or outflow hydrodynamics significantly disrupted.
<0.6	*Non-functioning*	The natural outflow regime is severely disrupted. Down-gradient hydrologic connection severe or nearly so. Alterations may cause widespread unnatural persistent flooding or dewatering of the wetland system.

Variable 6 Score 0.73

Variable 7: Water and Soil Chemical Environment

This variable concerns the chemical environment of the soil and water media within the AA, including pollutants and water quality. The origin of pollutants may be in the AA or delivered from up-gradient or surrounding areas. Score this variable by listing indicators of chemical stress in the AA. Consider point source and non-point sources of pollution, as well as mechanical or hydrologic changes that alter the chemical environment. Because water quality frequently cannot be inferred directly, the presence of many stressors is identified via indirect indicators.

Scoring rules:

1. Stressors are grouped into categories which have a similar signature or set of causes.
2. Use the indicator list to identify each stressor impacting the chemical environment of the AA.
3. For each stressor category, determine the sub-variable score using the scoring guideline table provided on the second page of the scoring sheet.
 -If the AA is part of a water body that is recognized as impaired or recommended for TMDL development for one of the factors, then score that sub-variable 0.65 or lower.
4. Transcribe sub-variable scores to the following variable scoring page and compute the sum.
5. Determine the variable score by following the scoring guidelines.

Stressor Category	Stressor Indicator	✔	Comments	Sub-variable Score
Nutrient Enrichment/ Eutrophication/ Oxygen (D.O.)	Livestock	X	Upstream livestock (mod)	0.90
	Agricultural Runoff			
	Septic/Sewage			
	Excessive Algae or Aquatic Veg.			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Sedimentation/ Turbidity	Excessive Erosion			0.95
	Excessive Deposition	X	Delta formation (low)	
	Fine Sediment Plumes			
	Agricultural Runoff			
	Excessive Turbidity			
	Nearby Construction Site			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Toxic contamination/ pH	Recent Chemical Spills			0.85
	Nearby Industrial Sites	X	Titan Industrial Park (mod)	
	Road Drainage/Runoff			
	Livestock	X	Upstream livestock (mod)	
	Agricultural Runoff			
	Storm Water Runoff	X	Upstream development (low)	
	Fish/Wildlife Impacts			
	Vegetation Impacts			
	Cumulative Watershed NPS			
	Acid Mine Drainage			
	Point Source Discharge			
	CDPHE Impairment/TMDL List			
Temperature	Excessive Temperature Regime			1.00
	Lack of Shading			
	Reservoir/Power Plant Discharge			
	Industrial Discharge			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Soil chemistry/ Redox potential	Unnatural Saturation/Desaturation	X	Reservoir effect	0.90
	Mechanical Soil Disturbance			
	Dumping/introduced Soil			
	CDPHE Impairment/TMDL List			

Variable 7: Water and Soil Chemical Environment

Sub-variable Scoring Guidelines

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stress indicators not present or trivial.
<0.9 - 0.8	*Highly Functioning*	Stress indicators scarcely present and mild, or otherwise not occurring in more than 10% of the AA.
<0.8 - 0.7	*Functioning*	Stress indicators present at mild to moderate levels, or otherwise not occurring in more than 33% of the AA.
<0.7 - 0.6	*Functioning Impaired*	Stress indicators present at moderate to high levels, or otherwise not occurring in more than 66% of the AA
<0.6	*Non-functioning*	Stress indicators strongly evident throughout the AA at levels which apparently alter the fundamental chemical environment of the wetland system

Input each factor score from the stressor list and calculate the sum.

Nutrient enrichment/ Eutrophication/ Oxygen (D.O.)		Sedimentation/ Turbidity		Toxic contamination/ pH		Temperature		Soil chemistry/ Redox potential		Sum of Sub-variable Scores
0.90	+	0.95	+	0.85	+	1.00	+	0.90	=	4.60

Use the table to score the Chemical Environment Variable circling the applicable scoring rules.

Variable Score	Condition Class	Scoring Rules		
		Single Factor		**Composite Score**
1.0 - 0.9	*Reference Standard*	No single factor scores < 0.9	or	The factor scores sum > 4.5
<0.9 - 0.8	*Highly Functioning*	Any single factor scores ≥ 0.8 but < 0.9	or	The factor scores sum >4.0 but ≤4.5
<0.8 - 0.7	*Functioning*	Any single factor scores ≥ 7.0 but < 0.8	or	The factor scores sum >3.5 but ≤ 4.0
<0.7 - 0.6	*Functioning Impaired*	Any single factor scores ≥ 0.6 but <0.7	or	The factor scores sum >3.0 but ≤3.5
< 0.6	*Non-functioning*	Any single factor scores < 0.6	or	The factor scores sum < 3.0

Variable 7 Score 0.9

Variable 8: Geomorphology

This variable is a measure of the degree to which the geomorphic setting has been altered within the AA. Changes to the surface configuration and natural topography constitute stressors. Such stressors may be observed in the form of fill, excavation, diking, sedimentation due to absence of flushing floods, etc. In riverine systems geomorphic changes to stream channel should be considered if the channel is within the AA. Alterations may include bed surface changes (embeddedness or morphology changes), stream bank instability, and stream channel reconfiguration. Geomorphic changes are usually ultimately manifested as changes to wetland hydrology and water relations with vegetation. Geomorphic alteration can also directly affect soil properties, such as near-surface texture, and the wetland chemical environment, such as the redox state or nutrient composition in the rooting zone. In rating this variable, do not include these resultant effects of geomorphic change; rather focus on the physical impacts within the footprint of the alteration. The effects of geomorphic change are addressed by other variables. All alterations to the geomorphology should be evaluated including small-scale impa

Scoring Rules:

1. Identify impacts to geomorphological setting and topography within the AA and record them on the stressor checklist.
2. Considering all of the stressors identified, assign an overall variable score using the scoring guidelines.

✔		Stressors	Comments
	General	Dredging/Excavation/Mining	
	General	Fill, including dikes, road grades, etc	
	General	Grading	
	General	Compaction	
	General	Plowing/Disking	
	General	Excessive Sedimentation	
	General	Dumping	
	General	Hoof Shear/Pugging	
	General	Aggregate or Mineral Mining	
X	General	Sand Accumulation	Delta formation at reservoir edge
	Channels Only	Channel Instability/Over Widening	
	Channels Only	Excessive Bank Erosion	
	Channels Only	Channelization	
	Channels Only	Reconfigured Stream Channels	
	Channels Only	Artificial Banks/Shoreline	
	Channels Only	Beaver Dam Removal	
	Channels Only	Substrate Embeddedness	
	Channels Only	Lack or Excess of Woody Debris	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Topography essentially unaltered from the natural state, or alterations don't appear to have a minimal effect on wetland functioning and condition. Patch or microtopographic complexity may be slightly altered, but native plant communities are still supported.
<0.9 - 0.8	*Highly Functioning*	Alterations to topography result in small but detectable changes to habitat conditions throughout all or most of the AA; or changes causing more significant impacts but affecting less than 10% of the AA.
<0.8 - 0.7	*Functioning*	Changes to AA topography may be pervasive but generally mild. May include patches of more significant habitat alteration; or more significant alteration affecting less than 20 % of the AA.
<0.7 - 0.6	*Functioning Impaired*	At least one important surface type or landform has been eliminated or created; microtopography has been moderately altered throughout most or all of the AA, or more severe alterations affect less than 50% AA. Evidence that widespread diminishment or alteration of native plant community exist due to physical habitat alterations. Most incidentally created wetland habitat such as that created by roadside ditches and the like would score in this range or lower.
<0.6	*Non-functioning*	Geomorphic alterations have rendered the AA essentially unusable by *characteristic* wildlife species, or the physical setting no longer supports native plant communities.

Variable 8 Score: 0.97

Variable 9: Vegetation Structure and Complexity

This variable is a measure of the condition of the wetland's vegetation relative to its native state. It is particularly relevant to the wetland's ability to perform higher-order functions such as support of wildlife populations, although it also affects primary functions such as flood-flow attenuation. Score this variable by listing stressors that have affected the diversity, composition and cover of each vegetation cover class that would normally be present for the wetland type being assessed. For this variable, stressor severity is a measure of how much each vegetation stratum differs functionally from its natural condition.

Rules for Scoring:

1. Determine the number and types of vegetation layers present within the AA. Make a judgment as to whether additional layers were historically present using direct evidence such as stumps, root wads or historical photographs. Indirect evidence such as local knowledge and expert opinion can also be used in this determination. Check each present or suspected vegetation layer in the third row of the table.

2. Do not score vegetation layers that would not normally be present in the wetland type being assessed.

3. Estimate the percent coverage of each vegetation layer. Aerial photographs can be helpful for this but are not required.

4. Enter the percent cover values as decimals in the row of the stressor table labeled "Percent Cover of Layer". Note, percentages will often sum to more than 100% (1.0).

5. Determine the severity of stressors acting on each individual canopy layers, indicating their presence with checks in the appropriate boxes of the stressor table.

6. Determine the sub-variable score for each valid vegetation layer using the scoring guidelines on the second page of the scoring sheet. Enter each sub-variable score in the appropriate cell of the row labeled "Veg. Layer Sub-variable Score".

7. Add the "Veg. Layer Sub-variable Scores" and enter the sum in the labled cell to the right of the individual scores. Follow this same process for the "Percent Cover of Layer".

8. Divide the sum of "Veg. Layer Sub-variable Scores" by the total coverage of all layers scored. This product is the Variable 9 score. Enter this number in the labeled box at the bottom of this page.

	Vegetation Layers				
Layers Scored *(check boxes to right to indicate scored layers)*					
Stressor	**Tree**	**Shrub**	**Herb**	**Aquatic**	**Comments**
Noxious Weeds					
Exotic/Invasive spp.			X		Reed canarygrass, smooth brome
Tree Harvest					
Brush Cutting/Shrub Removal					
Livestock Grazing					
Excessive Herbivory					
Mowing/Haying					
Herbicide					
Loss of Zonation/Homogenization					
Dewatering					
Over Saturation					

	Tree		Shrub		Herb		Aquatic		Total
Percent Cover of Layer	60.00	+	19.00	+	18.00	+	3.00	=	100
	x		x		x		x		÷
Veg. Layer Sub-variable Score	1		1		0.8				
	=		=		=		=		
Weighted Sub-variable Score	60.00	+	19.00	+	14.40	+		=	93.4

See sub-variable scoring guidelines on following page

Variable 9 Score 0.93

Sub-variable 9 Scoring Guidelines

Based on the list of stressors identified above, rate the severity of their cumulative effect on vegetation structure and complexity for each vegetation layer.

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stressors not present or with an intensity low enough as to not detectably affect the structure, diversity or composition of the vegetation layer.
<0.9 - 0.8	*Highly Functioning*	Stressors present at an intensity levels sufficient to cause detectable, but minor, changes in layer composition. Stress related change should generally be less than 10% for any given attribute (e.g., 10% cover of invasive, 10% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 33% if stressors are confined to patches comprising less than 10% of the wetland.
<0.8 - 0.7	*Functioning*	Stressors present with enough intensity to cause significant changes in the character of vegetation, including alteration of layer coverage, structure complexity and species composition. The vegetation layer retains its essential character though. AA's with a high proportion of non-native grasses will commonly fall in this class. Stress related change should generally be less than 33% for any given attribute (e.g., 33% cover of invasive, 33% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 66% if stressors are confined to patches comprising less than 25% of the wetland.
<0.7 - 0.6	*Functioning Impaired*	Stressor intensity severe enough to cause profound changes to the fundamental character of the vegetation layer. Stress-related change should generally be less than 66% for any given attribute (e.g 66% cover of invasive, 66% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 80% if stressors are confined to patches comprising less than 50% of the wetland.
<0.6	*Non-functioning*	Vegetation layer has been completely removed or altered to the extent that is no longer comparable to the natural structure, diversity and composition.

FACWet Score Card

Scoring Procedure:

1. Transcribe variable scores from each variable data sheet to the corresponding cell in the variable score table.
2. In each Functional Capacity Index (FCI) equation, enter the corresponding variable scores in the equation cells. Do not enter values in the crossed cells lacking labels.
3. Add the variable scores to calculate the total functional points achieved for each function.
4. Divide the total functional points achieved by the functional points possible. The typical number of total points possible is provided, howe if a variable is added or subtracted to FCI equation the total possible points must be adjusted
5. Calculate the Composite FCI, by adding the FCI scores and dividing by the total number of functions scored (usually 7).
6. If scoring is done directly in the Excel spreadsheet, all values will be transferred and calculated automatically.

VARIABLE SCORE TABLE

Buffer & Landscape Context	**Variable 1:**	**Habitat Connectivity - Neighboring Wetland Habitat Loss**	0.95
	Variable 2:	**Habitat Connectivity - Migration/Dispersal Barriers**	0.57
	Variable 3:	**Buffer Capacity**	0.72
Hydrology	**Variable 4:**	**Water Source**	0.87
	Variable 5:	**Water Distribution**	0.80
	Variable 6:	**Water Outflow**	0.73
Abiotic and Biotic Habitat	**Variable 7:**	**Chemical Environment**	0.90
	Variable 8:	**Geomorphology**	0.97
	Variable 9:	**Vegetation Structure and Complexity**	0.93

Functional Capacity Indices

Function	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6	Total Functional Points	÷	Functional Capacity Index
Function 1 -- Support of Characteristic Wildlife Habitat	$V1_{wetloss}$	$V2_{barriers}$	$V3_{buffer}$	$(2 \times V9_{veg})$					
	0.95	0.57	0.72	1.87			4.11	5	0.82
Function 2 -- Support of Characteristic Fish/aquatic Habitat	$(3 \times V4_{source})$	$(2 \times V5_{dist})$	$2 \times V6_{outflow}$	$V7_{chem}$	$V8_{geom}$				
	2.61	1.60	1.46	0.90	0.97		7.54	9	0.84
Function 3 -- Flood Attenuation	$V3_{buffer}$	$2 \times V4_{source}$	$(2 \times V5_{dist})$	$2 \times V6_{outflow}$	$V8_{geom}$	$V9_{veg}$			
	0.72	1.74	1.60	1.46	0.97	0.93	7.42	9	0.82
Function 4 -- Short- and Long-term Water Storage	V_{source}	$(2 \times V5_{dist})$	$2 \times V6_{outflow})$	$V8_{geom}$					
	0.87	1.60	1.46	0.97			4.90	6	0.82
Function 5 -- Nutrient/Toxicant Removal	$(2 \times V5_{dist})$	$V7_{chem}$	$V8_{geom}$						
	1.60	0.90	0.97				3.47	4	0.87
Function 6 -- Sediment Retention/Shoreline Stabilization	$V3_{buffer}$	$(2 \times V8_{geo})$	$(2 \times V9_{veg})$						
	0.72	1.94	1.87				4.53	5	0.91
Function 7 -- Production Export/Food Chain Support	$V1_{wetloss}$	$2 \times V6_{outflow}$	$V7_{chem}$	$V8_{geo}$	$(2 \times V9_{veg})$				
	0.95	1.46	0.90	0.97	1.87		6.15	7	0.88

Sum of Individual FCI Scores **5.95**

Divide by the Number of Functions Scored (usually 7) **÷ 7**

Composite FCI Score **0.85**

ADMINISTRATIVE CHARACTERIZATION

General Information

		Date of Evaluation:	12/10/2008
Site Name or ID:	SPR 1	Project Name:	Chatfield Reallocation Study
404 or Other Permit Application #:	NA	Lead Federal Agency:	US Army Corps of Engineers
Evaluator Name(s):	Mary L. Powell	Evaluator's professional position and organization:	Natural Resource Specialist, ERO Resources, Corp.

Location Information:

Site Location (Lat./Long. or UTM):	493456.3661 4375457.794	Geographic Datum Used (NAD 83 preferred):	AND 83
USGS Quadrangle Map:	Littleton	Map Scale: (Circle one)	**1:24,000** 1:100,000 Other 1:
Sub basin Name (8 digit HUC):	10190002	Wetland Ownership:	US Army Corps of Engineers

Project Information:

This evaluation is being performed at: *(Check applicable box)*

- X *Project Wetland*
- ☐ *Mitigation Site*

Purpose of Evaluation (check all applicable):

- X *Potentially Impacted Wetlands*
- ☐ *Mitigation; Pre-construction*
- ☐ *Mitigation; Post-construction*
- ☐ *Monitoring*
- ☐ *Other (Describe)*

Intent of Project: *(Check all applicable)* X Preservation X Restoration X Enhancement X Creation

Total Size of Wetland Involved: (Record Area, Check and Describe Measurement Method Used)	6.19 ac.	X	Measured using GIS.				
			Estimated				
Assessment Area (AA) Size (Record Area, check appropriate box. Additional spaces are used to record acreage when more than one AA is included in a single assessment)	ac.	X	Measured	ac.	ac.	ac.	ac.
			Estimated	ac.	ac.	ac.	ac.
Characteristics or Method used for AA boundary determination:	Extent of AA determined by wetland mapping performed by TetraTech for FR/EIS study. Wetlands of same wetland category were grouped together based logical location on landscape.						

Notes:	

ECOLOGICAL DESCRIPTION 1

Special Concerns

Check all that apply

- [ ] Organic soils including Histosols or Histic Epipedons are present in the AA (i.e., AA includes core fen habitat).
- [ ] Project will directly impact organic soil portions of the AA including areas possessing either Histosol soils or histic epipedons.
- [ ] Organic soils are known to occur anywhere within the contiguous wetland of which the AA is part.
- [ ] The wetland is a habitat oasis in an otherwise dry or urbanized landscape?
- [X] Federally threatened or endangered species are **KNOWN** to occur in the AA? List Below.

PMJM assumed to be present based on proximity to occupied habitat

- [ ] Federally threatened or endangered species are **SUSPECTED** to occur in the AA?
- [ ] Species of concern according to the Colorado Natural Heritage (CNHP) are known to occur in the AA?
- [ ] The site is located within a potential conservation area or element occurrence buffer area as determined by CNHP?
- [ ] Other special concerns (please describe)

HYDROGEOMORPHIC SETTING

- [ ] AA wetland maintains its fundamental natural hydrogeomorphic characteristics
- [X] AA wetland has been subject to change in HGM classes as a result of anthropogenic modification

If the above is checked, please describe the original wetland type if discernable using the table below.

- [ ] AA wetland was created from an upland setting.

Previous wetland typology

Historical Conditions

Water source	**Surface flow**	**Groundwater**	Precipitation	Unknown
Hydrodynamics	**Unidirectional**	Vertical		
Geomorphic Setting (Narrative Description)	Area was likely previously part of SPR riparian corridor			
Previous HGM Class	**Riverine**	Slope	Depressional	Lacustrine

Current Conditions

Describe the hydrogeomorphic setting of the wetland by circling all conditions that apply.

HGM Setting

Water source	**Surface flow**	**Groundwater**	Precipitation	Unknown		
Hydrodynamics	**Unidirectional**	Vertical				
Wetland Gradient	**0 - 2%**	2-4%	4-10%	>10%		
# Surface Inlets	**Over-bank**	0	1	2	3	>3
# Surface Outlets	**Over-bank**	0	1	2	3	>3
Geomorphic Setting (Narrative Description)	Wetland and riparian areas associated with permimeter of Chatfield Reservoir. This area was likely part of the SPR riparian corridor prior to the dam.					
HGM class	Riverine	Slope	Depressional	**Lacustrine**		

Notes (include information on charcteristics used to formulate reference standard): Reference standard is the condition of the South Platte River prior to construction of Stroncha dam, Chatfield Reservoir, and park roads and trails.

ECOLOGICAL DESCRIPTION 2

Vegetation Habitat Description

*US FWS habitat classification according as reported in Cowardin et. al (1979) - See also Appendix *** of FACWet User Guide.*

System	Subsystem	Class	Subclass	Water Regime	Other Modifiers	% AA
Palustrine	Palustrine	Aquatic Bed	Non-persistent	Seasonally flooded		80%
Palustrine	Palustrine	Emergent	Persistent	Intermittently flooded		20%
Palustrine	Palustrine	Forested	Broad-leaved decid.	Intermittently flooded		20%
Lacustrine Palustrine Riverine	Littoral; Limnoral Palustrine Lower perennial; Upper perennial; Intermittent	Rock Bot. (RB) Uncon Bottom(UB) Aquatic Bed(AB) Rocky Shore(RS) Uncon Shore(US) Emergent(EM) Shrub-scrub(SS) Forested (FO)	Floating vascular; Rooted vascular; Algal; Persistent; Non-Persistent; Broad-leaved deciduous; Needle-leaved evergreen; Cobble - gravel; Sand; Mud; Organic	**Examples** Temporarily flooded(A); Saturated(B); Seasonally flooded(C); Seas.-flood./sat.(E); Perm. flooded(F); Intermittently Flooded(G); Artificially Flooded(K); Sat./semiperm./Seas. (Y); Int. exposed/permenant(Z)	Hypersaline(7) ; Eusaline(8); Mixosaline(9); Fresh(0); Acid(a); Circumneutral(c); Alkaline/calcareous(i); Organic(g); Mineral(n); Beaver(b); Partially Drained/ditched(d); Farmed(f); Diked/impounded(h); Artificial Substrate(r); Spoil(s); Excavated(x)	

Site Map

Scale: 1 sq. =

Draw a sketch map of the site including relevant portions of the wetland, AA boundary, structures, habitat classes, and other significant features.

Variable 1: Habitat Connectivity - Neighboring Wetland Habitat Loss

This variable is a measure of how isolated from other naturally-occurring wetland or riparian habitat the AA has become as a result of the loss of that habitat. To score this variable, estimate the percent of naturally- occurring wetland/riparian habitat that has been lost (by filling, draining, development, or whatever means) within a 500-meter-wide belt surrounding the AA. This surrounding area is called the Habitat Connectivity Envelope (HCE). Historical photographs and NWI maps can be helpful in scoring this variable. In most cases the evaluator must use best professional judgment in estimating the amount of natural wetland loss. Evaluation of landforms and habitat patterns in the context of perceivable land use change should be used to steer estimates of the amount of wetland loss within the HCE. This variable is not meant to penalize AAs that are naturally isolated, or unique to the landscape. Rather, it should measure the degree to which natural habitat connectivity has been lost.

Rules for Scoring:

1. On the aerial photo outline the area that is within 500 meters of the AA.
2. Identify obvious natural barriers within 500 m of the AA boundary.
   - *Natural barriers include continuous cliff bands, deep open water, etc.*
3. Draw the **Habitat Connectivity Envelope**(HCE) on the aerial image.
   - *The HCE is all the area within 500 meters of the AA that is not separated from it by a natural barrier.*
4. Outline the current extent of naturally occurring wetland and riparian habitat. Then outline areas where the habitats appear to have historically occurred.
   - *Use your knowledge of the history of the area and evident land use change. Additional research could be utilized to increase the accuracy of this estimate including consideratation of floodplain maps, historical aerials, etc.*

Variable Score	Condition Category	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	*Wetland losses are absent or negligible or there is no evidence to suggest the native landscape within the HCE historically contained other wetland habitats*
<0.9 - 0.8	*Highly Functioning*	*More than 80% of historical wetland habitat area within the HCE is still present (less than 20% historical wetland habitat area lost).*
<0.8 - 0.7	*Functioning*	*80 to 60% of historical wetland habitat area within the HCE is still present (20% to 40% historical wetland habitat area lost).*
<0.7 - 0.6	*Functioning Impaired*	*Less than 60 to 30% of historical wetland habitat area within the HCE is still present (more than 30 to 70% historical wetland habitat area lost).*
<0.6	*Non-functioning*	*Less than 30% of the historical wetland habitat area from within the HCE is now no longer in existence (more than 70% historical wetland habitat area lost).*

Variable 1 Score 0.6

Notes: Habitat lost below OHWM of lake.

Variable 2: Habitat Connectivity - Migration/Dispersal Barriers

This variable is intended to rate the degree to which the AA has become isolated from existing neighboring wetland and riparian habitat by artificial barriers that inhibit migration or dispersal of organisms. On the aerial photograph, identify the man-made barriers within the HCE that intercede between the AA and surrounding wetlands and riparian areas, and identify them by type on the stressor list. Score this variable based on the barriers' impermeability to migration and dispersal and the amount of surrounding wetland/riparian habitat they affect.

Rules for Scoring:

1. On the aerial photo, outline all existing wetland and riparian habitat areas (WHAs) within the HCE.
2. Identify artificial barriers to dispersal and migration of organisms within the HCE that intercede between the AA and surrounding habitats. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.
3. Considering the composite effect of all of identified barriers to migration and dispersal (i.e., stressors), assign an overall variable score using the scoring guidelines.

Stressors = artificial barriers

✔	Stressors	Comments/description
	Major Highway	
	Secondary Highway	
X	Tertiary Roadway	Interior park road (moderate)
	Railroad	
X	Bike Path	Soft-surface trails (low)
X	Urban Development	Parking lot for trailhead (low)
	Agricultural Development	
X	Artificial Water Body	OHWM of Chatfield (high)
	Fence	
	Ditch or Aqueduct	
	Aquatic Organism Barriers	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	No appreciable barriers exist between the AA and other wetland and riparian habitats in th HCE; or there are no other wetland and riparian areas in the HCE.
<0.9 - 0.8	*Highly Functioning*	Barriers impeding migration/dispersal between the AA and up to 33% of surrounding WHA highly permeable and easily passed by most organisms. Examples could include gravel roads, minor levees, ditches or barbed-wire fences. More significant barriers (see "functioning category below) could affect migration to up to 10% of surrounding WHA.
<0.8 - 0.7	*Functioning*	Barriers to migration and dispersal retard the ability of many organisms/propagules to pass between the AA and up to 66% of WHA. Passage of organisms and propagules through such barriers is still possible, but it may be constrained to certain times of day, be slow, dangerous or require additional travel. Busy two-lane roads, culverted areas, small to medium artificial water bodies or small earthen dams would commonly rate a score in this range. More significant barriers (see "functioning impaired" category below) could affect migration to up to 10% of surrounding WHA.
<0.7 - 0.6	*Functioning Impaired*	Barriers to migration and dispersal preclude the passage of some types of organisms/propagules between the AA and up to 66% of surrounding WHA. Travel of those animals which can potential negotiate the barrier are strongly restricted and may include a high chance of mortality. Up to 33% of surrounding WHA could be functionally isolated from the AA.
<0.6	*Non-functioning*	AA is essentially isolated from surrounding WHA by impermeable migration and dispersal barriers. An interstate highway or concrete-lined water conveyance canal are examples of barriers which would generally create functional isolation between the AA and a WHA.

Variable 2 Score 0.6

Variable 3: Buffer Capacity

The buffer area is defined as a 250-meter-wide belt surrounding the perimeter of the AA. This variable is a measure of the capacity of that area to function as an effective buffer for the wetland against the deleterious effects of surrounding land use change. To score the variable, assume that the AA is 100% buffered except where land use changes inside the buffer area have diminished this quality. Identify these land use types as specific stressors in the list. For each stressor, rate severity and extent within the buffer area; then use this list to make an overall rating for the buffer's departure from reference conditions. When rating buffer capacity, consider both the intensity of the impact and the proximity of the stressor to the AA.

Rules for Scoring:

1. On the aerial photograph, outline the buffer area as the zone within 250 meters of the outer boundary of the AA.
2. Use the stressor list to record land use changes that affect buffering capacity within the buffer area. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.
3. Considering all of the identified stressors, their overall severity, extent and proximity to the AA assign an overall variable score using the scoring guidelines.

Stressors = Land Use Changes	✔	Stressors	Comments/description
		Industrial/commercial	
		Urban	
		Residential	
		Rural	
		Dryland Farming	
		Intensive Agriculture	
		Orchards or Nurseries	
		Livestock Grazing	
		Transportation Corridor	
	X	Urban Parklands	Parking lot for trailheads and facilities (low)
		Dams/impoundments	
	x	Artificial Water body	Chatfield Reservoir (High)
		Physical Resource Extraction	
		Biological Resource Extraction	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	No appreciable land use change has been imposed within the TBA and it provides the full buffering capacity.
<0.9 - 0.8	*Highly Functioning*	Some land use change has occurred in the BA, but such changes little impair the area's ability to provide a buffering function, either because land use is not intensive, for example haying, light grazing, or nurseries, or more substantial changes occur in approximately less than 10% of the BA.
<0.8 - 0.7	*Functioning*	BA has been subjected to a marked shift in land use, however, the land retains much of its original buffering capacity. Moderate-intensity land uses such as dry-land farming, urban "green" corridors, or moderate cattle grazing would commonly be placed within this scoring range.
<0.7 - 0.6	*Functioning Impaired*	Land use within the BA has been substantial including the a moderate to high coverage (up to 50%) of impermeable surfaces, bare soil, or other artificial surface; considerable in-flow urban runoff or fertilizer-rich waters common. While, the buffering capacity of the land has been greatly diminished it is not extinguished. Intensively logged areas, low-density urban developments, some urban parklands and some cropping situations would commonly rate a score within this range.
<0.6	*Non-functioning*	The area within the BA provides essentially no buffering capacity. Many Commercial developments or highly urban landscapes would rate a score of less than 0.6.

Variable 3 score 0.65

Variable 4: Water Source

This variable is concerned with up-gradient hydrologic connectivity. It is a measure of the impacts to the AA's water source, including the ability of source water to perform work such as sediment transport, erosion, soil pore flushing, etc. To score this variable, identify stressors that alter the source of water to the AA, and record their presence on the stressor list. Stressors can impact water source by depletion, augmentation, or alteration of inflow timing or hydrodynamics. For riverine systems, this variable is primarily concerned with the connection of the channel to the floodplain.This variable is designed to assess water quantity, power and timing, not water quality. Water quality will be evaluated in Variable 7.

Scoring rules:

1. Use the stressor list and knowledge of the watershed to catalog type-specific impairments of the AA's water source. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.

2. Considering the composite effect of stressors on the water source, rate the condition of this variable with the aid of the scoring guidelines.

✔	Stressors	Comments/description
	Ditches or Drains (tile, etc.)	
X	Dams	Stroncha Reservoir u/s, Chatfield Dam (high)
	Diversions	
	Groundwater pumping	
X	Draw-downs	Chatfield Lake drawn down (mod)
	Culverts or Constrictions	
	Point Source (urban, ind., ag.)	
	Non-point Source	
	Increased Drainage Area	
	Storm Drain/Urban Runoff	
	Impermeable Surface Runoff	
	Irrigation Return Flows	
	Mining/Natural Gas Extraction	
X	Transbasin Diversion	Roberts Tunnel (low)
	Actively Managed Hydrology	
X		Primarily influenced now by reservoir rather than river (high)

Variable Score	Condition Class	Depletion	Augmentation
1.0 - 0.9	*Reference Standard*	Unnatural drawdown events minor, rare or non-existent, very slight uniform depletion, or trivial alteration of hydrodynamics.	Unnatural high-water events minor, rare or non-existent, slight uniform increase in amount of inflow, or trivial alteration of hydrodynamics.
<0.9 - 0.8	*Highly Functioning*	Unnatural drawdown events occasional, short duration and/or mild; or uniform depletion up to 20%; or mild to moderate reduction of peak flows or natural capacity of water to perform work.	Occasional unnatural high-water events, short in duration and/or mild in intensity; or uniform augmentation up to 20%; or mild to moderate increase of peak flows or natural capacity of water to perform work.
<0.8 - 0.7	*Functioning*	Unnatural drawdown events common and of mild to moderate intensity and/or duration; or uniform depletion up to 50%; or moderate to substantial reduction of peak flows or natural capacity of water to perform work.	Common occurrence of unnatural high-water events, of a mild to moderate intensity and/or duration; or uniform augmentation up to 50%; or moderate to substantial reduction of peak flows or natural capacity of water to perform work.
<0.7 - 0.6	*Functioning Impaired*	Unnatural drawdown events occur frequently with a moderate to high intensity and/or duration; or uniform depletion up to 75%; or substantial reduction of peak flows or natural capacity of water to perform work. **Wetlands with actively managed or wholly artificial hydrology will usually score in this range or lower.**	Common occurrence of unnatural high-water events, some of which may be severe in nature or exist for a substantial portion of the growing season; or uniform augmentation more than 50% or natural capacity of water to perform work. **Wetlands with actively managed or wholly artificial hydrology will usually score in this range or lower.**
<0.6	*Non-functioning*	Water source diminished enough to threaten jurisdictional classification of the AA.	Frequency, duration or magnitude of unnaturally high-water great enough to change the fundamental characteristics of the wetland.

Variable 4 Score 0.6

Variable 5: Water Distribution

This variable is concerned with hydrologic connectivity within the AA. It is a measure of alteration to the spatial distribution of surface and groundwater within the AA. These alterations are manifested as local changes to the hydrograph and generally ***result*** *from geomorphic modifications. To score this variable, identify stressors that alter flow patterns and impact the hydrograph within portions of the AA, including localized increases or decreases to the depth or duration of the water table or surface water. In naturally confined rivers (i.e. canyons and gullies) floodplain width is generally very small, so these systems will tend to score high for this variable unless some gross stressor is present.*

Scoring rules:

1. Identify impacts to the natural distribution of water throughout the AA and catalog them in the stressor table.
2. Considering all of the stressors identified, assign an overall variable score using the scoring guidelines.

✔	Stressors	Comments/description
	Ditches	
	Ponding/Impoundment	
	Culverts	
	Road Grades	
	Channel Incision/Entrenchment	
	Hardened/Engineered Channel	
	Enlarged Channel	
	Artificial Banks/Shoreline	
	Weirs	
	Dikes/Levees/Berms	
	Diversions	
	Sediment/Fill Accumulation	
		Reservoir groundwater alters how water move through site (high)

Variable Score	Condition Class	Non-riverine	Riverine
1.0 - 0.9	*Reference Standard*	Little or no alteration has been made to the way in which water is distributed throughout the wetland.	Natural active floodplain areas flood on a normal recurrence interval. No evidence of alteration of flooding and subirrigation duration and intensity.
<0.9 - 0.8	*Highly Functioning*	Less than 10% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in less than a 2 in. (5 cm) change in mean growing season water table elevation.	Channel-adjacent areas have occasional unnatural periods of drying or flooding; or uniform shift in the hydrograph less than typical root depth.
<0.8 - 0.7	*Functioning*	Between 10 and 33% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in a 4 in. (5 cm) or less change in mean growing season water table elevation.	In channel-adjacent area, periods of drying or flooding are common; or uniform shift in the hydrograph near root depth.
<0.7 - 0.6	*Functioning Impaired*	33 to 66% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in a 6 in. (15 cm) or less change in mean growing season water table elevation. Water table behavior must still meet jurisdictional criteria to merit this rating.	Adjacent to the channel, unnatural periods of drying or flooding are the norm; or uniform shift in the hydrograph greater than root depth.
<0.6	*Non-functioning*	More than 66% of the AA is affected by hydrologic alteration which changes the fundamental functioning of the wetland system	Historical active floodplain areas are almost never wetted from overbank flooding, and/or groundwater infiltration is effectively cut off.

Variable 5 Score | 0.55

Variable 6: Water Outflow

This variable is concerned with down-gradient hydrologic connectivity and the flow of water (transporting materials and energy) out of the AA. It is a measure of impacts that affect the hydrologic outflow of water including the passage of water through its normal low- and high-flow surface outlets, and infiltration/groundwater recharge. In some cases, alteration of evapotranspiration rates may be significant enough of a factor to consider in scoring. Score this variable by identifying stressors that impact the means by which water is exported from the AA. In Variable 5, the stressors were evaluated in light of their impact on water distribution within the AA. To evaluate this variable focus on how water, energy and associated materials are exported out of the AA.

Scoring rules:

1. Identify impacts to the natural outflow of water from the AA and catalog them in the stressor table.

2.Considering all of the stressors identified, assign an overall variable score using the scoring guidelines. Take in to account the cumulative effect of stressors on the wetland's ability to export water and water-borne materials

✔	Stressors	Comments/description
	Ditches	
	Dikes/Levees	
	Road Grades	
	Culverts	
	Diversions	
	Constrictions	
	Channel Incision/Entrenchment	
	Hardened/Engineered Channel	
	Artificial Stream Banks	
	Weirs	
	Confined Bridge Openings	
		Grounderwater alters how water leaves AA (high)

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stressors have little to no effect on the magnitude, timing or hydrodynamics of the AA water outflow regime.
<0.9 - 0.8	*Highly Functioning*	High- or low-water outflows are mildly to moderately affected, but at intermediate ("normal") lev flow continues essentially unaltered in quantity or character.
<0.8 - 0.7	*Functioning*	High- or low-water outflows are moderately affected, mild alteration of intermediate level outflow occurs; or hydrodynamics mildly to moderately affected.
<0.7 - 0.6	*Functioning Impaired*	Outflow at all stages is moderately impaired resulting in persistent flooding of portions of the AA or unnatural drainage; or outflow hydrodynamics significantly disrupted.
<0.6	*Non-functioning*	The natural outflow regime is severely disrupted. Down-gradient hydrologic connection severed or nearly so. Alterations may cause widespread unnatural persistent flooding or dewatering of the wetland system.

Variable 6 Score 0.63

Variable 7: Water and Soil Chemical Environment

This variable concerns the chemical environment of the soil and water media within the AA, including pollutants and water quality. The origin of pollutants may be in the AA or delivered from up-gradient or surrounding areas. Score this variable by listing indicators of chemical stress in the AA. Consider point source and non-point sources of pollution, as well as mechanical or hydrologic changes that alter the chemical environment. Because water quality frequently cannot be inferred directly, the presence of many stressors is identified via indirect indicators.

Scoring rules:

1. Stressors are grouped into categories which have a similar signature or set of causes.
2. Use the indicator list to identify each stressor impacting the chemical environment of the AA.
3. For each stressor category, determine the sub-variable score using the scoring guideline table provided on the second page of the scoring sheet.
 -If the AA is part of a water body that is recognized as impaired or recommended for TMDL development for one of the factors, then score that sub-variable 0.65 or lower.
4. Transcribe sub-variable scores to the following variable scoring page and compute the sum.
5. Determine the variable score by following the scoring guidelines.

Stressor Category	Stressor Indicator	✔	Comments	Sub-variable Score
Nutrient Enrichment/ Eutrophication/ Oxygen (D.O.)	Livestock			1.00
	Agricultural Runoff			
	Septic/Sewage			
	Excessive Algae or Aquatic Veg.			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Sedimentation/ Turbidity	Excessive Erosion			1.00
	Excessive Deposition			
	Fine Sediment Plumes			
	Agricultural Runoff			
	Excessive Turbidity			
	Nearby Construction Site			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Toxic contamination/ pH	Recent Chemical Spills			0.98
	Nearby Industrial Sites			
	Road Drainage/Runoff	X	Interior park road (low)	
	Livestock			
	Agricultural Runoff			
	Storm Water Runoff			
	Fish/Wildlife Impacts			
	Vegetation Impacts			
	Cumulative Watershed NPS			
	Acid Mine Drainage			
	Point Source Discharge			
	CDPHE Impairment/TMDL List			
Temperature	Excessive Temperature Regime			1.00
	Lack of Shading			
	Reservoir/Power Plant Discharge			
	Industrial Discharge			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Soil chemistry/ Redox potential	Unnatural Saturation/Desaturation	X	Artificially high water table (hi)	0.65
	Mechanical Soil Disturbance			
	Dumping/introduced Soil			
	CDPHE Impairment/TMDL List			

Variable 7: Water and Soil Chemical Environment

Sub-variable Scoring Guidelines

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stress indicators not present or trivial.
<0.9 - 0.8	*Highly Functioning*	Stress indicators scarcely present and mild, or otherwise not occurring in more than 10% of the AA.
<0.8 - 0.7	*Functioning*	Stress indicators present at mild to moderate levels, or otherwise not occurring in more than 33% of the AA.
<0.7 - 0.6	*Functioning Impaired*	Stress indicators present at moderate to high levels, or otherwise not occurring in more than 66% of the AA
<0.6	*Non-functioning*	Stress indicators strongly evident throughout the AA at levels which apparently alter the fundamental chemical environment of the wetland system

Input each factor score from the stressor list and calculate the sum.

Nutrient enrichment/ Eutrophication/ Oxygen (D.O.)		Sedimentation/ Turbidity		Toxic contamination/ pH		Temperature		Soil chemistry/ Redox potential		Sum of Sub-variable Scores
1.00	+	1.00	+	0.98	+	1.00	+	0.65	=	4.63

Use the table to score the Chemical Environment Variable circling the applicable scoring rules.

Variable Score	Condition Class	Scoring Rules		
		Single Factor		**Composite Score**
1.0 - 0.9	*Reference Standard*	No single factor scores < 0.9	or	The factor scores sum > 4.5
<0.9 - 0.8	*Highly Functioning*	Any single factor scores ≥ 0.8 but < 0.9	or	The factor scores sum >4.0 but ≤4.5
<0.8 - 0.7	*Functioning*	Any single factor scores ≥ 7.0 but < 0.8	or	The factor scores sum >3.5 but ≤ 4.0
<0.7 - 0.6	*Functioning Impaired*	Any single factor scores ≥ 0.6 but <0.7	or	The factor scores sum >3.0 but ≤3.5
< 0.6	*Non-functioning*	Any single factor scores < 0.6	or	The factor scores sum < 3.0

Variable 7 Score 0.9

Variable 8: Geomorphology

This variable is a measure of the degree to which the geomorphic setting has been altered within the AA. Changes to the surface configuration and natural topography constitute stressors. Such stressors may be observed in the form of fill, excavation, diking, sedimentation due to absence of flushing floods, etc. In riverine systems geomorphic changes to stream channel should be considered if the channel is within the AA. Alterations may include bed surface changes (embeddedness or morphology changes), stream bank instability, and stream channel reconfiguration. Geomorphic changes are usually ultimately manifested as changes to wetland hydrology and water relations with vegetation. Geomorphic alteration can also directly affect soil properties, such as near-surface texture, and the wetland chemical environment, such as the redox state or nutrient composition in the rooting zone. In rating this variable, do not include these resultant effects of geomorphic change; rather focus on the physical impacts within the footprint of the alteration. The effects of geomorphic change are addressed by other variables. All alterations to the geomorphology should be evaluated including small-scale impa

Scoring Rules:

1. Identify impacts to geomorphological setting and topography within the AA and record them on the stressor checklist.
2. Considering all of the stressors identified, assign an overall variable score using the scoring guidelines.

✔		Stressors	Comments
	General	Dredging/Excavation/Mining	
	General	Fill, including dikes, road grades, etc	
	General	Grading	
	General	Compaction	
	General	Plowing/Disking	
	General	Excessive Sedimentation	
	General	Dumping	
	General	Hoof Shear/Pugging	
	General	Aggregate or Mineral Mining	
	General	Sand Accumulation	
	Channels Only	Channel Instability/Over Widening	
	Channels Only	Excessive Bank Erosion	
	Channels Only	Channelization	
	Channels Only	Reconfigured Stream Channels	
X	Channels Only	Artificial Banks/Shoreline	Chatfield Reservoir (low)
	Channels Only	Beaver Dam Removal	
	Channels Only	Substrate Embeddedness	
	Channels Only	Lack or Excess of Woody Debris	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Topography essentially unaltered from the natural state, or alterations don't appear to have a minimal effect on wetland functioning and condition. Patch or microtopographic complexity may be slightly altered, but native plant communities are still supported.
<0.9 - 0.8	*Highly Functioning*	Alterations to topography result in small but detectable changes to habitat conditions throughout all or most of the AA; or changes causing more significant impacts but affecting less than 10% of the AA.
<0.8 - 0.7	*Functioning*	Changes to AA topography may be pervasive but generally mild. May include patches of more significant habitat alteration; or more significant alteration affecting less than 20 % of the AA.
<0.7 - 0.6	*Functioning Impaired*	At least one important surface type or landform has been eliminated or created; microtopography has been moderately altered throughout most or all of the AA, or more severe alterations affect less than 50% AA. Evidence that widespread diminishment or alteration of native plant community exist due to physical habitat alterations. Most incidentally created wetland habitat such as that created by roadside ditches and the like would score in this range or lower.
<0.6	*Non-functioning*	Geomorphic alterations have rendered the AA essentially unusable by *characteristic* wildlife species, or the physical setting no longer supports native plant communities.

Variable 8 Score: 0.95

Variable 9: Vegetation Structure and Complexity

This variable is a measure of the condition of the wetland's vegetation relative to its native state. It is particularly relevant to the wetland's ability to perform higher-order functions such as support of wildlife populations, although it also affects primary functions such as flood-flow attenuation. Score this variable by listing stressors that have affected the diversity, composition and cover of each vegetation cover class that would normally be present for the wetland type being assessed. For this variable, stressor severity is a measure of how much each vegetation stratum differs functionally from its natural condition.

Rules for Scoring:

1. Determine the number and types of vegetation layers present within the AA. Make a judgment as to whether additional layers were historically present using direct evidence such as stumps, root wads or historical photographs. Indirect evidence such as local knowledge and expert opinion can also be used in this determination. Check each present or suspected vegetation layer in the third row of the table.

2. Do not score vegetation layers that would not normally be present in the wetland type being assessed.

3. Estimate the percent coverage of each vegetation layer. Aerial photographs can be helpful for this but are not required.

4. Enter the percent cover values as decimals in the row of the stressor table labeled "Percent Cover of Layer". Note, percentages will often sum to more than 100% (1.0).

5. Determine the severity of stressors acting on each individual canopy layers, indicating their presence with checks in the appropriate boxes of the stressor table.

6. Determine the sub-variable score for each valid vegetation layer using the scoring guidelines on the second page of the scoring sheet. Enter each sub-variable score in the appropriate cell of the row labeled "Veg. Layer Sub-variable Score".

7. Add the "Veg. Layer Sub-variable Scores" and enter the sum in the labled cell to the right of the individual scores. Follow this same process for the "Percent Cover of Layer".

8. Divide the sum of "Veg. Layer Sub-variable Scores" by the total coverage of all layers scored. This product is the Variable 9 score. Enter this number in the labeled box at the bottom of this page.

	Vegetation Layers				
Layers Scored *(check boxes to right to indicate scored layers)*					
Stressor	**Tree**	**Shrub**	**Herb**	**Aquatic**	**Comments**
Noxious Weeds					
Exotic/Invasive spp.					
Tree Harvest					
Brush Cutting/Shrub Removal					
Livestock Grazing					
Excessive Herbivory					
Mowing/Haying					
Herbicide					
Loss of Zonation/Homogenization					
Dewatering					
Over Saturation	X		X	X	Artifically high water table (high)

	Tree		Shrub		Herb		Aquatic		Total
Percent Cover of Layer	20.00	+	0.00	+	20.00	+	80.00	=	120
	x		x		x		x		
Veg. Layer Sub-variable Score	0.9		1		0.9		0.7		÷
	=		=		=		=		
Weighted Sub-variable Score	18.00	+	0.00	+	18.00	+	56.00	=	92

See sub-variable scoring guidelines on following page

Variable 9 Score 0.77

Sub-variable 9 Scoring Guidelines

Based on the list of stressors identified above, rate the severity of their cumulative effect on vegetation structure and complexity for each vegetation layer.

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stressors not present or with an intensity low enough as to not detectably affect the structure, diversity or composition of the vegetation layer.
<0.9 - 0.8	*Highly Functioning*	Stressors present at an intensity levels sufficient to cause detectable, but minor, changes in layer composition. Stress related change should generally be less than 10% for any given attribute (e.g., 10% cover of invasive, 10% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 33% if stressors are confined to patches comprising less than 10% of the wetland.
<0.8 - 0.7	*Functioning*	Stressors present with enough intensity to cause significant changes in the character of vegetation, including alteration of layer coverage, structure complexity and species composition. The vegetation layer retains its essential character though. AA's with a high proportion of non-native grasses will commonly fall in this class. Stress related change should generally be less than 33% for any given attribute (e.g., 33% cover of invasive, 33% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 66% if stressors are confined to patches comprising less than 25% of the wetland.
<0.7 - 0.6	*Functioning Impaired*	Stressor intensity severe enough to cause profound changes to the fundamental character of the vegetation layer. Stress-related change should generally be less than 66% for any given attribute (e.g 66% cover of invasive, 66% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 80% if stressors are confined to patches comprising less than 50% of the wetland.
<0.6	*Non-functioning*	Vegetation layer has been completely removed or altered to the extent that is no longer comparable to the natural structure, diversity and composition.

FACWet Score Card

Scoring Procedure:

1. Transcribe variable scores from each variable data sheet to the corresponding cell in the variable score table.
2. In each Functional Capacity Index (FCI) equation, enter the corresponding variable scores in the equation cells. Do not enter values in the crossed cells lacking labels.
3. Add the variable scores to calculate the total functional points achieved for each function.
4. Divide the total functional points achieved by the functional points possible. The typical number of total points possible is provided, howe if a variable is added or subtracted to FCI equation the total possible points must be adjusted
5. Calculate the Composite FCI, by adding the FCI scores and dividing by the total number of functions scored (usually 7).
6. If scoring is done directly in the Excel spreadsheet, all values will be transferred and calculated automatically.

VARIABLE SCORE TABLE

Buffer & Landscape Context	**Variable 1:**	**Habitat Connectivity - Neighboring Wetland Habitat Loss**	0.60
	Variable 2:	**Habitat Connectivity - Migration/Dispersal Barriers**	0.60
	Variable 3:	**Buffer Capacity**	0.65
Hydrology	**Variable 4:**	**Water Source**	0.60
	Variable 5:	**Water Distribution**	0.55
	Variable 6:	**Water Outflow**	0.63
Abiotic and Biotic Habitat	**Variable 7:**	**Chemical Environment**	0.90
	Variable 8:	**Geomorphology**	0.95
	Variable 9:	**Vegetation Structure and Complexity**	0.77

Functional Capacity Indices

							Total Functional Points			Functional Capacity Index
Function 1 -- Support of Characteristic Wildlife Habitat										
$V1_{wetloss}$ +	$V2_{barriers}$ +	$V3_{buffer}$ +	$(2 \times V9_{veg})$							
0.60 +	0.60 +	0.65 +	1.53 +	+		=	3.38	÷	5	= 0.68
Function 2 -- Support of Characteristic Fish/aquatic Habitat										
$(3 \times V4_{source})$ +	$(2 \times V5_{dist})$ +	$2 \times V6_{outflow}$ +	$V7_{chem}$ +	$V8_{geom}$						
1.80 +	1.10 +	1.26 +	0.90 +	0.95 +		=	6.01	÷	9	= 0.67
Function 3 -- Flood Attenuation										
$V3_{buffer}$ +	$2 \times V4_{source}$ +	$(2 \times V5_{dist})$ +	$2 \times V6_{outflow}$ +	$V8_{geom}$ +	$V9_{veg}$					
0.65 +	1.20 +	1.10 +	1.26 +	0.95 +	0.77	=	5.93	÷	9	= 0.66
Function 4 -- Short- and Long-term Water Storage										
V_{source} +	$(2 \times V5_{dist})$ +	$2 \times V6_{outflow})$	$V8_{geom}$							
0.60 +	1.10 +	1.26 +	0.95 +	+		=	3.91	÷	6	= 0.65
Function 5 -- Nutrient/Toxicant Removal										
$(2 \times V5_{dist})$ +	$V7_{chem}$ +	$V8_{geom}$								
1.10 +	0.90 +	0.95 +	+	+		=	2.95	÷	4	= 0.74
Function 6 -- Sediment Retention/Shoreline Stabilization										
$V3_{buffer}$ +	$(2 \times V8_{geo})$ +	$(2 \times V9_{veg})$								
0.65 +	1.90 +	1.53 +	+	+		=	4.08	÷	5	= 0.82
Function 7 -- Production Export/Food Chain Support										
$V1_{wetloss}$ +	$2 \times V6_{outflow}$ +	$V7_{chem}$ +	$V8_{geo}$ +	$(2 \times V9_{veg})$						
0.60 +	1.26 +	0.90 +	0.95 +	1.53 +		=	5.24	÷	7	= 0.75

Sum of Individual FCI Scores **4.96**

Divide by the Number of Functions Scored (usually 7) **÷ 7**

Composite FCI Score **0.71**

ADMINISTRATIVE CHARACTERIZATION

General Information

		Date of Evaluation:	12/10/2008
Site Name or ID:	SPR 2	Project Name:	Chatfield Reallocation FR/EIS
404 or Other Permit Application #:		Lead Federal Agency	U.S. Army Corps of Engineers
Evaluator Name(s):	Mary L. Powell	Evaluator's professional position and organization:	Natural Resource Specialist, ERO Resources, Corp.

Location Information:

Site Location (Lat./Long. or UTM):	493219.3101 4373890.11	Geographic Datum Used (NAD 83 preferred):	AND 83
USGS Quadrangle Map:	Littleton	Map Scale: (Circle one)	**1:24,000** 1:100,000 Other 1:
Sub basin Name (8 digit HUC):	Upper South Platte (10190002)	Wetland Ownership:	U.S. Army Corps of Engineers

Project Information:

This evaluation is being performed at: *(Check applicable box)*
- [x] *Project Wetland*
- [ ] *Mitigation Site*

Purpose of Evaluation (check all applicable):
- [x] *Potentially Impacted Wetlands*
- [ ] *Mitigation; Pre-construction*
- [ ] *Mitigation; Post-construction*
- [ ] *Monitoring*
- [ ] *Other (Describe)*

Intent of Project: *(Check all applicable)* X Preservation X Restoration X Enhancement X Creation

Total Size of Wetland Involved: (Record Area, Check and Describe Measurement Method Used)	3.98 ac.	X	Measured				
			Estimated				
Assessment Area (AA) Size (Record Area, check appropriate box. Additional spaces are used to record acreage when more than one AA is included in a single assessment)	ac.	X	Measured	ac.	ac.	ac.	ac.
			Estimated	ac.	ac.	ac.	ac.
Characteristics or Method used for AA boundary determination:	Extent of AA determined by wetland mapping performed by TetraTech for FR/EIS study. Wetlands of same wetland category were grouped together based logical location on landscape.						

Notes:	Riparian and wetlland complex along the South Platte River upstream of interior park road.

ECOLOGICAL DESCRIPTION 1

Special Concerns

Check all that apply

- [ ] Organic soils including Histosols or Histic Epipedons are present in the AA (i.e., AA includes core fen habitat).
- [ ] Project will directly impact organic soil portions of the AA including areas possessing either Histosol soils or histic epipedons.
- [ ] Organic soils are known to occur anywhere within the contiguous wetland of which the AA is part.
- [ ] The wetland is a habitat oasis in an otherwise dry or urbanized landscape?
- [X] Federally threatened or endangered species are **KNOWN** to occur in the AA? List Below.
- [ ] Federally threatened or endangered species are **SUSPECTED** to occur in the AA?
- [ ] Species of concern according to the Colorado Natural Heritage (CNHP) are known to occur in the AA?
- [ ] The site is located within a potential conservation area or element occurrence buffer area as determined by CNHP?
- [ ] Other special concerns (please describe)

HYDROGEOMORPHIC SETTING

- [X] AA wetland maintains its fundamental natural hydrogeomorphic characteristics
- [ ] AA wetland has been subject to change in HGM classes as a result of anthropogenic modification
  If the above is checked, please describe the original wetland type if discernable using the table below.
- [ ] AA wetland was created from an upland setting.

Previous wetland typology	Historical Conditions				
	Water source	Surface flow	Groundwater	Precipitation	Unknown
	Hydrodynamics	Unidirectional	Vertical		
	Geomorphic Setting (Narrative Description)				
	Previous HGM Class	Riverine	Slope	Depressional	Lacustrine

Current Conditions

Describe the hydrogeomorphic setting of the wetland by circling all conditions that apply.

HGM Setting							
	Water source	**Surface flow**	**Groundwater**	Precipitation	Unknown		
	Hydrodynamics	**Unidirectional**	Vertical				
	Wetland Gradient	**0 - 2%**	2-4%	4-10%	>10%		
	# Surface Inlets	Over-bank	0	**1**	2	3	>3
	# Surface Outlets		0	**1**	2	3	>3
	Geomorphic Setting (Narrative Description)	Wetlands located slightly above OHW of Chatfield Reservoir. Wetlands were probably present prior to the reservoir, but their subsurface hydrology may now be influenced by reservoir levels.					
	HGM class	**Riverine**	Slope	Depressional	Lacustrine		

Notes (include information on charcteristics used to formulate reference standard): Reference standard is South Platte River prior to construction of Stroncha and Chatfield dams, Highline Canal. The reference standard assumes that existing groundwater hydrograph in the riparian corridor at this location is under at least some influence from Chatfield, which may affect species composition.

ECOLOGICAL DESCRIPTION 2

Vegetation Habitat Description

*US FWS habitat classification according as reported in Cowardin et. al (1979) - See also Appendix *** of FACWet User Guide.*

System	Subsystem	Class	Subclass	Water Regime	Other Modifiers	% AA
Palustrine	Palustrine	Shrub-scrub	Persistent	Seasonally flooded		80
Palustrine	Palustrine	Emergent	Persistent	Seasonally flooded		20
Lacustrine	Littoral; Limnoral	Rock Bot. (RB) Uncon Bottom(UB) Aquatic Bed(AB) Rocky Shore(RS) Uncon Shore(US) Emergent(EM) Shrub-scrub(SS) Forested (FO)	Floating vascular; Rooted vascular; Algal; Persistent; Non-Persistent; Broad-leaved deciduous; Needle-leaved evergreen; Cobble - gravel; Sand; Mud; Organic	**Examples** Temporarily flooded(A); Saturated(B); Seasonally flooded(C); Seas.-flood./sat.(E); Perm. flooded(F); Intermittently Flooded(G); Artificially Flooded(K); Sat./semiperm./Seas. (Y); Int. exposed/permenant(Z)	Hypersaline(7) ; Eusaline(8); Mixosaline(9); Fresh(0); Acid(a); Circumneutral(c); Alkaline/calcareous(i); Organic(g); Mineral(n); Beaver(b); Partially Drained/ditched(d); Farmed(f); Diked/impounded(h); Artificial Substrate(r); Spoil(s); Excavated(x)	
Palustrine	Palustrine					
Riverine	Lower perennial; Upper perennial; Intermittent					

Site Map

Scale: 1 sq. =

Draw a sketch map of the site including relevant portions of the wetland, AA boundary, structures, habitat classes, and other significant features.

Variable 1: Habitat Connectivity - Neighboring Wetland Habitat Loss

This variable is a measure of how isolated from other naturally-occurring wetland or riparian habitat the AA has become as a result of the loss of that habitat. To score this variable, estimate the percent of naturally- occurring wetland/riparian habitat that has been lost (by filling, draining, development, or whatever means) within a 500-meter-wide belt surrounding the AA. This surrounding area is called the Habitat Connectivity Envelope (HCE). Historical photographs and NWI maps can be helpful in scoring this variable. In most cases the evaluator must use best professional judgment in estimating the amount of natural wetland loss. Evaluation of landforms and habitat patterns in the context of perceivable land use change should be used to steer estimates of the amount of wetland loss within the HCE. This variable is not meant to penalize AAs that are naturally isolated, or unique to the landscape. Rather, it should measure the degree to which natural habitat connectivity has been lost.

Rules for Scoring:

1. On the aerial photo outline the area that is within 500 meters of the AA.
2. Identify obvious natural barriers within 500 m of the AA boundary.
   - *Natural barriers include continuous cliff bands, deep open water, etc.*
3. Draw the **Habitat Connectivity Envelope**(HCE) on the aerial image.
   - *The HCE is all the area within 500 meters of the AA that is not separated from it by a natural barrier.*
4. Outline the current extent of naturally occurring wetland and riparian habitat. Then outline areas where the habitats appear to have historically occurred.
   - *Use your knowledge of the history of the area and evident land use change. Additional research could be utilized to increase the accuracy of this estimate including consideratation of floodplain maps, historical aerials, etc.*

Variable Score	Condition Category	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	*Wetland losses are absent or negligible or there is no evidence to suggest the native landscape within the HCE historically contained other wetland habitats*
<0.9 - 0.8	*Highly Functioning*	*More than 80% of historical wetland habitat area within the HCE is still present (less than 20% historical wetland habitat area lost).*
<0.8 - 0.7	*Functioning*	*80 to 60% of historical wetland habitat area within the HCE is still present (20% to 40% historical wetland habitat area lost).*
<0.7 - 0.6	*Functioning Impaired*	*Less than 60 to 30% of historical wetland habitat area within the HCE is still present (more than 30 to 70% historical wetland habitat area lost).*
<0.6	*Non-functioning*	*Less than 30% of the historical wetland habitat area from within the HCE is now no longer in existence (more than 70% historical wetland habitat area lost).*

Variable 1 Score 0.72

Notes: Chatfield Reservoir has inundated portions of riparian corridor.

Variable 2: Habitat Connectivity - Migration/Dispersal Barriers

This variable is intended to rate the degree to which the AA has become isolated from existing neighboring wetland and riparian habitat by artificial barriers that inhibit migration or dispersal of organisms. On the aerial photograph, identify the man-made barriers within the HCE that intercede between the AA and surrounding wetlands and riparian areas, and identify them by type on the stressor list. Score this variable based on the barriers' impermeability to migration and dispersal and the amount of surrounding wetland/riparian habitat they affect.

Rules for Scoring:

1. On the aerial photo, outline all existing wetland and riparian habitat areas (WHAs) within the HCE.

2. Identify artificial barriers to dispersal and migration of organisms within the HCE that intercede between the AA and surrounding habitats. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.

3. Considering the composite effect of all of identified barriers to migration and dispersal (i.e., stressors), assign an overall variable score using the scoring guidelines.

Stressors = artificial barriers	✔	Stressors	Comments/description
		Major Highway	
		Secondary Highway	
	X	Tertiary Roadway	Interior park roads, parking lot (moderate)
		Railroad	
	X	Bike Path	Soft surface trail on both sides of riparian corridor (low)
		Urban Development	
		Agricultural Development	
	X	Artificial Water Body	Gravel pits (moderate)
		Fence	
		Ditch or Aqueduct	
		Aquatic Organism Barriers	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	No appreciable barriers exist between the AA and other wetland and riparian habitats in th HCE; or there are no other wetland and riparian areas in the HCE.
<0.9 - 0.8	*Highly Functioning*	Barriers impeding migration/dispersal between the AA and up to 33% of surrounding WHA highly permeable and easily passed by most organisms. Examples could include gravel roads, minor levees, ditches or barbed-wire fences. More significant barriers (see "functioning category below) could affect migration to up to 10% of surrounding WHA.
<0.8 - 0.7	*Functioning*	Barriers to migration and dispersal retard the ability of many organisms/propagules to pass between the AA and up to 66% of WHA. Passage of organisms and propagules through such barriers is still possible, but it may be constrained to certain times of day, be slow, dangerous or require additional travel. Busy two-lane roads, culverted areas, small to medium artificial water bodies or small earthen dams would commonly rate a score in this range. More significant barriers (see "functioning impaired" category below) could affect migration to up to 10% of surrounding WHA.
<0.7 - 0.6	*Functioning Impaired*	Barriers to migration and dispersal preclude the passage of some types of organisms/propagules between the AA and up to 66% of surrounding WHA. Travel of those animals which can potential negotiate the barrier are strongly restricted and may include a high chance of mortality. Up to 33% of surrounding WHA could be functionally isolated from the AA.
<0.6	*Non-functioning*	AA is essentially isolated from surrounding WHA by impermeable migration and dispersal barriers. An interstate highway or concrete-lined water conveyance canal are examples of barriers which would generally create functional isolation between the AA and a WHA.

Variable 2 Score | 0.8

Variable 3: Buffer Capacity

The buffer area is defined as a 250-meter-wide belt surrounding the perimeter of the AA. This variable is a measure of the capacity of that area to function as an effective buffer for the wetland against the deleterious effects of surrounding land use change. To score the variable, assume that the AA is 100% buffered except where land use changes inside the buffer area have diminished this quality. Identify these land use types as specific stressors in the list. For each stressor, rate severity and extent within the buffer area; then use this list to make an overall rating for the buffer's departure from reference conditions. When rating buffer capacity, consider both the intensity of the impact and the proximity of the stressor to the AA.

Rules for Scoring:

1. On the aerial photograph, outline the buffer area as the zone within 250 meters of the outer boundary of the AA.
2. Use the stressor list to record land use changes that affect buffering capacity within the buffer area. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.
3. Considering all of the identified stressors, their overall severity, extent and proximity to the AA assign an overall variable score using the scoring guidelines.

Stressors = Land Use Changes

✔	Stressors	Comments/description
	Industrial/commercial	
	Urban	
	Residential	
	Rural	
	Dryland Farming	
	Intensive Agriculture	
	Orchards or Nurseries	
	Livestock Grazing	
	Transportation Corridor	
	Urban Parklands	
	Dams/impoundments	
	Artificial Water body	
X	Physical Resource Extraction	Gravel pits (high severity, low extent)
	Biological Resource Extraction	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	No appreciable land use change has been imposed within the TBA and it provides the full buffering capacity.
<0.9 - 0.8	*Highly Functioning*	Some land use change has occurred in the BA, but such changes little impair the area's ability to provide a buffering function, either because land use is not intensive, for example haying, light grazing, or nurseries, or more substantial changes occur in approximately less than 10% of the BA.
<0.8 - 0.7	*Functioning*	BA has been subjected to a marked shift in land use, however, the land retains much of its original buffering capacity. Moderate-intensity land uses such as dry-land farming, urban "green" corridors, or moderate cattle grazing would commonly be placed within this scoring range.
<0.7 - 0.6	*Functioning Impaired*	Land use within the BA has been substantial including the a moderate to high coverage (up to 50%) of impermeable surfaces, bare soil, or other artificial surface; considerable in-flow urban runoff or fertilizer-rich waters common. While, the buffering capacity of the land has been greatly diminished it is not extinguished. Intensively logged areas, low-density urban developments, some urban parklands and some cropping situations would commonly rate a score within this range.
<0.6	*Non-functioning*	The area within the BA provides essentially no buffering capacity. Many Commercial developments or highly urban landscapes would rate a score of less than 0.6.

Variable 3 score 0.85

Variable 4: Water Source

This variable is concerned with up-gradient hydrologic connectivity. It is a measure of the impacts to the AA's water source, including the ability of source water to perform work such as sediment transport, erosion, soil pore flushing, etc. To score this variable, identify stressors that alter the source of water to the AA, and record their presence on the stressor list. Stressors can impact water source by depletion, augmentation, or alteration of inflow timing or hydrodynamics. For riverine systems, this variable is primarily concerned with the connection of the channel to the floodplain.This variable is designed to assess water quantity, power and timing, not water quality. Water quality will be evaluated in Variable 7.

Scoring rules:

1. Use the stressor list and knowledge of the watershed to catalog type-specific impairments of the AA's water source. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.

2. Considering the composite effect of stressors on the water source, rate the condition of this variable with the aid of the scoring guidelines.

✔	Stressors	Comments/description
	Ditches or Drains (tile, etc.)	
X	Dams	Stroncha Dam (high)
X	Diversions	Highline Canal, Denver Water (moderate)
	Groundwater pumping	
	Draw-downs	
	Culverts or Constrictions	
	Point Source (urban, ind., ag.)	
	Non-point Source	
	Increased Drainage Area	
	Storm Drain/Urban Runoff	
	Impermeable Surface Runoff	
	Irrigation Return Flows	
	Mining/Natural Gas Extraction	
X	Transbasin Diversion	Roberts Tunnel (low)
	Actively Managed Hydrology	

Variable Score	Condition Class	Depletion	Augmentation
1.0 - 0.9	*Reference Standard*	Unnatural drawdown events minor, rare or non-existent, very slight uniform depletion, or trivial alteration of hydrodynamics.	Unnatural high-water events minor, rare or non-existent, slight uniform increase in amount of inflow, or trivial alteration of hydrodynamics.
<0.9 - 0.8	*Highly Functioning*	Unnatural drawdown events occasional, short duration and/or mild; or uniform depletion up to 20%; or mild to moderate reduction of peak flows or natural capacity of water to perform work.	Occasional unnatural high-water events, short in duration and/or mild in intensity; or uniform augmentation up to 20%; or mild to moderate increase of peak flows or natural capacity of water to perform work.
<0.8 - 0.7	*Functioning*	Unnatural drawdown events common and of mild to moderate intensity and/or duration; or uniform depletion up to 50%; or moderate to substantial reduction of peak flows or natural capacity of water to perform work.	Common occurrence of unnatural high-water events, of a mild to moderate intensity and/or duration; or uniform augmentation up to 50%; or moderate to substantial reduction of peak flows or natural capacity of water to perform work.
<0.7 - 0.6	*Functioning Impaired*	Unnatural drawdown events occur frequently with a moderate to high intensity and/or duration; or uniform depletion up to 75%; or substantial reduction of peak flows or natural capacity of water to perform work. **Wetlands with actively managed or wholly artificial hydrology will usually score in this range or lower.**	Common occurrence of unnatural high-water events, some of which may be severe in nature or exist for a substantial portion of the growing season; or uniform augmentation more than 50% or natural capacity of water to perform work. **Wetlands with actively managed or wholly artificial hydrology will usually score in this range or lower.**
<0.6	*Non-functioning*	Water source diminished enough to threaten jurisdictional classification of the AA.	Frequency, duration or magnitude of unnaturally high-water great enough to change the fundamental characteristics of the wetland.

Variable 4 Score 0.7

Variable 5: Water Distribution

This variable is concerned with hydrologic connectivity within the AA. It is a measure of alteration to the spatial distribution of surface and groundwater within the AA. These alterations are manifested as local changes to the hydrograph and generally ***result*** *from geomorphic modifications. To score this variable, identify stressors that alter flow patterns and impact the hydrograph within portions of the AA, including localized increases or decreases to the depth or duration of the water table or surface water. In naturally confined rivers (i.e. canyons and gullies) floodplain width is generally very small, so these systems will tend to score high for this variable unless some gross stressor is present.*

Scoring rules:

1. Identify impacts to the natural distribution of water throughout the AA and catalog them in the stressor table.
2. Considering all of the stressors identified, assign an overall variable score using the scoring guidelines.

✔	Stressors	Comments/description
	Ditches	
	Ponding/Impoundment	
	Culverts	
	Road Grades	
	Channel Incision/Entrenchment	Channel incised because of reduced sediment load and peak flows (high)
	Hardened/Engineered Channel	
	Enlarged Channel	
	Artificial Banks/Shoreline	
	Weirs	
	Dikes/Levees/Berms	
	Diversions	
	Sediment/Fill Accumulation	

Variable Score	Condition Class	Non-riverine	Riverine
1.0 - 0.9	*Reference Standard*	Little or no alteration has been made to the way in which water is distributed throughout the wetland.	Natural active floodplain areas flood on a normal recurrence interval. No evidence of alteration of flooding and subirrigation duration and intensity.
<0.9 - 0.8	*Highly Functioning*	Less than 10% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in less than a 2 in. (5 cm) change in mean growing season water table elevation.	Channel-adjacent areas have occasional unnatural periods of drying or flooding; or uniform shift in the hydrograph less than typical root depth.
<0.8 - 0.7	*Functioning*	Between 10 and 33% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in a 4 in. (5 cm) or less change in mean growing season water table elevation.	In channel-adjacent area, periods of drying or flooding are common; or uniform shift in the hydrograph near root depth.
<0.7 - 0.6	*Functioning Impaired*	33 to 66% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in a 6 in. (15 cm) or less change in mean growing season water table elevation. Water table behavior must still meet jurisdictional criteria to merit this rating.	Adjacent to the channel, unnatural periods of drying or flooding are the norm; or uniform shift in the hydrograph greater than root depth.
<0.6	*Non-functioning*	More than 66% of the AA is affected by hydrologic alteration which changes the fundamental functioning of the wetland system	Historical active floodplain areas are almost never wetted from overbank flooding, and/or groundwater infiltration is effectively cut off.

Variable 5 Score | 0.7

Variable 6: Water Outflow

This variable is concerned with down-gradient hydrologic connectivity and the flow of water (transporting materials and energy) out of the AA. It is a measure of impacts that affect the hydrologic outflow of water including the passage of water through its normal low- and high-flow surface outlets, and infiltration/groundwater recharge. In some cases, alteration of evapotranspiration rates may be significant enough of a factor to consider in scoring. Score this variable by identifying stressors that impact the means by which water is exported from the AA. In Variable 5, the stressors were evaluated in light of their impact on water distribution within the AA. To evaluate this variable focus on how water, energy and associated materials are exported out of the AA.

Scoring rules:

1. Identify impacts to the natural outflow of water from the AA and catalog them in the stressor table.

2.Considering all of the stressors identified, assign an overall variable score using the scoring guidelines. Take in to account the cumulative effect of stressors on the wetland's ability to export water and water-borne materials

✔	Stressors	Comments/description
	Ditches	
	Dikes/Levees	
	Road Grades	
	Culverts	
	Diversions	
	Constrictions	
X	Channel Incision/Entrenchment	Incised channel (low effect on outflow)
	Hardened/Engineered Channel	
	Artificial Stream Banks	
	Weirs	
	Confined Bridge Openings	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stressors have little to no effect on the magnitude, timing or hydrodynamics of the AA water outflow regime.
<0.9 - 0.8	*Highly Functioning*	High- or low-water outflows are mildly to moderately affected, but at intermediate ("normal") lev flow continues essentially unaltered in quantity or character.
<0.8 - 0.7	*Functioning*	High- or low-water outflows are moderately affected, mild alteration of intermediate level outflow occurs; or hydrodynamics mildly to moderately affected.
<0.7 - 0.6	*Functioning Impaired*	Outflow at all stages is moderately impaired resulting in persistent flooding of portions of the AA or unnatural drainage; or outflow hydrodynamics significantly disrupted.
<0.6	*Non-functioning*	The natural outflow regime is severely disrupted. Down-gradient hydrologic connection severed or nearly so. Alterations may cause widespread unnatural persistent flooding or dewatering of the wetland system.

Variable 6 Score | 0.95

Variable 7: Water and Soil Chemical Environment

This variable concerns the chemical environment of the soil and water media within the AA, including pollutants and water quality. The origin of pollutants may be in the AA or delivered from up-gradient or surrounding areas. Score this variable by listing indicators of chemical stress in the AA. Consider point source and non-point sources of pollution, as well as mechanical or hydrologic changes that alter the chemical environment. Because water quality frequently cannot be inferred directly, the presence of many stressors is identified via indirect indicators.

Scoring rules:

1. Stressors are grouped into categories which have a similar signature or set of causes.
2. Use the indicator list to identify each stressor impacting the chemical environment of the AA.
3. For each stressor category, determine the sub-variable score using the scoring guideline table provided on the second page of the scoring sheet.
   -If the AA is part of a water body that is recognized as impaired or recommended for TMDL development for one of the factors, then score that sub-variable 0.65 or lower.
4. Transcribe sub-variable scores to the following variable scoring page and compute the sum.
5. Determine the variable score by following the scoring guidelines.

Stressor Category	Stressor Indicator	✔	Comments	Sub-variable Score
Nutrient Enrichment/ Eutrophication/ Oxygen (D.O.)	Livestock			1.00
	Agricultural Runoff			
	Septic/Sewage			
	Excessive Algae or Aquatic Veg.			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Sedimentation/ Turbidity	Excessive Erosion	X	Channel incision (mod)	0.90
	Excessive Deposition			
	Fine Sediment Plumes			
	Agricultural Runoff			
	Excessive Turbidity			
	Nearby Construction Site			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Toxic contamination/ pH	Recent Chemical Spills			0.90
	Nearby Industrial Sites	X	Lockheed Martin (low)	
	Road Drainage/Runoff			
	Livestock			
	Agricultural Runoff			
	Storm Water Runoff	X	Upstream development (low)	
	Fish/Wildlife Impacts			
	Vegetation Impacts			
	Cumulative Watershed NPS			
	Acid Mine Drainage			
	Point Source Discharge			
	CDPHE Impairment/TMDL List			
Temperature	Excessive Temperature Regime			1.00
	Lack of Shading			
	Reservoir/Power Plant Discharge			
	Industrial Discharge			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Soil chemistry/ Redox potential	Unnatural Saturation/Desaturation			1.00
	Mechanical Soil Disturbance			
	Dumping/introduced Soil			
	CDPHE Impairment/TMDL List			

Variable 7: Water and Soil Chemical Environment

Sub-variable Scoring Guidelines

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stress indicators not present or trivial.
<0.9 - 0.8	*Highly Functioning*	Stress indicators scarcely present and mild, or otherwise not occurring in more than 10% of the AA.
<0.8 - 0.7	*Functioning*	Stress indicators present at mild to moderate levels, or otherwise not occurring in more than 33% of the AA.
<0.7 - 0.6	*Functioning Impaired*	Stress indicators present at moderate to high levels, or otherwise not occurring in more than 66% of the AA
<0.6	*Non-functioning*	Stress indicators strongly evident throughout the AA at levels which apparently alter the fundamental chemical environment of the wetland system

Input each factor score from the stressor list and calculate the sum.

Nutrient enrichment/ Eutrophication/ Oxygen (D.O.)		Sedimentation/ Turbidity		Toxic contamination/ pH		Temperature		Soil chemistry/ Redox potential		Sum of Sub-variable Scores
1.00	+	0.90	+	0.90	+	1.00	+	1.00	=	4.80

Use the table to score the Chemical Environment Variable circling the applicable scoring rules.

Variable Score	Condition Class	Scoring Rules		
		Single Factor		**Composite Score**
1.0 - 0.9	*Reference Standard*	No single factor scores < 0.9	or	The factor scores sum > 4.5
<0.9 - 0.8	*Highly Functioning*	Any single factor scores ≥ 0.8 but < 0.9	or	The factor scores sum >4.0 but ≤4.5
<0.8 - 0.7	*Functioning*	Any single factor scores ≥ 7.0 but < 0.8	or	The factor scores sum >3.5 but ≤ 4.0
<0.7 - 0.6	*Functioning Impaired*	Any single factor scores ≥ 0.6 but <0.7	or	The factor scores sum >3.0 but ≤3.5
< 0.6	*Non-functioning*	Any single factor scores < 0.6	or	The factor scores sum < 3.0

Variable 7 Score 0.9

Variable 8: Geomorphology

This variable is a measure of the degree to which the geomorphic setting has been altered within the AA. Changes to the surface configuration and natural topography constitute stressors. Such stressors may be observed in the form of fill, excavation, diking, sedimentation due to absence of flushing floods, etc. In riverine systems geomorphic changes to stream channel should be considered if the channel is within the AA. Alterations may include bed surface changes (embeddedness or morphology changes), stream bank instability, and stream channel reconfiguration. Geomorphic changes are usually ultimately manifested as changes to wetland hydrology and water relations with vegetation. Geomorphic alteration can also directly affect soil properties, such as near-surface texture, and the wetland chemical environment, such as the redox state or nutrient composition in the rooting zone. In rating this variable, do not include these resultant effects of geomorphic change; rather focus on the physical impacts within the footprint of the alteration. The effects of geomorphic change are addressed by other variables. All alterations to the geomorphology should be evaluated including small-scale impa

Scoring Rules:

1. Identify impacts to geomorphological setting and topography within the AA and record them on the stressor checklist.
2.Considering all of the stressors identified, assign an overall variable score using the scoring guidelines.

✔		Stressors	Comments
	General	Dredging/Excavation/Mining	
		Fill, including dikes, road grades, etc	
		Grading	
		Compaction	
		Plowing/Disking	
		Excessive Sedimentation	
		Dumping	
		Hoof Shear/Pugging	
X		Aggregate or Mineral Mining	Gravel mining (moderate)
		Sand Accumulation	
	Channels Only	Channel Instability/Over Widening	
X		Excessive Bank Erosion	Channel incision (moderate)
		Channelization	
		Reconfigured Stream Channels	
		Artificial Banks/Shoreline	
		Beaver Dam Removal	
		Substrate Embeddedness	
		Lack or Excess of Woody Debris	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Topography essentially unaltered from the natural state, or alterations don't appear to have a minimal effect on wetland functioning and condition. Patch or microtopographic complexity may be slightly altered, but native plant communities are still supported.
<0.9 - 0.8	*Highly Functioning*	Alterations to topography result in small but detectable changes to habitat conditions throughout all or most of the AA; or changes causing more significant impacts but affecting less than 10% of the AA.
<0.8 - 0.7	*Functioning*	Changes to AA topography may be pervasive but generally mild. May include patches of more significant habitat alteration; or more significant alteration affecting less than 20 % of the AA.
<0.7 - 0.6	*Functioning Impaired*	At least one important surface type or landform has been eliminated or created; microtopography has been moderately altered throughout most or all of the AA, or more severe alterations affect less than 50% AA. Evidence that widespread diminishment or alteration of native plant community exist due to physical habitat alterations. Most incidentally created wetland habitat such as that created by roadside ditches and the like would score in this range or lower.
<0.6	*Non-functioning*	Geomorphic alterations have rendered the AA essentially unusable by *characteristic* wildlife species, or the physical setting no longer supports native plant communities.

Variable 8 Score 0.87

Variable 9: Vegetation Structure and Complexity

This variable is a measure of the condition of the wetland's vegetation relative to its native state. It is particularly relevant to the wetland's ability to perform higher-order functions such as support of wildlife populations, although it also affects primary functions such as flood-flow attenuation. Score this variable by listing stressors that have affected the diversity, composition and cover of each vegetation cover class that would normally be present for the wetland type being assessed. For this variable, stressor severity is a measure of how much each vegetation stratum differs functionally from its natural condition.

Rules for Scoring:

1. Determine the number and types of vegetation layers present within the AA. Make a judgment as to whether additional layers were historically present using direct evidence such as stumps, root wads or historical photographs. Indirect evidence such as local knowledge and expert opinion can also be used in this determination. Check each present or suspected vegetation layer in the third row of the table.

2. Do not score vegetation layers that would not normally be present in the wetland type being assessed.

3. Estimate the percent coverage of each vegetation layer. Aerial photographs can be helpful for this but are not required.

4. Enter the percent cover values as decimals in the row of the stressor table labeled "Percent Cover of Layer". Note, percentages will often sum to more than 100% (1.0).

5. Determine the severity of stressors acting on each individual canopy layers, indicating their presence with checks in the appropriate boxes of the stressor table.

6. Determine the sub-variable score for each valid vegetation layer using the scoring guidelines on the second page of the scoring sheet. Enter each sub-variable score in the appropriate cell of the row labeled "Veg. Layer Sub-variable Score".

7. Add the "Veg. Layer Sub-variable Scores" and enter the sum in the labled cell to the right of the individual scores. Follow this same process for the "Percent Cover of Layer".

8. Divide the sum of "Veg. Layer Sub-variable Scores" by the total coverage of all layers scored. This product is the Variable 9 score. Enter this number in the labeled box at the bottom of this page.

	Vegetation Layers				
Layers Scored *(check boxes to right to indicate scored layers)*					
Stressor	**Tree**	**Shrub**	**Herb**	**Aquatic**	**Comments**
Noxious Weeds					
Exotic/Invasive spp.			X		Reed canarygrass, smooth brome (high)
Tree Harvest					
Brush Cutting/Shrub Removal					
Livestock Grazing					
Excessive Herbivory					
Mowing/Haying					
Herbicide					
Loss of Zonation/Homogenization					
Dewatering					
Over Saturation					

Percent Cover of Layer	84.00	+	5.00	+	10.00	+	1.00	=	100	
	x		x		x		x		÷	
Veg. Layer Sub-variable Score	1		1		0.7		1			**See sub-variable scoring guidelines on following page**
	=		=		=		=			
Weighted Sub-variable Score	84.00	+	5.00	+	7.00	+	1.00	=	97	

Variable 9 Score 0.97

Sub-variable 9 Scoring Guidelines

Based on the list of stressors identified above, rate the severity of their cumulative effect on vegetation structure and complexity for each vegetation layer.

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stressors not present or with an intensity low enough as to not detectably affect the structure, diversity or composition of the vegetation layer.
<0.9 - 0.8	*Highly Functioning*	Stressors present at an intensity levels sufficient to cause detectable, but minor, changes in layer composition. Stress related change should generally be less than 10% for any given attribute (e.g., 10% cover of invasive, 10% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 33% if stressors are confined to patches comprising less than 10% of the wetland.
<0.8 - 0.7	*Functioning*	Stressors present with enough intensity to cause significant changes in the character of vegetation, including alteration of layer coverage, structure complexity and species composition. The vegetation layer retains its essential character though. AA's with a high proportion of non-native grasses will commonly fall in this class. Stress related change should generally be less than 33% for any given attribute (e.g., 33% cover of invasive, 33% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 66% if stressors are confined to patches comprising less than 25% of the wetland.
<0.7 - 0.6	*Functioning Impaired*	Stressor intensity severe enough to cause profound changes to the fundamental character of the vegetation layer. Stress-related change should generally be less than 66% for any given attribute (e.g 66% cover of invasive, 66% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 80% if stressors are confined to patches comprising less than 50% of the wetland.
<0.6	*Non-functioning*	Vegetation layer has been completely removed or altered to the extent that is no longer comparable to the natural structure, diversity and composition.

FACWet Score Card

Scoring Procedure:

1. Transcribe variable scores from each variable data sheet to the corresponding cell in the variable score table.
2. In each Functional Capacity Index (FCI) equation, enter the corresponding variable scores in the equation cells. Do not enter values in the crossed cells lacking labels.
3. Add the variable scores to calculate the total functional points achieved for each function.
4. Divide the total functional points achieved by the functional points possible. The typical number of total points possible is provided, howe if a variable is added or subtracted to FCI equation the total possible points must be adjusted
5. Calculate the Composite FCI, by adding the FCI scores and dividing by the total number of functions scored (usually 7).
6. If scoring is done directly in the Excel spreadsheet, all values will be transferred and calculated automatically.

VARIABLE SCORE TABLE

Buffer & Landscape Context	Variable 1:	Habitat Connectivity - Neighboring Wetland Habitat Loss	0.72
	Variable 2:	Habitat Connectivity - Migration/Dispersal Barriers	0.80
	Variable 3:	Buffer Capacity	0.85
Hydrology	Variable 4:	Water Source	0.70
	Variable 5:	Water Distribution	0.70
	Variable 6:	Water Outflow	0.95
Abiotic and Biotic Habitat	Variable 7:	Chemical Environment	0.90
	Variable 8:	Geomorphology	0.87
	Variable 9:	Vegetation Structure and Complexity	0.97

Functional Capacity Indices

							Total Functional Points		Functional Capacity Index
Function 1 -- Support of Characteristic Wildlife Habitat									
$V1_{wetloss}$	+ $V2_{barriers}$	+ $V3_{buffer}$	+ (2 x $V9_{veg}$)						
0.72	+ 0.80	+ 0.85	+ 1.94	+	+	=	4.31	÷ 5	= 0.86
Function 2 -- Support of Characteristic Fish/aquatic Habitat									
(3 x $V4_{source}$)	+ (2 x $V5_{dist}$)	+ 2 x $V6_{outflow}$	+ $V7_{chem}$	+ $V8_{geom}$					
2.10	+ 1.40	+ 1.90	+ 0.90	+ 0.87	+	=	7.17	÷ 9	= 0.80
Function 3 -- Flood Attenuation									
$V3_{buffer}$	+ 2 x $V4_{source}$	+ (2 x $V5_{dist}$)	+ 2 x $V6_{outflow}$	+ $V8_{geom}$	+ $V9_{veg}$				
0.85	+ 1.40	+ 1.40	+ 1.90	+ 0.87	+ 0.97	=	7.39	÷ 9	= 0.82
Function 4 -- Short- and Long-term Water Storage									
V_{source}	+ (2 x $V5_{dist}$)	+ 2 x $V6_{outflow}$)	$V8_{geom}$						
0.70	+ 1.40	+ 1.90	+ 0.87	+	+	=	4.87	÷ 6	= 0.81
Function 5 -- Nutrient/Toxicant Removal									
(2 x $V5_{dist}$)	+ $V7_{chem}$	+ $V8_{geom}$							
1.40	+ 0.90	+ 0.87	+	+	+	=	3.17	÷ 4	= 0.79
Function 6 -- Sediment Retention/Shoreline Stabilization									
$V3_{buffer}$	+ (2 x $V8_{geo}$)	+ (2 x $V9_{veg}$)							
0.85	+ 1.74	+ 1.94	+	+	+	=	4.53	÷ 5	= 0.91
Function 7 -- Production Export/Food Chain Support									
$V1_{wetloss}$	+ 2 x $V6_{outflow}$	+ $V7_{chem}$	+ $V8_{geo}$	+ (2 x $V9_{veg}$)					
0.72	+ 1.90	+ 0.90	+ 0.87	+ 1.94	+	=	6.33	÷ 7	= 0.90

Sum of Individual FCI Scores **5.89**

Divide by the Number of Functions Scored (usually 7) **÷ 7**

Composite FCI Score **0.84**

ADMINISTRATIVE CHARACTERIZATION

General Information

		Date of Evaluation:	12/10/2008
Site Name or ID:	SPR 3	Project Name:	Chatfield Reallocation FR/EIS
404 or Other Permit Application #:		Lead Federal Agency	U.S. Army Corps of Engineers
Evaluator Name(s):	Mary L. Powell	Evaluator's professional position and organization:	Natural Resource Specialist, ERO Resources, Corp.

Location Information:

Site Location (Lat./Long. or UTM):	493094.9435 4374247.154	Geographic Datum Used (NAD 83 preferred):	AND 83
USGS Quadrangle Map:	Littleton	Map Scale: (Circle one)	**1:24,000** 1:100,000 Other 1:
Sub basin Name (8 digit HUC):	Upper South Platte (10190002)	Wetland Ownership:	U.S. Army Corps of Engineers

Project Information:

This evaluation is being performed at: *(Check applicable box)*
- [x] *Project Wetland*
- [ ] *Mitigation Site*

Purpose of Evaluation (check all applicable):
- [x] *Potentially Impacted Wetlands*
- [ ] *Mitigation; Pre-construction*
- [ ] *Mitigation; Post-construction*
- [ ] *Monitoring*
- [ ] *Other (Describe)*

Intent of Project: *(Check all applicable)* X Preservation X Restoration X Enhancement X Creation

Total Size of Wetland Involved: (Record Area, Check and Describe Measurement Method Used)	6.39 ac.	X Measured					
		Estimated					
Assessment Area (AA) Size (Record Area, check appropriate box. Additional spaces are used to record acreage when more than one AA is included in a single assessment)	ac.	X Measured	ac.	ac.	ac.	ac.	
		Estimated	ac.	ac.	ac.	ac.	
Characteristics or Method used for AA boundary determination:	Extent of AA determined by wetland mapping performed by TetraTech for FR/EIS study. Wetlands of same wetland category were grouped together based logical location on landscape.						

Notes:	Riparian and side channel wetland complex just west of the South Platte River upstream of interior park road.

ECOLOGICAL DESCRIPTION 1

Special Concerns

Check all that apply

- [ ] Organic soils including Histosols or Histic Epipedons are present in the AA (i.e., AA includes core fen habitat).
- [ ] Project will directly impact organic soil portions of the AA including areas possessing either Histosol soils or histic epipedons.
- [ ] Organic soils are known to occur anywhere within the contiguous wetland of which the AA is part.
- [ ] The wetland is a habitat oasis in an otherwise dry or urbanized landscape?
- [X] Federally threatened or endangered species are **KNOWN** to occur in the AA? List Below.
- [ ] Federally threatened or endangered species are **SUSPECTED** to occur in the AA?
- [ ] Species of concern according to the Colorado Natura Heritage (CNHP) are known to occur in the AA?
- [ ] The site is located within a potential conservation area or element occurrence buffer area as determined by CNHP?
- [ ] Other special concerns (please describe)

HYDROGEOMORPHIC SETTING

- [X] AA wetland maintains its fundamental natural hydrogeomorphic characteristics
- [ ] AA wetland has been subject to change in HGM classes as a result of anthropogenic modification

If the above is checked, please describe the original wetland type if discernable using the table below.

- [ ] AA wetland was created from an upland setting.

Previous wetland typology

Historical Conditions				
Water source	Surface flow	Groundwater	Precipitation	Unknown
Hydrodynamics	Unidirectional	Vertical		
Geomorphic Setting (Narrative Description)				
Previous HGM Class	Riverine	Slope	Depressional	Lacustrine

Current Conditions

Describe the hydrogeomorphic setting of the wetland by circling all conditions that apply.

HGM Setting

Water source	**Surface flow**	**Groundwater**	Precipitation	Unknown		
Hydrodynamics	Unidirectional	Vertical				
Wetland Gradient	**0 - 2%**	2-4%	4-10%	>10%		
# Surface Inlets	**Over-bank**	0	1	2	3	>3
# Surface Outlets	**0**	1	2	3	>3	
Geomorphic Setting (Narrative Description)	Side channel wetlands and riparian area. Probably primarily groundwater supported. May have surface flows during high water in river.					
HGM class	**Riverine**	Slope	Depressional	Lacustrine		

Notes (include information on charcteristics used to formulate reference standard): Reference standard is South Platte River prior to construction of Stroncha and Chatfield dams, Highline Canal, interior park road. The reference standard assumes that existing groundwater hydrograph in the riparian corridor at this location is under the influence of Chatfield, which likely affects species composition.

ECOLOGICAL DESCRIPTION 2

Vegetation Habitat Description

*US FWS habitat classification according as reported in Cowardin et. al (1979) - See also Appendix *** of FACWet User Guide.*

System	Subsystem	Class	Subclass	Water Regime	Other Modifiers	% AA
Palustrine	Palustrine	Shrub-scrub	Persistent	Seasonally flooded		65
Palustrine	Palustrine	Emergent	Persistent	Seasonally flooded		45
Lacustrine Palustrine Riverine	Littoral; Limnoral Palustrine Lower perennial; Upper perennial; Intermittent	Rock Bot. (RB) Uncon Bottom(UB) Aquatic Bed(AB) Rocky Shore(RS) Uncon Shore(US) Emergent(EM) Shrub-scrub(SS) Forested (FO)	Floating vascular; Rooted vascular; Algal; Persistent; Non-Persistent; Broad-leaved deciduous; Needle-leaved evergreen; Cobble - gravel; Sand; Mud; Organic	**Examples** Temporarily flooded(A); Saturated(B); Seasonally flooded(C); Seas.-flood./sat.(E); Perm. flooded(F); Intermittently Flooded(G); Artificially Flooded(K); Sat./semiperm./Seas. (Y); Int. exposed/permenant(Z)	Hypersaline(7) ; Eusaline(8); Mixosaline(9); Fresh(0); Acid(a); Circumneutral(c); Alkaline/calcareous(i); Organic(g); Mineral(n); Beaver(b); Partially Drained/ditched(d); Farmed(f); Diked/impounded(h); Artificial Substrate(r); Spoil(s); Excavated(x)	

Site Map

Scale: 1 sq. =

Draw a sketch map of the site including relevant portions of the wetland, AA boundary, structures, habitat classes, and other significant features.

Variable 1: Habitat Connectivity - Neighboring Wetland Habitat Loss

This variable is a measure of how isolated from other naturally-occurring wetland or riparian habitat the AA has become as a result of the loss of that habitat. To score this variable, estimate the percent of naturally- occurring wetland/riparian habitat that has been lost (by filling, draining, development, or whatever means) within a 500-meter-wide belt surrounding the AA. This surrounding area is called the Habitat Connectivity Envelope (HCE). Historical photographs and NWI maps can be helpful in scoring this variable. In most cases the evaluator must use best professional judgment in estimating the amount of natural wetland loss. Evaluation of landforms and habitat patterns in the context of perceivable land use change should be used to steer estimates of the amount of wetland loss within the HCE. This variable is not meant to penalize AAs that are naturally isolated, or unique to the landscape. Rather, it should measure the degree to which natural habitat connectivity has been lost.

Rules for Scoring:

1. On the aerial photo outline the area that is within 500 meters of the AA.
2. Identify obvious natural barriers within 500 m of the AA boundary.
   - *Natural barriers include continuous cliff bands, deep open water, etc.*
3. Draw the **Habitat Connectivity Envelope**(HCE) on the aerial image.
   - *The HCE is all the area within 500 meters of the AA that is not separated from it by a natural barrier.*
4. Outline the current extent of naturally occurring wetland and riparian habitat. Then outline areas where the habitats appear to have historically occurred.
   - *Use your knowledge of the history of the area and evident land use change. Additional research could be utilized to increase the accuracy of this estimate including consideratation of floodplain maps, historical aerials, etc.*

Variable Score	Condition Category	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	*Wetland losses are absent or negligible or there is no evidence to suggest the native landscape within the HCE historically contained other wetland habitats*
<0.9 - 0.8	*Highly Functioning*	*More than 80% of historical wetland habitat area within the HCE is still present (less than 20% historical wetland habitat area lost).*
<0.8 - 0.7	*Functioning*	*80 to 60% of historical wetland habitat area within the HCE is still present (20% to 40% historical wetland habitat area lost).*
<0.7 - 0.6	*Functioning Impaired*	*Less than 60 to 30% of historical wetland habitat area within the HCE is still present (more than 30 to 70% historical wetland habitat area lost).*
<0.6	*Non-functioning*	*Less than 30% of the historical wetland habitat area from within the HCE is now no longer in existence (more than 70% historical wetland habitat area lost).*

Variable 1 Score 0.8

Notes: Gravel extraction and lake have removed significant areas of riparian vegetation.

Variable 2: Habitat Connectivity - Migration/Dispersal Barriers

This variable is intended to rate the degree to which the AA has become isolated from existing neighboring wetland and riparian habitat by artificial barriers that inhibit migration or dispersal of organisms. On the aerial photograph, identify the man-made barriers within the HCE that intercede between the AA and surrounding wetlands and riparian areas, and identify them by type on the stressor list. Score this variable based on the barriers' impermeability to migration and dispersal and the amount of surrounding wetland/riparian habitat they affect.

Rules for Scoring:

1. On the aerial photo, outline all existing wetland and riparian habitat areas (WHAs) within the HCE.

2. Identify artificial barriers to dispersal and migration of organisms within the HCE that intercede between the AA and surrounding habitats. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.

3. Considering the composite effect of all of identified barriers to migration and dispersal (i.e., stressors), assign an overall variable score using the scoring guidelines.

Stressors = artificial barriers	✔	Stressors	Comments/description
		Major Highway	
		Secondary Highway	
	X	Tertiary Roadway	Interior park roads, parking lot (moderate)
		Railroad	
	X	Bike Path	Soft surface trail on both sides of riparian corridor (low)
		Urban Development	
		Agricultural Development	
	X	Artificial Water Body	Gravel pits, Chatfield (high)
		Fence	
		Ditch or Aqueduct	
		Aquatic Organism Barriers	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	No appreciable barriers exist between the AA and other wetland and riparian habitats in th HCE; or there are no other wetland and riparian areas in the HCE.
<0.9 - 0.8	*Highly Functioning*	Barriers impeding migration/dispersal between the AA and up to 33% of surrounding WHA highly permeable and easily passed by most organisms. Examples could include gravel roads, minor levees, ditches or barbed-wire fences. More significant barriers (see "functioning category below) could affect migration to up to 10% of surrounding WHA.
<0.8 - 0.7	*Functioning*	Barriers to migration and dispersal retard the ability of many organisms/propagules to pass between the AA and up to 66% of WHA. Passage of organisms and propagules through such barriers is still possible, but it may be constrained to certain times of day, be slow, dangerous or require additional travel. Busy two-lane roads, culverted areas, small to medium artificial water bodies or small earthen dams would commonly rate a score in this range. More significant barriers (see "functioning impaired" category below) could affect migration to up to 10% of surrounding WHA.
<0.7 - 0.6	*Functioning Impaired*	Barriers to migration and dispersal preclude the passage of some types of organisms/propagules between the AA and up to 66% of surrounding WHA. Travel of those animals which can potential negotiate the barrier are strongly restricted and may include a high chance of mortality. Up to 33% of surrounding WHA could be functionally isolated from the AA.
<0.6	*Non-functioning*	AA is essentially isolated from surrounding WHA by impermeable migration and dispersal barriers. An interstate highway or concrete-lined water conveyance canal are examples of barriers which would generally create functional isolation between the AA and a WHA.

Variable 2 Score | 0.65

Variable 3: Buffer Capacity

The buffer area is defined as a 250-meter-wide belt surrounding the perimeter of the AA. This variable is a measure of the capacity of that area to function as an effective buffer for the wetland against the deleterious effects of surrounding land use change. To score the variable, assume that the AA is 100% buffered except where land use changes inside the buffer area have diminished this quality. Identify these land use types as specific stressors in the list. For each stressor, rate severity and extent within the buffer area; then use this list to make an overall rating for the buffer's departure from reference conditions. When rating buffer capacity, consider both the intensity of the impact and the proximity of the stressor to the AA.

Rules for Scoring:

1. On the aerial photograph, outline the buffer area as the zone within 250 meters of the outer boundary of the AA.
2. Use the stressor list to record land use changes that affect buffering capacity within the buffer area. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.
3. Considering all of the identified stressors, their overall severity, extent and proximity to the AA assign an overall variable score using the scoring guidelines.

Stressors = Land Use Changes

✔	Stressors	Comments/description
	Industrial/commercial	
	Urban	
	Residential	
	Rural	
	Dryland Farming	
	Intensive Agriculture	
	Orchards or Nurseries	
	Livestock Grazing	
X	Transportation Corridor	Interior park road (low)
	Urban Parklands	
	Dams/impoundments	
X	Artificial Water body	Chatfield (low)
X	Physical Resource Extraction	Gravel pits (high)
	Biological Resource Extraction	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	No appreciable land use change has been imposed within the TBA and it provides the full buffering capacity.
<0.9 - 0.8	*Highly Functioning*	Some land use change has occurred in the BA, but such changes little impair the area's ability to provide a buffering function, either because land use is not intensive, for example haying, light grazing, or nurseries, or more substantial changes occur in approximately less than 10% of the BA.
<0.8 - 0.7	*Functioning*	BA has been subjected to a marked shift in land use, however, the land retains much of its original buffering capacity. Moderate-intensity land uses such as dry-land farming, urban "green" corridors, or moderate cattle grazing would commonly be placed within this scoring range.
<0.7 - 0.6	*Functioning Impaired*	Land use within the BA has been substantial including the a moderate to high coverage (up to 50%) of impermeable surfaces, bare soil, or other artificial surface; considerable in-flow urban runoff or fertilizer-rich waters common. While, the buffering capacity of the land has been greatly diminished it is not extinguished. Intensively logged areas, low-density urban developments, some urban parklands and some cropping situations would commonly rate a score within this range.
<0.6	*Non-functioning*	The area within the BA provides essentially no buffering capacity. Many Commercial developments or highly urban landscapes would rate a score of less than 0.6.

Variable 3 score 0.68

Variable 4: Water Source

This variable is concerned with up-gradient hydrologic connectivity. It is a measure of the impacts to the AA's water source, including the ability of source water to perform work such as sediment transport, erosion, soil pore flushing, etc. To score this variable, identify stressors that alter the source of water to the AA, and record their presence on the stressor list. Stressors can impact water source by depletion, augmentation, or alteration of inflow timing or hydrodynamics. For riverine systems, this variable is primarily concerned with the connection of the channel to the floodplain.This variable is designed to assess water quantity, power and timing, not water quality. Water quality will be evaluated in Variable 7.

Scoring rules:

1. Use the stressor list and knowledge of the watershed to catalog type-specific impairments of the AA's water source. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.

2. Considering the composite effect of stressors on the water source, rate the condition of this variable with the aid of the scoring guidelines.

✔	Stressors	Comments/description
	Ditches or Drains (tile, etc.)	
X	Dams	Stroncha Dam (high)
X	Diversions	Highline Canal, Denver Water (moderate)
	Groundwater pumping	
	Draw-downs	
	Culverts or Constrictions	
	Point Source (urban, ind., ag.)	
	Non-point Source	
	Increased Drainage Area	
	Storm Drain/Urban Runoff	
	Impermeable Surface Runoff	
	Irrigation Return Flows	
	Mining/Natural Gas Extraction	
X	Transbasin Diversion	Roberts Tunnel (low)
	Actively Managed Hydrology	
X		Reservoir groundwater effect

Variable Score	Condition Class	Depletion	Augmentation
1.0 - 0.9	*Reference Standard*	Unnatural drawdown events minor, rare or non-existent, very slight uniform depletion, or trivial alteration of hydrodynamics.	Unnatural high-water events minor, rare or non-existent, slight uniform increase in amount of inflow, or trivial alteration of hydrodynamics.
<0.9 - 0.8	*Highly Functioning*	Unnatural drawdown events occasional, short duration and/or mild; or uniform depletion up to 20%; or mild to moderate reduction of peak flows or natural capacity of water to perform work.	Occasional unnatural high-water events, short in duration and/or mild in intensity; or uniform augmentation up to 20%; or mild to moderate increase of peak flows or natural capacity of water to perform work.
<0.8 - 0.7	*Functioning*	Unnatural drawdown events common and of mild to moderate intensity and/or duration; or uniform depletion up to 50%; or moderate to substantial reduction of peak flows or natural capacity of water to perform work.	Common occurrence of unnatural high-water events, of a mild to moderate intensity and/or duration; or uniform augmentation up to 50%; or moderate to substantial reduction of peak flows or natural capacity of water to perform work.
<0.7 - 0.6	*Functioning Impaired*	Unnatural drawdown events occur frequently with a moderate to high intensity and/or duration; or uniform depletion up to 75%; or substantial reduction of peak flows or natural capacity of water to perform work. **Wetlands with actively managed or wholly artificial hydrology will usually score in this range or lower.**	Common occurrence of unnatural high-water events, some of which may be severe in nature or exist for a substantial portion of the growing season; or uniform augmentation more than 50% or natural capacity of water to perform work. **Wetlands with actively managed or wholly artificial hydrology will usually score in this range or lower.**
<0.6	*Non-functioning*	Water source diminished enough to threaten jurisdictional classification of the AA.	Frequency, duration or magnitude of unnaturally high-water great enough to change the fundamental characteristics of the wetland.

Variable 4 Score 0.65

Variable 5: Water Distribution

*This variable is concerned with hydrologic connectivity within the AA. It is a measure of alteration to the spatial distribution of surface and groundwater within the AA. These alterations are manifested as local changes to the hydrograph and generally **result** from geomorphic modifications. To score this variable, identify stressors that alter flow patterns and impact the hydrograph within portions of the AA, including localized increases or decreases to the depth or duration of the water table or surface water. In naturally confined rivers (i.e. canyons and gullies) floodplain width is generally very small, so these systems will tend to score high for this variable unless some gross stressor is present.*

Scoring rules:

1. Identify impacts to the natural distribution of water throughout the AA and catalog them in the stressor table.
2. Considering all of the stressors identified, assign an overall variable score using the scoring guidelines.

✔	Stressors	Comments/description
	Ditches	
	Ponding/Impoundment	
	Culverts	
	Road Grades	
	Channel Incision/Entrenchment	Incised channel reduces overbank flow (high)
	Hardened/Engineered Channel	
	Enlarged Channel	
	Artificial Banks/Shoreline	
	Weirs	
	Dikes/Levees/Berms	
	Diversions	
	Sediment/Fill Accumulation	
		Groundwater alters how water moves through site

Variable Score	Condition Class	Non-riverine	Riverine
1.0 - 0.9	*Reference Standard*	Little or no alteration has been made to the way in which water is distributed throughout the wetland.	Natural active floodplain areas flood on a normal recurrence interval. No evidence of alteration of flooding and subirrigation duration and intensity.
<0.9 - 0.8	*Highly Functioning*	Less than 10% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in less than a 2 in. (5 cm) change in mean growing season water table elevation.	Channel-adjacent areas have occasional unnatural periods of drying or flooding; or uniform shift in the hydrograph less than typical root depth.
<0.8 - 0.7	*Functioning*	Between 10 and 33% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in a 4 in. (5 cm) or less change in mean growing season water table elevation.	In channel-adjacent area, periods of drying or flooding are common; or uniform shift in the hydrograph near root depth.
<0.7 - 0.6	*Functioning Impaired*	33 to 66% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in a 6 in. (15 cm) or less change in mean growing season water table elevation. Water table behavior must still meet jurisdictional criteria to merit this rating.	Adjacent to the channel, unnatural periods of drying or flooding are the norm; or uniform shift in the hydrograph greater than root depth.
<0.6	*Non-functioning*	More than 66% of the AA is affected by hydrologic alteration which changes the fundamental functioning of the wetland system	Historical active floodplain areas are almost never wetted from overbank flooding, and/or groundwater infiltration is effectively cut off.

Variable 5 Score 0.65

Variable 6: Water Outflow

This variable is concerned with down-gradient hydrologic connectivity and the flow of water (transporting materials and energy) out of the AA. It is a measure of impacts that affect the hydrologic outflow of water including the passage of water through its normal low- and high-flow surface outlets, and infiltration/groundwater recharge. In some cases, alteration of evapotranspiration rates may be significant enough of a factor to consider in scoring. Score this variable by identifying stressors that impact the means by which water is exported from the AA. In Variable 5, the stressors were evaluated in light of their impact on water distribution within the AA. To evaluate this variable focus on how water, energy and associated materials are exported out of the AA.

Scoring rules:

1. Identify impacts to the natural outflow of water from the AA and catalog them in the stressor table.

2.Considering all of the stressors identified, assign an overall variable score using the scoring guidelines. Take in to account the cumulative effect of stressors on the wetland's ability to export water and water-borne materials

✔	Stressors	Comments/description
	Ditches	
	Dikes/Levees	
X	Road Grades	Interior park road (high)
	Culverts	
	Diversions	
	Constrictions	
	Channel Incision/Entrenchment	
	Hardened/Engineered Channel	
	Artificial Stream Banks	
	Weirs	
X	Confined Bridge Openings	Groundwater alters how water leaves site (high)

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stressors have little to no effect on the magnitude, timing or hydrodynamics of the AA water outflow regime.
<0.9 - 0.8	*Highly Functioning*	High- or low-water outflows are mildly to moderately affected, but at intermediate ("normal") lev flow continues essentially unaltered in quantity or character.
<0.8 - 0.7	*Functioning*	High- or low-water outflows are moderately affected, mild alteration of intermediate level outflow occurs; or hydrodynamics mildly to moderately affected.
<0.7 - 0.6	*Functioning Impaired*	Outflow at all stages is moderately impaired resulting in persistent flooding of portions of the AA or unnatural drainage; or outflow hydrodynamics significantly disrupted.
<0.6	*Non-functioning*	The natural outflow regime is severely disrupted. Down-gradient hydrologic connection severed or nearly so. Alterations may cause widespread unnatural persistent flooding or dewatering of the wetland system.

Variable 6 Score 0.68

Variable 7: Water and Soil Chemical Environment

This variable concerns the chemical environment of the soil and water media within the AA, including pollutants and water quality. The origin of pollutants may be in the AA or delivered from up-gradient or surrounding areas. Score this variable by listing indicators of chemical stress in the AA. Consider point source and non-point sources of pollution, as well as mechanical or hydrologic changes that alter the chemical environment. Because water quality frequently cannot be inferred directly, the presence of many stressors is identified via indirect indicators.

Scoring rules:

1. Stressors are grouped into categories which have a similar signature or set of causes.
2. Use the indicator list to identify each stressor impacting the chemical environment of the AA.
3. For each stressor category, determine the sub-variable score using the scoring guideline table provided on the second page of the scoring sheet.
 -If the AA is part of a water body that is recognized as impaired or recommended for TMDL development for one of the factors, then score that sub-variable 0.65 or lower.
4. Transcribe sub-variable scores to the following variable scoring page and compute the sum.
5. Determine the variable score by following the scoring guidelines.

Stressor Category	Stressor Indicator	✔	Comments	Sub-variable Score
Nutrient Enrichment/ Eutrophication/ Oxygen (D.O.)	Livestock			1.00
	Agricultural Runoff			
	Septic/Sewage			
	Excessive Algae or Aquatic Veg.			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Sedimentation/ Turbidity	Excessive Erosion			1.00
	Excessive Deposition			
	Fine Sediment Plumes			
	Agricultural Runoff			
	Excessive Turbidity			
	Nearby Construction Site			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Toxic contamination/ pH	Recent Chemical Spills			1.00
	Nearby Industrial Sites			
	Road Drainage/Runoff			
	Livestock			
	Agricultural Runoff			
	Storm Water Runoff			
	Fish/Wildlife Impacts			
	Vegetation Impacts			
	Cumulative Watershed NPS			
	Acid Mine Drainage			
	Point Source Discharge			
	CDPHE Impairment/TMDL List			
Temperature	Excessive Temperature Regime			1.00
	Lack of Shading			
	Reservoir/Power Plant Discharge			
	Industrial Discharge			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Soil chemistry/ Redox potential	Unnatural Saturation/Desaturation	X	High groundwater (high)	0.68
	Mechanical Soil Disturbance			
	Dumping/introduced Soil			
	CDPHE Impairment/TMDL List			

Variable 7: Water and Soil Chemical Environment

Sub-variable Scoring Guidelines

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stress indicators not present or trivial.
<0.9 - 0.8	*Highly Functioning*	Stress indicators scarcely present and mild, or otherwise not occurring in more than 10% of the AA.
<0.8 - 0.7	*Functioning*	Stress indicators present at mild to moderate levels, or otherwise not occurring in more than 33% of the AA.
<0.7 - 0.6	*Functioning Impaired*	Stress indicators present at moderate to high levels, or otherwise not occurring in more than 66% of the AA
<0.6	*Non-functioning*	Stress indicators strongly evident throughout the AA at levels which apparently alter the fundamental chemical environment of the wetland system

Input each factor score from the stressor list and calculate the sum.

Nutrient enrichment/ Eutrophication/ Oxygen (D.O.)		Sedimentation/ Turbidity		Toxic contamination/ pH		Temperature		Soil chemistry/ Redox potential		Sum of Sub-variable Scores
1.00	+	1.00	+	1.00	+	1.00	+	0.68	=	4.68

Use the table to score the Chemical Environment Variable circling the applicable scoring rules.

Variable Score	Condition Class	Scoring Rules		
		Single Factor		**Composite Score**
1.0 - 0.9	*Reference Standard*	No single factor scores < 0.9	or	The factor scores sum > 4.5
<0.9 - 0.8	*Highly Functioning*	Any single factor scores ≥ 0.8 but < 0.9	or	The factor scores sum >4.0 but ≤4.5
<0.8 - 0.7	*Functioning*	Any single factor scores ≥ 7.0 but < 0.8	or	The factor scores sum >3.5 but ≤ 4.0
<0.7 - 0.6	*Functioning Impaired*	Any single factor scores ≥ 0.6 but <0.7	or	The factor scores sum >3.0 but ≤3.5
< 0.6	*Non-functioning*	Any single factor scores < 0.6	or	The factor scores sum < 3.0

Variable 7 Score 0.9

Variable 8: Geomorphology

This variable is a measure of the degree to which the geomorphic setting has been altered within the AA. Changes to the surface configuration and natural topography constitute stressors. Such stressors may be observed in the form of fill, excavation, diking, sedimentation due to absence of flushing floods, etc. In riverine systems geomorphic changes to stream channel should be considered if the channel is within the AA. Alterations may include bed surface changes (embeddedness or morphology changes), stream bank instability, and stream channel reconfiguration. Geomorphic changes are usually ultimately manifested as changes to wetland hydrology and water relations with vegetation. Geomorphic alteration can also directly affect soil properties, such as near-surface texture, and the wetland chemical environment, such as the redox state or nutrient composition in the rooting zone. In rating this variable, do not include these resultant effects of geomorphic change; rather focus on the physical impacts within the footprint of the alteration. The effects of geomorphic change are addressed by other variables. All alterations to the geomorphology should be evaluated including small-scale impa

Scoring Rules:

1. Identify impacts to geomorphological setting and topography within the AA and record them on the stressor checklist.

2.Considering all of the stressors identified, assign an overall variable score using the scoring guidelines.

✔		Stressors	Comments
	General	Dredging/Excavation/Mining	
		Fill, including dikes, road grades, etc	
		Grading	
		Compaction	
		Plowing/Disking	
		Excessive Sedimentation	
		Dumping	
		Hoof Shear/Pugging	
X		Aggregate or Mineral Mining	Gravel mining (high)
		Sand Accumulation	
	Channels Only	Channel Instability/Over Widening	
X		Excessive Bank Erosion	Channel incision (moderate)
		Channelization	
		Reconfigured Stream Channels	
		Artificial Banks/Shoreline	
		Beaver Dam Removal	
		Substrate Embeddedness	
		Lack or Excess of Woody Debris	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Topography essentially unaltered from the natural state, or alterations don't appear to have a minimal effect on wetland functioning and condition. Patch or microtopographic complexity may be slightly altered, but native plant communities are still supported.
<0.9 - 0.8	*Highly Functioning*	Alterations to topography result in small but detectable changes to habitat conditions throughout all or most of the AA; or changes causing more significant impacts but affecting less than 10% of the AA.
<0.8 - 0.7	*Functioning*	Changes to AA topography may be pervasive but generally mild. May include patches of more significant habitat alteration; or more significant alteration affecting less than 20 % of the AA.
<0.7 - 0.6	*Functioning Impaired*	At least one important surface type or landform has been eliminated or created; microtopography has been moderately altered throughout most or all of the AA, or more severe alterations affect less than 50% AA. Evidence that widespread diminishment or alteration of native plant community exist due to physical habitat alterations. Most incidentally created wetland habitat such as that created by roadside ditches and the like would score in this range or lower.
<0.6	*Non-functioning*	Geomorphic alterations have rendered the AA essentially unusable by *characteristic* wildlife species, or the physical setting no longer supports native plant communities.

Variable 8 Score: 0.7

Variable 9: Vegetation Structure and Complexity

This variable is a measure of the condition of the wetland's vegetation relative to its native state. It is particularly relevant to the wetland's ability to perform higher-order functions such as support of wildlife populations, although it also affects primary functions such as flood-flow attenuation. Score this variable by listing stressors that have affected the diversity, composition and cover of each vegetation cover class that would normally be present for the wetland type being assessed. For this variable, stressor severity is a measure of how much each vegetation stratum differs functionally from its natural condition.

Rules for Scoring:

1. Determine the number and types of vegetation layers present within the AA. Make a judgment as to whether additional layers were historically present using direct evidence such as stumps, root wads or historical photographs. Indirect evidence such as local knowledge and expert opinion can also be used in this determination. Check each present or suspected vegetation layer in the third row of the table.

2. Do not score vegetation layers that would not normally be present in the wetland type being assessed.

3. Estimate the percent coverage of each vegetation layer. Aerial photographs can be helpful for this but are not required.

4. Enter the percent cover values as decimals in the row of the stressor table labeled "Percent Cover of Layer". Note, percentages will often sum to more than 100% (1.0).

5. Determine the severity of stressors acting on each individual canopy layers, indicating their presence with checks in the appropriate boxes of the stressor table.

6. Determine the sub-variable score for each valid vegetation layer using the scoring guidelines on the second page of the scoring sheet. Enter each sub-variable score in the appropriate cell of the row labeled "Veg. Layer Sub-variable Score".

7. Add the "Veg. Layer Sub-variable Scores" and enter the sum in the labled cell to the right of the individual scores. Follow this same process for the "Percent Cover of Layer".

8. Divide the sum of "Veg. Layer Sub-variable Scores" by the total coverage of all layers scored. This product is the Variable 9 score. Enter this number in the labeled box at the bottom of this page.

	Vegetation Layers				
Layers Scored *(check boxes to right to indicate scored layers)*					
Stressor	**Tree**	**Shrub**	**Herb**	**Aquatic**	**Comments**
Noxious Weeds					
Exotic/Invasive spp.			X		Reed canarygrass, smooth brome (high)
Tree Harvest					
Brush Cutting/Shrub Removal					
Livestock Grazing					
Excessive Herbivory					
Mowing/Haying					
Herbicide					
Loss of Zonation/Homogenization					
Dewatering					
Over Saturation					

Percent Cover of Layer	80.00	+	10.00	+	9.00	+	1.00	=	100	
	x		x		x		x		÷	
Veg. Layer Sub-variable Score	1		1		0.8		1			**See sub-variable scoring guidelines on following page**
	=		=		=		=			
Weighted Sub-variable Score	80.00	+	10.00	+	7.20	+	1.00	=	98.2	

Variable 9 Score 0.98

Sub-variable 9 Scoring Guidelines

Based on the list of stressors identified above, rate the severity of their cumulative effect on vegetation structure and complexity for each vegetation layer.

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stressors not present or with an intensity low enough as to not detectably affect the structure, diversity or composition of the vegetation layer.
<0.9 - 0.8	*Highly Functioning*	Stressors present at an intensity levels sufficient to cause detectable, but minor, changes in layer composition. Stress related change should generally be less than 10% for any given attribute (e.g., 10% cover of invasive, 10% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 33% if stressors are confined to patches comprising less than 10% of the wetland.
<0.8 - 0.7	*Functioning*	Stressors present with enough intensity to cause significant changes in the character of vegetation, including alteration of layer coverage, structure complexity and species composition. The vegetation layer retains its essential character though. AA's with a high proportion of non-native grasses will commonly fall in this class. Stress related change should generally be less than 33% for any given attribute (e.g., 33% cover of invasive, 33% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 66% if stressors are confined to patches comprising less than 25% of the wetland.
<0.7 - 0.6	*Functioning Impaired*	Stressor intensity severe enough to cause profound changes to the fundamental character of the vegetation layer. Stress-related change should generally be less than 66% for any given attribute (e.g 66% cover of invasive, 66% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 80% if stressors are confined to patches comprising less than 50% of the wetland.
<0.6	*Non-functioning*	Vegetation layer has been completely removed or altered to the extent that is no longer comparable to the natural structure, diversity and composition.

FACWet Score Card

Scoring Procedure:

1. Transcribe variable scores from each variable data sheet to the corresponding cell in the variable score table.
2. In each Functional Capacity Index (FCI) equation, enter the corresponding variable scores in the equation cells. Do not enter values in the crossed cells lacking labels.
3. Add the variable scores to calculate the total functional points achieved for each function.
4. Divide the total functional points achieved by the functional points possible. The typical number of total points possible is provided, howe if a variable is added or subtracted to FCI equation the total possible points must be adjusted
5. Calculate the Composite FCI, by adding the FCI scores and dividing by the total number of functions scored (usually 7).
6. If scoring is done directly in the Excel spreadsheet, all values will be transferred and calculated automatically.

VARIABLE SCORE TABLE

Buffer & Landscape Context	**Variable 1:**	**Habitat Connectivity - Neighboring Wetland Habitat Loss**	0.80
	Variable 2:	**Habitat Connectivity - Migration/Dispersal Barriers**	0.65
	Variable 3:	**Buffer Capacity**	0.68
Hydrology	**Variable 4:**	**Water Source**	0.65
	Variable 5:	**Water Distribution**	0.65
	Variable 6:	**Water Outflow**	0.68
Abiotic and Biotic Habitat	**Variable 7:**	**Chemical Environment**	0.90
	Variable 8:	**Geomorphology**	0.70
	Variable 9:	**Vegetation Structure and Complexity**	0.98

Functional Capacity Indices

Function	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6	Total Functional Points	÷	Functional Capacity Index
Function 1 -- Support of Characteristic Wildlife Habitat	$V1_{wetloss}$	+ $V2_{barriers}$	+ $V3_{buffer}$	+ (2 x $V9_{veg}$)					
	0.80	0.65	0.68	1.96			4.09	5	0.82
Function 2 -- Support of Characteristic Fish/aquatic Habitat	(3 x $V4_{source}$)	+ (2 x $V5_{dist}$)	+ 2 x $V6_{outflow}$	+ $V7_{chem}$	+ $V8_{geom}$				
	1.95	1.30	1.36	0.90	0.70		6.21	9	0.69
Function 3 -- Flood Attenuation	$V3_{buffer}$	+ 2 x $V4_{source}$	+ (2 x $V5_{dist}$)	+ 2 x $V6_{outflow}$	+ $V8_{geom}$	+ $V9_{veg}$			
	0.68	1.30	1.30	1.36	0.70	0.98	6.32	9	0.70
Function 4 -- Short- and Long-term Water Storage	V_{source}	+ (2 x $V5_{dist}$)	+ 2 x $V6_{outflow}$)	$V8_{geom}$					
	0.65	1.30	1.36	0.70			4.01	6	0.67
Function 5 -- Nutrient/Toxicant Removal	(2 x $V5_{dist}$)	+ $V7_{chem}$	+ $V8_{geom}$						
	1.30	0.90	0.70				2.90	4	0.73
Function 6 -- Sediment Retention/Shoreline Stabilization	$V3_{buffer}$	+ (2 x $V8_{geo}$)	+ (2 x $V9_{veg}$)						
	0.68	1.40	1.96				4.04	5	0.81
Function 7 -- Production Export/Food Chain Support	$V1_{wetloss}$	+ 2 x $V6_{outflow}$	+ $V7_{chem}$	+ $V8_{geo}$	+ (2 x $V9_{veg}$)				
	0.80	1.36	0.90	0.70	1.96		5.72	7	0.82

Sum of Individual FCI Scores **5.23**

Divide by the Number of Functions Scored (usually 7) **÷ 7**

Composite FCI Score **0.75**

ADMINISTRATIVE CHARACTERIZATION

General Information

		Date of Evaluation:	12/10/2008
Site Name or ID:	SPR 4	Project Name:	Chatfield Reallocation Study
404 or Other Permit Application #:	NA	Lead Federal Agency:	US Army Corps of Engineers
Evaluator Name(s):	Mary L. Powell	Evaluator's professional position and organization:	Natural Resource Specialist, ERO Resources, Corp.

Location Information:

Site Location (Lat./Long. or UTM):	493082.2692 4374705.418	Geographic Datum Used (NAD 83 preferred):	AND 83
USGS Quadrangle Map:	Littleton	Map Scale: (Circle one)	**1:24,000** 1:100,000 Other 1:
Sub basin Name (8 digit HUC):	Upper South Platte (10190002)	Wetland Ownership:	US Army Corps of Engineers

Project Information:

This evaluation is being performed at: *(Check applicable box)*

- [X] *Project Wetland*
- [ ] *Mitigation Site*

Purpose of Evaluation (check all applicable):

- [X] *Potentially Impacted Wetlands*
- [ ] *Mitigation; Pre-construction*
- [ ] *Mitigation; Post-construction*
- [ ] *Monitoring*
- [ ] *Other (Describe)*

Intent of Project: *(Check all applicable)* X Preservation X Restoration X Enhancement X Creation

Total Size of Wetland Involved: (Record Area, Check and Describe Measurement Method Used)	7.08 ac.	X	Measured using GIS.	
			Estimated	
Assessment Area (AA) Size (Record Area, check appropriate box. Additional spaces are used to record acreage when more than one AA is included in a single assessment)	ac.	X	Measured	ac. ac. ac. ac.
			Estimated	ac. ac. ac. ac.
Characteristics or Method used for AA boundary determination:	Extent of AA determined by wetland mapping performed by TetraTech for FR/EIS study. Wetlands of same wetland category were grouped together based logical location on landscape.			

Notes:	Wetland and riparian complex at interface of South Platte River and Chatfield Reservoir. North of interior park road.

ECOLOGICAL DESCRIPTION 1

Special Concerns

Check all that apply

- [ ] Organic soils including Histosols or Histic Epipedons are present in the AA (i.e., AA includes core fen habitat).
- [ ] Project will directly impact organic soil portions of the AA including areas possessing either Histosol soils or histic epipedons.
- [ ] Organic soils are known to occur anywhere within the contiguous wetland of which the AA is part.
- [ ] The wetland is a habitat oasis in an otherwise dry or urbanized landscape?
- [X] Federally threatened or endangered species are **KNOWN** to occur in the AA? List Below.

PMJM assumed to be present based on proximity to occupied habitat

- [ ] Federally threatened or endangered species are **SUSPECTED** to occur in the AA?
- [ ] Species of concern according to the Colorado Natural Heritage (CNHP) are known to occur in the AA?
- [ ] The site is located within a potential conservation area or element occurrence buffer area as determined by CNHP?
- [ ] Other special concerns (please describe)

HYDROGEOMORPHIC SETTING

- [ ] AA wetland maintains its fundamental natural hydrogeomorphic characteristics
- [X] AA wetland has been subject to change in HGM classes as a result of anthropogenic modification

If the above is checked, please describe the original wetland type if discernable using the table below.

- [ ] AA wetland was created from an upland setting.

Previous wetland typology

Historical Conditions

Water source	**Surface flow**	**Groundwater**	Precipitation	Unknown
Hydrodynamics	**Unidirectional**	Vertical		
Geomorphic Setting (Narrative Description)	Previously totally influenced by SPR. Now, reservoir is has primary influence.			
Previous HGM Class	**Riverine**	Slope	Depressional	Lacustrine

Current Conditions

Describe the hydrogeomorphic setting of the wetland by circling all conditions that apply.

HGM Setting

Water source	**Surface flow**	**Groundwater**	Precipitation	Unknown		
Hydrodynamics	**Unidirectional**	Vertical				
Wetland Gradient	0 - 2%	**2-4%**	4-10%	>10%		
# Surface Inlets	**Over-bank**	0	**1**	2	3	>3
# Surface Outlets	0	**1**	2	3	>3	
Geomorphic Setting (Narrative Description)	At interface of reservoir and SPR. OHW extends through portions of area. Water backs up into area and enters over the surface.					
HGM class	Riverine	Slope	Depressional	**Lacustrine**		

Notes (include information on charcteristics used to formulate reference standard): Reference standard is the condition of South Platte River prior to construction of Chatfield Reservoir, Stroncha dam, and park roads and trails.

ECOLOGICAL DESCRIPTION 2

Vegetation Habitat Description

*US FWS habitat classification according as reported in Cowardin et. al (1979) - See also Appendix *** of FACWet User Guide.*

System	Subsystem	Class	Subclass	Water Regime	Other Modifiers	% AA
Palustrine	Palustrine	Emergent	Persistent	Seasonally flooded		20%
Palustrine	Palustrine	Shrub-scrub	Persistent	Seasonally flooded		80%
Lacustrine	Littoral; Limnoral	Rock Bot. (RB) Uncon Bottom(UB) Aquatic Bed(AB) Rocky Shore(RS) Uncon Shore(US) Emergent(EM) Shrub-scrub(SS) Forested (FO)	Floating vascular; Rooted vascular; Algal; Persistent; Non-Persistent; Broad-leaved deciduous; Needle-leaved evergreen; Cobble - gravel; Sand; Mud; Organic	**Examples** Temporarily flooded(A); Saturated(B); Seasonally flooded(C); Seas.-flood./sat.(E); Perm. flooded(F); Intermittently Flooded(G); Artificially Flooded(K); Sat./semiperm./Seas. (Y); Int. exposed/permenant(Z)	Hypersaline(7) ; Eusaline(8); Mixosaline(9); Fresh(0); Acid(a); Circumneutral(c); Alkaline/calcareous(i); Organic(g); Mineral(n); Beaver(b); Partially Drained/ditched(d); Farmed(f); Diked/impounded(h); Artificial Substrate(r); Spoil(s); Excavated(x)	
Palustrine	Palustrine					
Riverine	Lower perennial; Upper perennial; Intermittent					

Site Map

Scale: 1 sq. =

Draw a sketch map of the site including relevant portions of the wetland, AA boundary, structures, habitat classes, and other significant features.

Variable 1: Habitat Connectivity - Neighboring Wetland Habitat Loss

This variable is a measure of how isolated from other naturally-occurring wetland or riparian habitat the AA has become as a result of the loss of that habitat. To score this variable, estimate the percent of naturally- occurring wetland/riparian habitat that has been lost (by filling, draining, development, or whatever means) within a 500-meter-wide belt surrounding the AA. This surrounding area is called the Habitat Connectivity Envelope (HCE). Historical photographs and NWI maps can be helpful in scoring this variable. In most cases the evaluator must use best professional judgment in estimating the amount of natural wetland loss. Evaluation of landforms and habitat patterns in the context of perceivable land use change should be used to steer estimates of the amount of wetland loss within the HCE. This variable is not meant to penalize AAs that are naturally isolated, or unique to the landscape. Rather, it should measure the degree to which natural habitat connectivity has been lost.

Rules for Scoring:

1. On the aerial photo outline the area that is within 500 meters of the AA.
2. Identify obvious natural barriers within 500 m of the AA boundary.
   - Natural barriers include continuous cliff bands, deep open water, etc.
3. Draw the **Habitat Connectivity Envelope**(HCE) on the aerial image.
   - The HCE is all the area within 500 meters of the AA that is not separated from it by a natural barrier.
4. Outline the current extent of naturally occurring wetland and riparian habitat. Then outline areas where the habitats appear to have historically occurred.
   - Use your knowledge of the history of the area and evident land use change. Additional research could be utilized to increase the accuracy of this estimate including consideratation of floodplain maps, historical aerials, etc.

Variable Score	Condition Category	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	*Wetland losses are absent or negligible or there is no evidence to suggest the native landscape within the HCE historically contained other wetland habitats*
<0.9 - 0.8	*Highly Functioning*	*More than 80% of historical wetland habitat area within the HCE is still present (less than 20% historical wetland habitat area lost).*
<0.8 - 0.7	*Functioning*	*80 to 60% of historical wetland habitat area within the HCE is still present (20% to 40% historical wetland habitat area lost).*
<0.7 - 0.6	*Functioning Impaired*	*Less than 60 to 30% of historical wetland habitat area within the HCE is still present (more than 30 to 70% historical wetland habitat area lost).*
<0.6	*Non-functioning*	*Less than 30% of the historical wetland habitat area from within the HCE is now no longer in existence (more than 70% historical wetland habitat area lost).*

Variable 1 Score 0.82

Notes: Habitat lost below OHWM of lake and from gravel mining.

Variable 2: Habitat Connectivity - Migration/Dispersal Barriers

This variable is intended to rate the degree to which the AA has become isolated from existing neighboring wetland and riparian habitat by artificial barriers that inhibit migration or dispersal of organisms. On the aerial photograph, identify the man-made barriers within the HCE that intercede between the AA and surrounding wetlands and riparian areas, and identify them by type on the stressor list. Score this variable based on the barriers' impermeability to migration and dispersal and the amount of surrounding wetland/riparian habitat they affect.

Rules for Scoring:

1. On the aerial photo, outline all existing wetland and riparian habitat areas (WHAs) within the HCE.

2. Identify artificial barriers to dispersal and migration of organisms within the HCE that intercede between the AA and surrounding habitats. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.

3. Considering the composite effect of all of identified barriers to migration and dispersal (i.e., stressors), assign an overall variable score using the scoring guidelines.

Stressors = artificial barriers

✔	Stressors	Comments/description
	Major Highway	
	Secondary Highway	
X	Tertiary Roadway	Interior park road (moderate)
	Railroad	
X	Bike Path	Soft-surface trails (low)
X	Urban Development	Parking lot for trailhead (low)
	Agricultural Development	
X	Artificial Water Body	OHWM of Chatfield and gravel ponds (high)
	Fence	
	Ditch or Aqueduct	
	Aquatic Organism Barriers	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	No appreciable barriers exist between the AA and other wetland and riparian habitats in th HCE; or there are no other wetland and riparian areas in the HCE.
<0.9 - 0.8	*Highly Functioning*	Barriers impeding migration/dispersal between the AA and up to 33% of surrounding WHA highly permeable and easily passed by most organisms. Examples could include gravel roads, minor levees, ditches or barbed-wire fences. More significant barriers (see "functioning category below) could affect migration to up to 10% of surrounding WHA.
<0.8 - 0.7	*Functioning*	Barriers to migration and dispersal retard the ability of many organisms/propagules to pass between the AA and up to 66% of WHA. Passage of organisms and propagules through such barriers is still possible, but it may be constrained to certain times of day, be slow, dangerous or require additional travel. Busy two-lane roads, culverted areas, small to medium artificial water bodies or small earthen dams would commonly rate a score in this range. More significant barriers (see "functioning impaired" category below) could affect migration to up to 10% of surrounding WHA.
<0.7 - 0.6	*Functioning Impaired*	Barriers to migration and dispersal preclude the passage of some types of organisms/propagules between the AA and up to 66% of surrounding WHA. Travel of those animals which can potential negotiate the barrier are strongly restricted and may include a high chance of mortality. Up to 33% of surrounding WHA could be functionally isolated from the AA.
<0.6	*Non-functioning*	AA is essentially isolated from surrounding WHA by impermeable migration and dispersal barriers. An interstate highway or concrete-lined water conveyance canal are examples of barriers which would generally create functional isolation between the AA and a WHA.

Variable 2 Score 0.6

Variable 3: Buffer Capacity

The buffer area is defined as a 250-meter-wide belt surrounding the perimeter of the AA. This variable is a measure of the capacity of that area to function as an effective buffer for the wetland against the deleterious effects of surrounding land use change. To score the variable, assume that the AA is 100% buffered except where land use changes inside the buffer area have diminished this quality. Identify these land use types as specific stressors in the list. For each stressor, rate severity and extent within the buffer area; then use this list to make an overall rating for the buffer's departure from reference conditions. When rating buffer capacity, consider both the intensity of the impact and the proximity of the stressor to the AA.

Rules for Scoring:

1. On the aerial photograph, outline the buffer area as the zone within 250 meters of the outer boundary of the AA.
2. Use the stressor list to record land use changes that affect buffering capacity within the buffer area. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.
3. Considering all of the identified stressors, their overall severity, extent and proximity to the AA assign an overall variable score using the scoring guidelines.

Stressors = Land Use Changes

✔	Stressors	Comments/description
	Industrial/commercial	
	Urban	
	Residential	
	Rural	
	Dryland Farming	
	Intensive Agriculture	
	Orchards or Nurseries	
	Livestock Grazing	
	Transportation Corridor	
X	Urban Parklands	Parking lot for trailheads and facilities (low)
	Dams/impoundments	
x	Artificial Water body	Chatfield Reservoir and gravel ponds (High)
	Physical Resource Extraction	
	Biological Resource Extraction	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	No appreciable land use change has been imposed within the TBA and it provides the full buffering capacity.
<0.9 - 0.8	*Highly Functioning*	Some land use change has occurred in the BA, but such changes little impair the area's ability to provide a buffering function, either because land use is not intensive, for example haying, light grazing, or nurseries, or more substantial changes occur in approximately less than 10% of the BA.
<0.8 - 0.7	*Functioning*	BA has been subjected to a marked shift in land use, however, the land retains much of its original buffering capacity. Moderate-intensity land uses such as dry-land farming, urban "green" corridors, or moderate cattle grazing would commonly be placed within this scoring range.
<0.7 - 0.6	*Functioning Impaired*	Land use within the BA has been substantial including the a moderate to high coverage (up to 50%) of impermeable surfaces, bare soil, or other artificial surface; considerable in-flow urban runoff or fertilizer-rich waters common. While, the buffering capacity of the land has been greatly diminished it is not extinguished. Intensively logged areas, low-density urban developments, some urban parklands and some cropping situations would commonly rate a score within this range.
<0.6	*Non-functioning*	The area within the BA provides essentially no buffering capacity. Many Commercial developments or highly urban landscapes would rate a score of less than 0.6.

Variable 3 score 0.65

Variable 4: Water Source

This variable is concerned with up-gradient hydrologic connectivity. It is a measure of the impacts to the AA's water source, including the ability of source water to perform work such as sediment transport, erosion, soil pore flushing, etc. To score this variable, identify stressors that alter the source of water to the AA, and record their presence on the stressor list. Stressors can impact water source by depletion, augmentation, or alteration of inflow timing or hydrodynamics. For riverine systems, this variable is primarily concerned with the connection of the channel to the floodplain.This variable is designed to assess water quantity, power and timing, not water quality. Water quality will be evaluated in Variable 7.

Scoring rules:

1. Use the stressor list and knowledge of the watershed to catalog type-specific impairments of the AA's water source. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.

2. Considering the composite effect of stressors on the water source, rate the condition of this variable with the aid of the scoring guidelines.

✔	Stressors	Comments/description
	Ditches or Drains (tile, etc.)	
X	Dams	Stroncha Reservoir u/s (moderate)
	Diversions	
	Groundwater pumping	
X	Draw-downs	Chatfield Lake is drawn down (moderate)
	Culverts or Constrictions	
	Point Source (urban, ind., ag.)	
	Non-point Source	
	Increased Drainage Area	
	Storm Drain/Urban Runoff	
	Impermeable Surface Runoff	
	Irrigation Return Flows	
	Mining/Natural Gas Extraction	
X	Transbasin Diversion	Roberts Tunnel (low)
	Actively Managed Hydrology	
X		Groundwater and reservoir now primary source of water (high)

Variable Score	Condition Class	Depletion	Augmentation
1.0 - 0.9	*Reference Standard*	Unnatural drawdown events minor, rare or non-existent, very slight uniform depletion, or trivial alteration of hydrodynamics.	Unnatural high-water events minor, rare or non-existent, slight uniform increase in amount of inflow, or trivial alteration of hydrodynamics.
<0.9 - 0.8	*Highly Functioning*	Unnatural drawdown events occasional, short duration and/or mild; or uniform depletion up to 20%; or mild to moderate reduction of peak flows or natural capacity of water to perform work.	Occasional unnatural high-water events, short in duration and/or mild in intensity; or uniform augmentation up to 20%; or mild to moderate increase of peak flows or natural capacity of water to perform work.
<0.8 - 0.7	*Functioning*	Unnatural drawdown events common and of mild to moderate intensity and/or duration; or uniform depletion up to 50%; or moderate to substantial reduction of peak flows or natural capacity of water to perform work.	Common occurrence of unnatural high-water events, of a mild to moderate intensity and/or duration; or uniform augmentation up to 50%; or moderate to substantial reduction of peak flows or natural capacity of water to perform work.
<0.7 - 0.6	*Functioning Impaired*	Unnatural drawdown events occur frequently with a moderate to high intensity and/or duration; or uniform depletion up to 75%; or substantial reduction of peak flows or natural capacity of water to perform work. **Wetlands with actively managed or wholly artificial hydrology will usually score in this range or lower.**	Common occurrence of unnatural high-water events, some of which may be severe in nature or exist for a substantial portion of the growing season; or uniform augmentation more than 50% or natural capacity of water to perform work. **Wetlands with actively managed or wholly artificial hydrology will usually score in this range or lower.**
<0.6	*Non-functioning*	Water source diminished enough to threaten jurisdictional classification of the AA.	Frequency, duration or magnitude of unnaturally high-water great enough to change the fundamental characteristics of the wetland.

Variable 4 Score 0.65

Variable 5: Water Distribution

This variable is concerned with hydrologic connectivity within the AA. It is a measure of alteration to the spatial distribution of surface and groundwater within the AA. These alterations are manifested as local changes to the hydrograph and generally ***result*** *from geomorphic modifications. To score this variable, identify stressors that alter flow patterns and impact the hydrograph within portions of the AA, including localized increases or decreases to the depth or duration of the water table or surface water. In naturally confined rivers (i.e. canyons and gullies) floodplain width is generally very small, so these systems will tend to score high for this variable unless some gross stressor is present.*

Scoring rules:

1. Identify impacts to the natural distribution of water throughout the AA and catalog them in the stressor table.
2. Considering all of the stressors identified, assign an overall variable score using the scoring guidelines.

✔	Stressors	Comments/description
	Ditches	
	Ponding/Impoundment	
	Culverts	
	Road Grades	Interior park road (high)
	Channel Incision/Entrenchment	
	Hardened/Engineered Channel	
	Enlarged Channel	
	Artificial Banks/Shoreline	
	Weirs	
	Dikes/Levees/Berms	
	Diversions	
	Sediment/Fill Accumulation	
		Groundwater affects how water moves through site (high)

Variable Score	Condition Class	Non-riverine	Riverine
1.0 - 0.9	*Reference Standard*	Little or no alteration has been made to the way in which water is distributed throughout the wetland.	Natural active floodplain areas flood on a normal recurrence interval. No evidence of alteration of flooding and subirrigation duration and intensity.
<0.9 - 0.8	*Highly Functioning*	Less than 10% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in less than a 2 in. (5 cm) change in mean growing season water table elevation.	Channel-adjacent areas have occasional unnatural periods of drying or flooding; or uniform shift in the hydrograph less than typical root depth.
<0.8 - 0.7	*Functioning*	Between 10 and 33% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in a 4 in. (5 cm) or less change in mean growing season water table elevation.	In channel-adjacent area, periods of drying or flooding are common; or uniform shift in the hydrograph near root depth.
<0.7 - 0.6	*Functioning Impaired*	33 to 66% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in a 6 in. (15 cm) or less change in mean growing season water table elevation. Water table behavior must still meet jurisdictional criteria to merit this rating.	Adjacent to the channel, unnatural periods of drying or flooding are the norm; or uniform shift in the hydrograph greater than root depth.
<0.6	*Non-functioning*	More than 66% of the AA is affected by hydrologic alteration which changes the fundamental functioning of the wetland system	Historical active floodplain areas are almost never wetted from overbank flooding, and/or groundwater infiltration is effectively cut off.

Variable 5 Score | 0.6

Variable 6: Water Outflow

This variable is concerned with down-gradient hydrologic connectivity and the flow of water (transporting materials and energy) out of the AA. It is a measure of impacts that affect the hydrologic outflow of water including the passage of water through its normal low- and high-flow surface outlets, and infiltration/groundwater recharge. In some cases, alteration of evapotranspiration rates may be significant enough of a factor to consider in scoring. Score this variable by identifying stressors that impact the means by which water is exported from the AA. In Variable 5, the stressors were evaluated in light of their impact on water distribution within the AA. To evaluate this variable focus on how water, energy and associated materials are exported out of the AA.

Scoring rules:

1. Identify impacts to the natural outflow of water from the AA and catalog them in the stressor table.

2.Considering all of the stressors identified, assign an overall variable score using the scoring guidelines. Take in to account the cumulative effect of stressors on the wetland's ability to export water and water-borne materials

✔	Stressors	Comments/description
	Ditches	
	Dikes/Levees	
	Road Grades	
	Culverts	
	Diversions	
	Constrictions	
	Channel Incision/Entrenchment	
	Hardened/Engineered Channel	
	Artificial Stream Banks	
	Weirs	
	Confined Bridge Openings	
		Groundwater alters how water leaves the site.

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stressors have little to no effect on the magnitude, timing or hydrodynamics of the AA water outflow regime.
<0.9 - 0.8	*Highly Functioning*	High- or low-water outflows are mildly to moderately affected, but at intermediate ("normal") lev flow continues essentially unaltered in quantity or character.
<0.8 - 0.7	*Functioning*	High- or low-water outflows are moderately affected, mild alteration of intermediate level outflow occurs; or hydrodynamics mildly to moderately affected.
<0.7 - 0.6	*Functioning Impaired*	Outflow at all stages is moderately impaired resulting in persistent flooding of portions of the AA or unnatural drainage; or outflow hydrodynamics significantly disrupted.
<0.6	*Non-functioning*	The natural outflow regime is severely disrupted. Down-gradient hydrologic connection severed or nearly so. Alterations may cause widespread unnatural persistent flooding or dewatering of the wetland system.

Variable 6 Score 0.68

Variable 7: Water and Soil Chemical Environment

This variable concerns the chemical environment of the soil and water media within the AA, including pollutants and water quality. The origin of pollutants may be in the AA or delivered from up-gradient or surrounding areas. Score this variable by listing indicators of chemical stress in the AA. Consider point source and non-point sources of pollution, as well as mechanical or hydrologic changes that alter the chemical environment. Because water quality frequently cannot be inferred directly, the presence of many stressors is identified via indirect indicators.

Scoring rules:

1. Stressors are grouped into categories which have a similar signature or set of causes.
2. Use the indicator list to identify each stressor impacting the chemical environment of the AA.
3. For each stressor category, determine the sub-variable score using the scoring guideline table provided on the second page of the scoring sheet.
 -If the AA is part of a water body that is recognized as impaired or recommended for TMDL development for one of the factors, then score that sub-variable 0.65 or lower.
4. Transcribe sub-variable scores to the following variable scoring page and compute the sum.
5. Determine the variable score by following the scoring guidelines.

Stressor Category	Stressor Indicator	✔	Comments	Sub-variable Score
Nutrient Enrichment/ Eutrophication/ Oxygen (D.O.)	Livestock			1.00
	Agricultural Runoff			
	Septic/Sewage			
	Excessive Algae or Aquatic Veg.			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Sedimentation/ Turbidity	Excessive Erosion			1.00
	Excessive Deposition			
	Fine Sediment Plumes			
	Agricultural Runoff			
	Excessive Turbidity			
	Nearby Construction Site			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Toxic contamination/ pH	Recent Chemical Spills			0.95
	Nearby Industrial Sites			
	Road Drainage/Runoff	X	Interior park road (low)	
	Livestock			
	Agricultural Runoff			
	Storm Water Runoff			
	Fish/Wildlife Impacts			
	Vegetation Impacts			
	Cumulative Watershed NPS			
	Acid Mine Drainage			
	Point Source Discharge			
	CDPHE Impairment/TMDL List			
Temperature	Excessive Temperature Regime			1.00
	Lack of Shading			
	Reservoir/Power Plant Discharge			
	Industrial Discharge			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Soil chemistry/ Redox potential	Unnatural Saturation/Desaturation	X	Artificially high water table (hi)	0.65
	Mechanical Soil Disturbance			
	Dumping/introduced Soil			
	CDPHE Impairment/TMDL List			

Variable 7: Water and Soil Chemical Environment

Sub-variable Scoring Guidelines

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stress indicators not present or trivial.
<0.9 - 0.8	*Highly Functioning*	Stress indicators scarcely present and mild, or otherwise not occurring in more than 10% of the AA.
<0.8 - 0.7	*Functioning*	Stress indicators present at mild to moderate levels, or otherwise not occurring in more than 33% of the AA.
<0.7 - 0.6	*Functioning Impaired*	Stress indicators present at moderate to high levels, or otherwise not occurring in more than 66% of the AA
<0.6	*Non-functioning*	Stress indicators strongly evident throughout the AA at levels which apparently alter the fundamental chemical environment of the wetland system

Input each factor score from the stressor list and calculate the sum.

Nutrient enrichment/ Eutrophication/ Oxygen (D.O.)		Sedimentation/ Turbidity		Toxic contamination/ pH		Temperature		Soil chemistry/ Redox potential		Sum of Sub-variable Scores
1.00	+	1.00	+	0.95	+	1.00	+	0.65	=	4.60

Use the table to score the Chemical Environment Variable circling the applicable scoring rules.

Variable Score	Condition Class	Scoring Rules		
		Single Factor		**Composite Score**
1.0 - 0.9	*Reference Standard*	No single factor scores < 0.9	or	The factor scores sum > 4.5
<0.9 - 0.8	*Highly Functioning*	Any single factor scores ≥ 0.8 but < 0.9	or	The factor scores sum >4.0 but ≤4.5
<0.8 - 0.7	*Functioning*	Any single factor scores ≥ 7.0 but < 0.8	or	The factor scores sum >3.5 but ≤ 4.0
<0.7 - 0.6	*Functioning Impaired*	Any single factor scores ≥ 0.6 but <0.7	or	The factor scores sum >3.0 but ≤3.5
< 0.6	*Non-functioning*	Any single factor scores < 0.6	or	The factor scores sum < 3.0

Variable 7 Score 0.9

Variable 8: Geomorphology

This variable is a measure of the degree to which the geomorphic setting has been altered within the AA. Changes to the surface configuration and natural topography constitute stressors. Such stressors may be observed in the form of fill, excavation, diking, sedimentation due to absence of flushing floods, etc. In riverine systems geomorphic changes to stream channel should be considered if the channel is within the AA. Alterations may include bed surface changes (embeddedness or morphology changes), stream bank instability, and stream channel reconfiguration. Geomorphic changes are usually ultimately manifested as changes to wetland hydrology and water relations with vegetation. Geomorphic alteration can also directly affect soil properties, such as near-surface texture, and the wetland chemical environment, such as the redox state or nutrient composition in the rooting zone. In rating this variable, do not include these resultant effects of geomorphic change; rather focus on the physical impacts within the footprint of the alteration. The effects of geomorphic change are addressed by other variables. All alterations to the geomorphology should be evaluated including small-scale impa

Scoring Rules:

1. Identify impacts to geomorphological setting and topography within the AA and record them on the stressor checklist.
2. Considering all of the stressors identified, assign an overall variable score using the scoring guidelines.

✔		Stressors	Comments
	General	Dredging/Excavation/Mining	
	General	Fill, including dikes, road grades, etc	
	General	Grading	
	General	Compaction	
	General	Plowing/Disking	
	General	Excessive Sedimentation	
	General	Dumping	
	General	Hoof Shear/Pugging	
X	General	Aggregate or Mineral Mining	Gravel ponds (high)
	General	Sand Accumulation	
	Channels Only	Channel Instability/Over Widening	
	Channels Only	Excessive Bank Erosion	
	Channels Only	Channelization	
	Channels Only	Reconfigured Stream Channels	
	Channels Only	Artificial Banks/Shoreline	
	Channels Only	Beaver Dam Removal	
	Channels Only	Substrate Embeddedness	
	Channels Only	Lack or Excess of Woody Debris	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Topography essentially unaltered from the natural state, or alterations don't appear to have a minimal effect on wetland functioning and condition. Patch or microtopographic complexity may be slightly altered, but native plant communities are still supported.
<0.9 - 0.8	*Highly Functioning*	Alterations to topography result in small but detectable changes to habitat conditions throughout all or most of the AA; or changes causing more significant impacts but affecting less than 10% of the AA.
<0.8 - 0.7	*Functioning*	Changes to AA topography may be pervasive but generally mild. May include patches of more significant habitat alteration; or more significant alteration affecting less than 20 % of the AA.
<0.7 - 0.6	*Functioning Impaired*	At least one important surface type or landform has been eliminated or created; microtopography has been moderately altered throughout most or all of the AA, or more severe alterations affect less than 50% AA. Evidence that widespread diminishment or alteration of native plant community exist due to physical habitat alterations. Most incidentally created wetland habitat such as that created by roadside ditches and the like would score in this range or lower.
<0.6	*Non-functioning*	Geomorphic alterations have rendered the AA essentially unusable by *characteristic* wildlife species, or the physical setting no longer supports native plant communities.

Variable 8 Score: 0.75

Variable 9: Vegetation Structure and Complexity

This variable is a measure of the condition of the wetland's vegetation relative to its native state. It is particularly relevant to the wetland's ability to perform higher-order functions such as support of wildlife populations, although it also affects primary functions such as flood-flow attenuation. Score this variable by listing stressors that have affected the diversity, composition and cover of each vegetation cover class that would normally be present for the wetland type being assessed. For this variable, stressor severity is a measure of how much each vegetation stratum differs functionally from its natural condition.

Rules for Scoring:

1. Determine the number and types of vegetation layers present within the AA. Make a judgment as to whether additional layers were historically present using direct evidence such as stumps, root wads or historical photographs. Indirect evidence such as local knowledge and expert opinion can also be used in this determination. Check each present or suspected vegetation layer in the third row of the table.

2. Do not score vegetation layers that would not normally be present in the wetland type being assessed.

3. Estimate the percent coverage of each vegetation layer. Aerial photographs can be helpful for this but are not required.

4. Enter the percent cover values as decimals in the row of the stressor table labeled "Percent Cover of Layer". Note, percentages will often sum to more than 100% (1.0).

5. Determine the severity of stressors acting on each individual canopy layers, indicating their presence with checks in the appropriate boxes of the stressor table.

6. Determine the sub-variable score for each valid vegetation layer using the scoring guidelines on the second page of the scoring sheet. Enter each sub-variable score in the appropriate cell of the row labeled "Veg. Layer Sub-variable Score".

7. Add the "Veg. Layer Sub-variable Scores" and enter the sum in the labled cell to the right of the individual scores. Follow this same process for the "Percent Cover of Layer".

8. Divide the sum of "Veg. Layer Sub-variable Scores" by the total coverage of all layers scored. This product is the Variable 9 score. Enter this number in the labeled box at the bottom of this page.

	Vegetation Layers				
Layers Scored *(check boxes to right to indicate scored layers)*					
Stressor	**Tree**	**Shrub**	**Herb**	**Aquatic**	**Comments**
Noxious Weeds					
Exotic/Invasive spp.			X		Reedcanary grass, smooth brome (mod)
Tree Harvest					
Brush Cutting/Shrub Removal					
Livestock Grazing					
Excessive Herbivory					
Mowing/Haying					
Herbicide					
Loss of Zonation/Homogenization					
Dewatering					
Over Saturation			X		Artifically high water table (high)

	Tree		Shrub		Herb		Aquatic		
Percent Cover of Layer	10.00	+	70.00	+	20.00	+	0.00	=	100
	x		x		x		x		÷
Veg. Layer Sub-variable Score	1		1		0.75		0		
	=		=		=		=		
Weighted Sub-variable Score	10.00	+	70.00	+	15.00	+		=	95

See sub-variable scoring guidelines on following page

Variable 9 Score 0.95

Sub-variable 9 Scoring Guidelines

Based on the list of stressors identified above, rate the severity of their cumulative effect on vegetation structure and complexity for each vegetation layer.

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stressors not present or with an intensity low enough as to not detectably affect the structure, diversity or composition of the vegetation layer.
<0.9 - 0.8	*Highly Functioning*	Stressors present at an intensity levels sufficient to cause detectable, but minor, changes in layer composition. Stress related change should generally be less than 10% for any given attribute (e.g., 10% cover of invasive, 10% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 33% if stressors are confined to patches comprising less than 10% of the wetland.
<0.8 - 0.7	*Functioning*	Stressors present with enough intensity to cause significant changes in the character of vegetation, including alteration of layer coverage, structure complexity and species composition. The vegetation layer retains its essential character though. AA's with a high proportion of non-native grasses will commonly fall in this class. Stress related change should generally be less than 33% for any given attribute (e.g., 33% cover of invasive, 33% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 66% if stressors are confined to patches comprising less than 25% of the wetland.
<0.7 - 0.6	*Functioning Impaired*	Stressor intensity severe enough to cause profound changes to the fundamental character of the vegetation layer. Stress-related change should generally be less than 66% for any given attribute (e.g 66% cover of invasive, 66% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 80% if stressors are confined to patches comprising less than 50% of the wetland.
<0.6	*Non-functioning*	Vegetation layer has been completely removed or altered to the extent that is no longer comparable to the natural structure, diversity and composition.

FACWet Score Card

Scoring Procedure:

1. Transcribe variable scores from each variable data sheet to the corresponding cell in the variable score table.
2. In each Functional Capacity Index (FCI) equation, enter the corresponding variable scores in the equation cells. Do not enter values in the crossed cells lacking labels.
3. Add the variable scores to calculate the total functional points achieved for each function.
4. Divide the total functional points achieved by the functional points possible. The typical number of total points possible is provided, howe if a variable is added or subtracted to FCI equation the total possible points must be adjusted
5. Calculate the Composite FCI, by adding the FCI scores and dividing by the total number of functions scored (usually 7).
6. If scoring is done directly in the Excel spreadsheet, all values will be transferred and calculated automatically.

VARIABLE SCORE TABLE

Buffer & Landscape Context	**Variable 1:**	**Habitat Connectivity - Neighboring Wetland Habitat Loss**	0.82
	Variable 2:	**Habitat Connectivity - Migration/Dispersal Barriers**	0.60
	Variable 3:	**Buffer Capacity**	0.65
Hydrology	**Variable 4:**	**Water Source**	0.65
	Variable 5:	**Water Distribution**	0.60
	Variable 6:	**Water Outflow**	0.68
Abiotic and Biotic Habitat	**Variable 7:**	**Chemical Environment**	0.90
	Variable 8:	**Geomorphology**	0.75
	Variable 9:	**Vegetation Structure and Complexity**	0.95

Functional Capacity Indices

Function 1 -- Support of Characteristic Wildlife Habitat

$V1_{wetloss}$	+	$V2_{barriers}$	+	$V3_{buffer}$	+	$(2 \times V9_{veg})$	+		+		=	Total Functional Points	÷		=	Functional Capacity Index
0.82	+	0.60	+	0.65	+	1.90	+		+		=	3.97	÷	5	=	0.79

Function 2 -- Support of Characteristic Fish/aquatic Habitat

$(3 \times V4_{source})$	+	$(2 \times V5_{dist})$	+	$(2 \times V6_{outflow})$	+	$V7_{chem}$	+	$V8_{geom}$	+		=		÷		=	
1.95	+	1.20	+	1.36	+	0.90	+	0.75	+		=	6.16	÷	9	=	0.68

Function 3 -- Flood Attenuation

$V3_{buffer}$	+	$(2 \times V4_{source})$	+	$(2 \times V5_{dist})$	+	$(2 \times V6_{outflow})$	+	$V8_{geom}$	+	$V9_{veg}$	=		÷		=	
0.65	+	1.30	+	1.20	+	1.36	+	0.75	+	0.95	=	6.21	÷	9	=	0.69

Function 4 -- Short- and Long-term Water Storage

V_{source}	+	$(2 \times V5_{dist})$	+	$(2 \times V6_{outflow})$		$V8_{geom}$	+		+		=		÷		=	
0.65	+	1.20	+	1.36	+	0.75	+		+		=	3.96	÷	6	=	0.66

Function 5 -- Nutrient/Toxicant Removal

$(2 \times V5_{dist})$	+	$V7_{chem}$	+	$V8_{geom}$	+		+		+		=		÷		=	
1.20	+	0.90	+	0.75	+		+		+		=	2.85	÷	4	=	0.71

Function 6 -- Sediment Retention/Shoreline Stabilization

$V3_{buffer}$	+	$(2 \times V8_{geo})$	+	$(2 \times V9_{veg})$	+		+		+		=		÷		=	
0.65	+	1.50	+	1.90	+		+		+		=	4.05	÷	5	=	0.81

Function 7 -- Production Export/Food Chain Support

$V1_{wetloss}$	+	$(2 \times V6_{outflow})$	+	$V7_{chem}$	+	$V8_{geo}$	+	$(2 \times V9_{veg})$	+		=		÷		=	
0.82	+	1.36	+	0.90	+	0.75	+	1.90	+		=	5.73	÷	7	=	0.82

Sum of Individual FCI Scores	**5.17**
Divide by the Number of Functions Scored (usually 7)	**÷ 7**
Composite FCI Score	**0.74**

ADMINISTRATIVE CHARACTERIZATION

General Information

		Date of Evaluation:	12/10/2008
Site Name or ID:	SPR 5	Project Name:	Chatfield Reallocation Study
404 or Other Permit Application #:	NA	Lead Federal Agency:	US Army Corps of Engineers
Evaluator Name(s):	Mary L. Powell	Evaluator's professional position and organization:	Natural Resource Specialist, ERO Resources, Corp.

Location Information:

Site Location (Lat./Long. or UTM):	492778.3691 4373912.142	Geographic Datum Used (NAD 83 preferred):	AND 83
USGS Quadrangle Map:	Littleton	Map Scale: (Circle one)	**1:24,000** 1:100,000 Other 1:
Sub basin Name (8 digit HUC):	Upper South Platte (10190002)	Wetland Ownership:	US Army Corps of Engineers

Project Information:

This evaluation is being performed at: *(Check applicable box)*
- X *Project Wetland*
- [ ] *Mitigation Site*

Purpose of Evaluation (check all applicable):
- X *Potentially Impacted Wetlands*
- [ ] *Mitigation; Pre-construction*
- [ ] *Mitigation; Post-construction*
- [ ] *Monitoring*
- [ ] *Other (Describe)*

Intent of Project: *(Check all applicable)* X Preservation X Restoration X Enhancement X Creation

Total Size of Wetland Involved: (Record Area, Check and Describe Measurement Method Used)	3.34 ac.	X	Measured using GIS.				
			Estimated				
Assessment Area (AA) Size (Record Area, check appropriate box. Additional spaces are used to record acreage when more than one AA is included in a single assessment)	ac.	X	Measured	ac.	ac.	ac.	ac.
			Estimated	ac.	ac.	ac.	ac.
Characteristics or Method used for AA boundary determination:	Extent of AA determined by wetland mapping performed by TetraTech for FR/EIS study. Wetlands of same wetland category were grouped together based logical location on landscape.						

Notes:	Wetland around perimeter of gravel pond west of SPR, south of interior park road

ECOLOGICAL DESCRIPTION 1

Special Concerns

Check all that apply

- [ ] Organic soils including Histosols or Histic Epipedons are present in the AA (i.e., AA includes core fen habitat).
- [ ] Project will directly impact organic soil portions of the AA including areas possessing either Histosol soils or histic epipedons.
- [ ] Organic soils are known to occur anywhere within the contiguous wetland of which the AA is part.
- [ ] The wetland is a habitat oasis in an otherwise dry or urbanized landscape?
- [X] Federally threatened or endangered species are **KNOWN** to occur in the AA? List Below.

PMJM assumed to be present based on proximity to occupied habitat

- [ ] Federally threatened or endangered species are **SUSPECTED** to occur in the AA?
- [ ] Species of concern according to the Colorado Natural Heritage (CNHP) are known to occur in the AA?
- [ ] The site is located within a potential conservation area or element occurrence buffer area as determined by CNHP?
- [ ] Other special concerns (please describe)

HYDROGEOMORPHIC SETTING

- [ ] AA wetland maintains its fundamental natural hydrogeomorphic characteristics
- [ ] AA wetland has been subject to change in HGM classes as a result of anthropogenic modification

If the above is checked, please describe the original wetland type if discernable using the table below.

- [X] AA wetland was created from an upland setting.

Previous wetland typology

Historical Conditions				
Water source	Surface flow	Groundwater	Precipitation	Unknown
Hydrodynamics	Unidirectional	Vertical		
Geomorphic Setting (Narrative Description)	Previously totally influenced by SPR. Now, reservoir is has primary influence.			
Previous HGM Class	Riverine	Slope	Depressional	Lacustrine

Current Conditions

Describe the hydrogeomorphic setting of the wetland by circling all conditions that apply.

HGM Setting

Water source	**Surface flow**	**Groundwater**	Precipitation	Unknown		
Hydrodynamics	Unidirectional	**Vertical**				
Wetland Gradient	**0 - 2%**	2-4%	4-10%	>10%		
# Surface Inlets	Over-bank	**0**	1	2	3	>3
# Surface Outlets		0	1	2	3	>3
Geomorphic Setting (Narrative Description)	Around perimeter of gravel pond					
HGM class	Riverine	Slope	Depressional	**Lacustrine**		

Notes (include information on charcteristics used to formulate reference standard): Reference standard is the condition of South Platte River prior to construction of Chatfield Reservoir, Stroncha dam, and park roads and trails.

ECOLOGICAL DESCRIPTION 2

Vegetation Habitat Description

*US FWS habitat classification according as reported in Cowardin et. al (1979) - See also Appendix *** of FACWet User Guide.*

System	Subsystem	Class	Subclass	Water Regime	Other Modifiers	% AA
Palustrine	Palustrine	Emergent	Persistent	Seasonally flooded		20%
Palustrine	Palustrine	Shrub-scrub	Persistent	Seasonally flooded		80%
Lacustrine Palustrine Riverine	Littoral; Limnoral Palustrine Lower perennial; Upper perennial; Intermittent	Rock Bot. (RB) Uncon Bottom(UB) Aquatic Bed(AB) Rocky Shore(RS) Uncon Shore(US) Emergent(EM) Shrub-scrub(SS) Forested (FO)	Floating vascular; Rooted vascular; Algal; Persistent; Non-Persistent; Broad-leaved deciduous; Needle-leaved evergreen; Cobble - gravel; Sand; Mud; Organic	**Examples** Temporarily flooded(A); Saturated(B); Seasonally flooded(C); Seas.-flood./sat.(E); Perm. flooded(F); Intermittently Flooded(G); Artificially Flooded(K); Sat./semiperm./Seas. (Y); Int. exposed/permenant(Z)	Hypersaline(7) ; Eusaline(8); Mixosaline(9); Fresh(0); Acid(a); Circumneutral(c); Alkaline/calcareous(i); Organic(g); Mineral(n); Beaver(b); Partially Drained/ditched(d); Farmed(f); Diked/impounded(h); Artificial Substrate(r); Spoil(s); Excavated(x)	

Site Map

Scale: 1 sq. =

Draw a sketch map of the site including relevant portions of the wetland, AA boundary, structures, habitat classes, and other significant features.

Variable 1: Habitat Connectivity - Neighboring Wetland Habitat Loss

This variable is a measure of how isolated from other naturally-occurring wetland or riparian habitat the AA has become as a result of the loss of that habitat. To score this variable, estimate the percent of naturally- occurring wetland/riparian habitat that has been lost (by filling, draining, development, or whatever means) within a 500-meter-wide belt surrounding the AA. This surrounding area is called the Habitat Connectivity Envelope (HCE). Historical photographs and NWI maps can be helpful in scoring this variable. In most cases the evaluator must use best professional judgment in estimating the amount of natural wetland loss. Evaluation of landforms and habitat patterns in the context of perceivable land use change should be used to steer estimates of the amount of wetland loss within the HCE. This variable is not meant to penalize AAs that are naturally isolated, or unique to the landscape. Rather, it should measure the degree to which natural habitat connectivity has been lost.

Rules for Scoring:

1. On the aerial photo outline the area that is within 500 meters of the AA.
2. Identify obvious natural barriers within 500 m of the AA boundary.
   - *Natural barriers include continuous cliff bands, deep open water, etc.*
3. Draw the **Habitat Connectivity Envelope**(HCE) on the aerial image.
   - *The HCE is all the area within 500 meters of the AA that is not separated from it by a natural barrier.*
4. Outline the current extent of naturally occurring wetland and riparian habitat. Then outline areas where the habitats appear to have historically occurred.
   - *Use your knowledge of the history of the area and evident land use change. Additional research could be utilized to increase the accuracy of this estimate including consideratation of floodplain maps, historical aerials, etc.*

Variable Score	Condition Category	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	*Wetland losses are absent or negligible or there is no evidence to suggest the native landscape within the HCE historically contained other wetland habitats*
<0.9 - 0.8	*Highly Functioning*	*More than 80% of historical wetland habitat area within the HCE is still present (less than 20% historical wetland habitat area lost).*
<0.8 - 0.7	*Functioning*	*80 to 60% of historical wetland habitat area within the HCE is still present (20% to 40% historical wetland habitat area lost).*
<0.7 - 0.6	*Functioning Impaired*	*Less than 60 to 30% of historical wetland habitat area within the HCE is still present (more than 30 to 70% historical wetland habitat area lost).*
<0.6	*Non-functioning*	*Less than 30% of the historical wetland habitat area from within the HCE is now no longer in existence (more than 70% historical wetland habitat area lost).*

Variable 1 Score 0.75

Notes: Habitat lost below OHWM of lake and from gravel mining.

Variable 2: Habitat Connectivity - Migration/Dispersal Barriers

This variable is intended to rate the degree to which the AA has become isolated from existing neighboring wetland and riparian habitat by artificial barriers that inhibit migration or dispersal of organisms. On the aerial photograph, identify the man-made barriers within the HCE that intercede between the AA and surrounding wetlands and riparian areas, and identify them by type on the stressor list. Score this variable based on the barriers' impermeability to migration and dispersal and the amount of surrounding wetland/riparian habitat they affect.

Rules for Scoring:

1. On the aerial photo, outline all existing wetland and riparian habitat areas (WHAs) within the HCE.

2. Identify artificial barriers to dispersal and migration of organisms within the HCE that intercede between the AA and surrounding habitats. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.

3. Considering the composite effect of all of identified barriers to migration and dispersal (i.e., stressors), assign an overall variable score using the scoring guidelines.

Stressors = artificial barriers	✔	Stressors	Comments/description
	X	Major Highway	Wadsworth (moderate)
		Secondary Highway	
	X	Tertiary Roadway	Interior park road (moderate)
		Railroad	
	X	Bike Path	Soft-surface trails (low)
	X	Urban Development	Parking lot for trailhead (low)
		Agricultural Development	
	X	Artificial Water Body	OHWM of Chatfield and gravel ponds (high)
		Fence	
	X	Ditch or Aqueduct	Platte Canyon Ditch (low)
		Aquatic Organism Barriers	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	No appreciable barriers exist between the AA and other wetland and riparian habitats in th HCE; or there are no other wetland and riparian areas in the HCE.
<0.9 - 0.8	*Highly Functioning*	Barriers impeding migration/dispersal between the AA and up to 33% of surrounding WHA highly permeable and easily passed by most organisms. Examples could include gravel roads, minor levees, ditches or barbed-wire fences. More significant barriers (see "functioning category below) could affect migration to up to 10% of surrounding WHA.
<0.8 - 0.7	*Functioning*	Barriers to migration and dispersal retard the ability of many organisms/propagules to pass between the AA and up to 66% of WHA. Passage of organisms and propagules through such barriers is still possible, but it may be constrained to certain times of day, be slow, dangerous or require additional travel. Busy two-lane roads, culverted areas, small to medium artificial water bodies or small earthen dams would commonly rate a score in this range. More significant barriers (see "functioning impaired" category below) could affect migration to up to 10% of surrounding WHA.
<0.7 - 0.6	*Functioning Impaired*	Barriers to migration and dispersal preclude the passage of some types of organisms/propagules between the AA and up to 66% of surrounding WHA. Travel of those animals which can potential negotiate the barrier are strongly restricted and may include a high chance of mortality. Up to 33% of surrounding WHA could be functionally isolated from the AA.
<0.6	*Non-functioning*	AA is essentially isolated from surrounding WHA by impermeable migration and dispersal barriers. An interstate highway or concrete-lined water conveyance canal are examples of barriers which would generally create functional isolation between the AA and a WHA.

Variable 2 Score 0.5

Variable 3: Buffer Capacity

The buffer area is defined as a 250-meter-wide belt surrounding the perimeter of the AA. This variable is a measure of the capacity of that area to function as an effective buffer for the wetland against the deleterious effects of surrounding land use change. To score the variable, assume that the AA is 100% buffered except where land use changes inside the buffer area have diminished this quality. Identify these land use types as specific stressors in the list. For each stressor, rate severity and extent within the buffer area; then use this list to make an overall rating for the buffer's departure from reference conditions. When rating buffer capacity, consider both the intensity of the impact and the proximity of the stressor to the AA.

Rules for Scoring:

1. On the aerial photograph, outline the buffer area as the zone within 250 meters of the outer boundary of the AA.
2. Use the stressor list to record land use changes that affect buffering capacity within the buffer area. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.
3. Considering all of the identified stressors, their overall severity, extent and proximity to the AA assign an overall variable score using the scoring guidelines.

Stressors = Land Use Changes

✔	Stressors	Comments/description
	Industrial/commercial	
	Urban	
	Residential	
	Rural	
	Dryland Farming	
	Intensive Agriculture	
	Orchards or Nurseries	
	Livestock Grazing	
X	Transportation Corridor	Wadsworth (moderate)
X	Urban Parklands	Parking lot for trailheads and facilities (low)
	Dams/impoundments	
x	Artificial Water body	Chatfield Reservoir and gravel ponds (High)
	Physical Resource Extraction	
	Biological Resource Extraction	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	No appreciable land use change has been imposed within the TBA and it provides the full buffering capacity.
<0.9 - 0.8	*Highly Functioning*	Some land use change has occurred in the BA, but such changes little impair the area's ability to provide a buffering function, either because land use is not intensive, for example haying, light grazing, or nurseries, or more substantial changes occur in approximately less than 10% of the BA.
<0.8 - 0.7	*Functioning*	BA has been subjected to a marked shift in land use, however, the land retains much of its original buffering capacity. Moderate-intensity land uses such as dry-land farming, urban "green" corridors, or moderate cattle grazing would commonly be placed within this scoring range.
<0.7 - 0.6	*Functioning Impaired*	Land use within the BA has been substantial including the a moderate to high coverage (up to 50%) of impermeable surfaces, bare soil, or other artificial surface; considerable in-flow urban runoff or fertilizer-rich waters common. While, the buffering capacity of the land has been greatly diminished it is not extinguished. Intensively logged areas, low-density urban developments, some urban parklands and some cropping situations would commonly rate a score within this range.
<0.6	*Non-functioning*	The area within the BA provides essentially no buffering capacity. Many Commercial developments or highly urban landscapes would rate a score of less than 0.6.

Variable 3 score 0.65

Variable 4: Water Source

This variable is concerned with up-gradient hydrologic connectivity. It is a measure of the impacts to the AA's water source, including the ability of source water to perform work such as sediment transport, erosion, soil pore flushing, etc. To score this variable, identify stressors that alter the source of water to the AA, and record their presence on the stressor list. Stressors can impact water source by depletion, augmentation, or alteration of inflow timing or hydrodynamics. For riverine systems, this variable is primarily concerned with the connection of the channel to the floodplain.This variable is designed to assess water quantity, power and timing, not water quality. Water quality will be evaluated in Variable 7.

Scoring rules:

1. Use the stressor list and knowledge of the watershed to catalog type-specific impairments of the AA's water source. Mark the stressors present with a check in the first column and describe the general nature, severity and extent of each. List additional stressors in empty rows at the bottom of the table and explain.

2. Considering the composite effect of stressors on the water source, rate the condition of this variable with the aid of the scoring guidelines.

✔	Stressors	Comments/description
	Ditches or Drains (tile, etc.)	
	Dams	
	Diversions	
	Groundwater pumping	
	Draw-downs	
	Culverts or Constrictions	
	Point Source (urban, ind., ag.)	
	Non-point Source	
	Increased Drainage Area	
	Storm Drain/Urban Runoff	
	Impermeable Surface Runoff	
	Irrigation Return Flows	
	Mining/Natural Gas Extraction	
	Transbasin Diversion	
	Actively Managed Hydrology	
		Groundwater now supports wetlands that were previously uplands

Variable Score	Condition Class	Depletion	Augmentation
1.0 - 0.9	*Reference Standard*	Unnatural drawdown events minor, rare or non-existent, very slight uniform depletion, or trivial alteration of hydrodynamics.	Unnatural high-water events minor, rare or non-existent, slight uniform increase in amount of inflow, or trivial alteration of hydrodynamics.
<0.9 - 0.8	*Highly Functioning*	Unnatural drawdown events occasional, short duration and/or mild; or uniform depletion up to 20%; or mild to moderate reduction of peak flows or natural capacity of water to perform work.	Occasional unnatural high-water events, short in duration and/or mild in intensity; or uniform augmentation up to 20%; or mild to moderate increase of peak flows or natural capacity of water to perform work.
<0.8 - 0.7	*Functioning*	Unnatural drawdown events common and of mild to moderate intensity and/or duration; or uniform depletion up to 50%; or moderate to substantial reduction of peak flows or natural capacity of water to perform work.	Common occurrence of unnatural high-water events, of a mild to moderate intensity and/or duration; or uniform augmentation up to 50%; or moderate to substantial reduction of peak flows or natural capacity of water to perform work.
<0.7 - 0.6	*Functioning Impaired*	Unnatural drawdown events occur frequently with a moderate to high intensity and/or duration; or uniform depletion up to 75%; or substantial reduction of peak flows or natural capacity of water to perform work. **Wetlands with actively managed or wholly artificial hydrology will usually score in this range or lower.**	Common occurrence of unnatural high-water events, some of which may be severe in nature or exist for a substantial portion of the growing season; or uniform augmentation more than 50% or natural capacity of water to perform work. **Wetlands with actively managed or wholly artificial hydrology will usually score in this range or lower.**
<0.6	*Non-functioning*	Water source diminished enough to threaten jurisdictional classification of the AA.	Frequency, duration or magnitude of unnaturally high-water great enough to change the fundamental characteristics of the wetland.

Variable 4 Score 0.55

Variable 5: Water Distribution

This variable is concerned with hydrologic connectivity within the AA. It is a measure of alteration to the spatial distribution of surface and groundwater within the AA. These alterations are manifested as local changes to the hydrograph and generally ***result*** *from geomorphic modifications. To score this variable, identify stressors that alter flow patterns and impact the hydrograph within portions of the AA, including localized increases or decreases to the depth or duration of the water table or surface water. In naturally confined rivers (i.e. canyons and gullies) floodplain width is generally very small, so these systems will tend to score high for this variable unless some gross stressor is present.*

Scoring rules:

1. Identify impacts to the natural distribution of water throughout the AA and catalog them in the stressor table.
2. Considering all of the stressors identified, assign an overall variable score using the scoring guidelines.

✔	Stressors	Comments/description
	Ditches	
	Ponding/Impoundment	
	Culverts	
	Road Grades	
	Channel Incision/Entrenchment	
	Hardened/Engineered Channel	
	Enlarged Channel	
	Artificial Banks/Shoreline	
	Weirs	
	Dikes/Levees/Berms	
	Diversions	
	Sediment/Fill Accumulation	
		Groundwater now supports wetlands in previously upland site

Variable Score	Condition Class	Non-riverine	Riverine
1.0 - 0.9	*Reference Standard*	Little or no alteration has been made to the way in which water is distributed throughout the wetland.	Natural active floodplain areas flood on a normal recurrence interval. No evidence of alteration of flooding and subirrigation duration and intensity.
<0.9 - 0.8	*Highly Functioning*	Less than 10% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in less than a 2 in. (5 cm) change in mean growing season water table elevation.	Channel-adjacent areas have occasional unnatural periods of drying or flooding; or uniform shift in the hydrograph less than typical root depth.
<0.8 - 0.7	*Functioning*	Between 10 and 33% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in a 4 in. (5 cm) or less change in mean growing season water table elevation.	In channel-adjacent area, periods of drying or flooding are common; or uniform shift in the hydrograph near root depth.
<0.7 - 0.6	*Functioning Impaired*	33 to 66% of the AA is affected by *in situ* hydrologic alteration; or more widespread impacts result in a 6 in. (15 cm) or less change in mean growing season water table elevation. Water table behavior must still meet jurisdictional criteria to merit this rating.	Adjacent to the channel, unnatural periods of drying or flooding are the norm; or uniform shift in the hydrograph greater than root depth.
<0.6	*Non-functioning*	More than 66% of the AA is affected by hydrologic alteration which changes the fundamental functioning of the wetland system	Historical active floodplain areas are almost never wetted from overbank flooding, and/or groundwater infiltration is effectively cut off.

Variable 5 Score 0.55

Variable 6: Water Outflow

This variable is concerned with down-gradient hydrologic connectivity and the flow of water (transporting materials and energy) out of the AA. It is a measure of impacts that affect the hydrologic outflow of water including the passage of water through its normal low- and high-flow surface outlets, and infiltration/groundwater recharge. In some cases, alteration of evapotranspiration rates may be significant enough of a factor to consider in scoring. Score this variable by identifying stressors that impact the means by which water is exported from the AA. In Variable 5, the stressors were evaluated in light of their impact on water distribution within the AA. To evaluate this variable focus on how water, energy and associated materials are exported out of the AA.

Scoring rules:

1. Identify impacts to the natural outflow of water from the AA and catalog them in the stressor table.

2.Considering all of the stressors identified, assign an overall variable score using the scoring guidelines. Take in to account the cumulative effect of stressors on the wetland's ability to export water and water-borne materials

✓	Stressors	Comments/description
	Ditches	
	Dikes/Levees	
	Road Grades	
	Culverts	
	Diversions	
	Constrictions	
	Channel Incision/Entrenchment	
	Hardened/Engineered Channel	
	Artificial Stream Banks	
	Weirs	
	Confined Bridge Openings	
		Groundwater alters how water moves out of site

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stressors have little to no effect on the magnitude, timing or hydrodynamics of the AA water outflow regime.
<0.9 - 0.8	*Highly Functioning*	High- or low-water outflows are mildly to moderately affected, but at intermediate ("normal") lev flow continues essentially unaltered in quantity or character.
<0.8 - 0.7	*Functioning*	High- or low-water outflows are moderately affected, mild alteration of intermediate level outflo occurs; or hydrodynamics mildly to moderately affected.
<0.7 - 0.6	*Functioning Impaired*	Outflow at all stages is moderately impaired resulting in persistent flooding of portions of the A or unnatural drainage; or outflow hydrodynamics significantly disrupted.
<0.6	*Non-functioning*	The natural outflow regime is severely disrupted. Down-gradient hydrologic connection severe or nearly so. Alterations may cause widespread unnatural persistent flooding or dewatering of the wetland system.

Variable 6 Score 0.55

Variable 7: Water and Soil Chemical Environment

This variable concerns the chemical environment of the soil and water media within the AA, including pollutants and water quality. The origin of pollutants may be in the AA or delivered from up-gradient or surrounding areas. Score this variable by listing indicators of chemical stress in the AA. Consider point source and non-point sources of pollution, as well as mechanical or hydrologic changes that alter the chemical environment. Because water quality frequently cannot be inferred directly, the presence of many stressors is identified via indirect indicators.

Scoring rules:

1. Stressors are grouped into categories which have a similar signature or set of causes.
2. Use the indicator list to identify each stressor impacting the chemical environment of the AA.
3. For each stressor category, determine the sub-variable score using the scoring guideline table provided on the second page of the scoring sheet.
 -If the AA is part of a water body that is recognized as impaired or recommended for TMDL development for one of the factors, then score that sub-variable 0.65 or lower.
4. Transcribe sub-variable scores to the following variable scoring page and compute the sum.
5. Determine the variable score by following the scoring guidelines.

Stressor Category	Stressor Indicator	✔	Comments	Sub-variable Score
Nutrient Enrichment/ Eutrophication/ Oxygen (D.O.)	Livestock			1.00
	Agricultural Runoff			
	Septic/Sewage			
	Excessive Algae or Aquatic Veg.			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Sedimentation/ Turbidity	Excessive Erosion			1.00
	Excessive Deposition			
	Fine Sediment Plumes			
	Agricultural Runoff			
	Excessive Turbidity			
	Nearby Construction Site			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Toxic contamination/ pH	Recent Chemical Spills			1.00
	Nearby Industrial Sites			
	Road Drainage/Runoff			
	Livestock			
	Agricultural Runoff			
	Storm Water Runoff			
	Fish/Wildlife Impacts			
	Vegetation Impacts			
	Cumulative Watershed NPS			
	Acid Mine Drainage			
	Point Source Discharge			
	CDPHE Impairment/TMDL List			
Temperature	Excessive Temperature Regime			1.00
	Lack of Shading			
	Reservoir/Power Plant Discharge			
	Industrial Discharge			
	Cumulative Watershed NPS			
	CDPHE Impairment/TMDL List			
Soil chemistry/ Redox potential	Unnatural Saturation/Desaturation	X	Artificially high water table (hi)	0.65
	Mechanical Soil Disturbance			
	Dumping/introduced Soil			
	CDPHE Impairment/TMDL List			

Variable 7: Water and Soil Chemical Environment

Sub-variable Scoring Guidelines

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stress indicators not present or trivial.
<0.9 - 0.8	*Highly Functioning*	Stress indicators scarcely present and mild, or otherwise not occurring in more than 10% of the AA.
<0.8 - 0.7	*Functioning*	Stress indicators present at mild to moderate levels, or otherwise not occurring in more than 33% of the AA.
<0.7 - 0.6	*Functioning Impaired*	Stress indicators present at moderate to high levels, or otherwise not occurring in more than 66% of the AA
<0.6	*Non-functioning*	Stress indicators strongly evident throughout the AA at levels which apparently alter the fundamental chemical environment of the wetland system

Input each factor score from the stressor list and calculate the sum.

Nutrient enrichment/ Eutrophication/ Oxygen (D.O.)		Sedimentation/ Turbidity		Toxic contamination/ pH		Temperature		Soil chemistry/ Redox potential		Sum of Sub-variable Scores
1.00	+	1.00	+	1.00	+	1.00	+	0.65	=	4.65

Use the table to score the Chemical Environment Variable circling the applicable scoring rules.

Variable Score	Condition Class	Scoring Rules		
		Single Factor		**Composite Score**
1.0 - 0.9	*Reference Standard*	No single factor scores < 0.9	or	The factor scores sum > 4.5
<0.9 - 0.8	*Highly Functioning*	Any single factor scores ≥ 0.8 but < 0.9	or	The factor scores sum >4.0 but ≤4.5
<0.8 - 0.7	*Functioning*	Any single factor scores ≥ 7.0 but < 0.8	or	The factor scores sum >3.5 but ≤ 4.0
<0.7 - 0.6	*Functioning Impaired*	Any single factor scores ≥ 0.6 but <0.7	or	The factor scores sum >3.0 but ≤3.5
< 0.6	*Non-functioning*	Any single factor scores < 0.6	or	The factor scores sum < 3.0

Variable 7 Score 0.9

Variable 8: Geomorphology

This variable is a measure of the degree to which the geomorphic setting has been altered within the AA. Changes to the surface configuration and natural topography constitute stressors. Such stressors may be observed in the form of fill, excavation, diking, sedimentation due to absence of flushing floods, etc. In riverine systems geomorphic changes to stream channel should be considered if the channel is within the AA. Alterations may include bed surface changes (embeddedness or morphology changes), stream bank instability, and stream channel reconfiguration. Geomorphic changes are usually ultimately manifested as changes to wetland hydrology and water relations with vegetation. Geomorphic alteration can also directly affect soil properties, such as near-surface texture, and the wetland chemical environment, such as the redox state or nutrient composition in the rooting zone. In rating this variable, do not include these resultant effects of geomorphic change; rather focus on the physical impacts within the footprint of the alteration. The effects of geomorphic change are addressed by other variables. All alterations to the geomorphology should be evaluated including small-scale impa

Scoring Rules:

1. Identify impacts to geomorphological setting and topography within the AA and record them on the stressor checklist.
2. Considering all of the stressors identified, assign an overall variable score using the scoring guidelines.

✔		Stressors	Comments
	General	Dredging/Excavation/Mining	
		Fill, including dikes, road grades, etc	
		Grading	
		Compaction	
		Plowing/Disking	
		Excessive Sedimentation	
		Dumping	
		Hoof Shear/Pugging	
X		Aggregate or Mineral Mining	Gravel ponds (high)
		Sand Accumulation	
	Channels Only	Channel Instability/Over Widening	
		Excessive Bank Erosion	
		Channelization	
		Reconfigured Stream Channels	
		Artificial Banks/Shoreline	
		Beaver Dam Removal	
		Substrate Embeddedness	
		Lack or Excess of Woody Debris	

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Topography essentially unaltered from the natural state, or alterations don't appear to have a minimal effect on wetland functioning and condition. Patch or microtopographic complexity may be slightly altered, but native plant communities are still supported.
<0.9 - 0.8	*Highly Functioning*	Alterations to topography result in small but detectable changes to habitat conditions throughout all or most of the AA; or changes causing more significant impacts but affecting less than 10% of the AA.
<0.8 - 0.7	*Functioning*	Changes to AA topography may be pervasive but generally mild. May include patches of more significant habitat alteration; or more significant alteration affecting less than 20 % of the AA.
<0.7 - 0.6	*Functioning Impaired*	At least one important surface type or landform has been eliminated or created; microtopography has been moderately altered throughout most or all of the AA, or more severe alterations affect less than 50% AA. Evidence that widespread diminishment or alteration of native plant community exist due to physical habitat alterations. Most incidentally created wetland habitat such as that created by roadside ditches and the like would score in this range or lower.
<0.6	*Non-functioning*	Geomorphic alterations have rendered the AA essentially unusable by *characteristic* wildlife species, or the physical setting no longer supports native plant communities.

Variable 8 Score 0.55

Variable 9: Vegetation Structure and Complexity

This variable is a measure of the condition of the wetland's vegetation relative to its native state. It is particularly relevant to the wetland's ability to perform higher-order functions such as support of wildlife populations, although it also affects primary functions such as flood-flow attenuation. Score this variable by listing stressors that have affected the diversity, composition and cover of each vegetation cover class that would normally be present for the wetland type being assessed. For this variable, stressor severity is a measure of how much each vegetation stratum differs functionally from its natural condition.

Rules for Scoring:

1. Determine the number and types of vegetation layers present within the AA. Make a judgment as to whether additional layers were historically present using direct evidence such as stumps, root wads or historical photographs. Indirect evidence such as local knowledge and expert opinion can also be used in this determination. Check each present or suspected vegetation layer in the third row of the table.

2. Do not score vegetation layers that would not normally be present in the wetland type being assessed.

3. Estimate the percent coverage of each vegetation layer. Aerial photographs can be helpful for this but are not required.

4. Enter the percent cover values as decimals in the row of the stressor table labeled "Percent Cover of Layer". Note, percentages will often sum to more than 100% (1.0).

5. Determine the severity of stressors acting on each individual canopy layers, indicating their presence with checks in the appropriate boxes of the stressor table.

6. Determine the sub-variable score for each valid vegetation layer using the scoring guidelines on the second page of the scoring sheet. Enter each sub-variable score in the appropriate cell of the row labeled "Veg. Layer Sub-variable Score".

7. Add the "Veg. Layer Sub-variable Scores" and enter the sum in the labled cell to the right of the individual scores. Follow this same process for the "Percent Cover of Layer".

8. Divide the sum of "Veg. Layer Sub-variable Scores" by the total coverage of all layers scored. This product is the Variable 9 score. Enter this number in the labeled box at the bottom of this page.

	Vegetation Layers				
Layers Scored *(check boxes to right to indicate scored layers)*					
Stressor	**Tree**	**Shrub**	**Herb**	**Aquatic**	**Comments**
Noxious Weeds					
Exotic/Invasive spp.					
Tree Harvest					
Brush Cutting/Shrub Removal					
Livestock Grazing					
Excessive Herbivory					
Mowing/Haying					
Herbicide					
Loss of Zonation/Homogenization					
Dewatering					
Over Saturation					

	Tree		Shrub		Herb		Aquatic		Total
Percent Cover of Layer	0.00	+	70.00	+	20.00	+	0.00	=	90
	x		x		x		x		÷
Veg. Layer Sub-variable Score	1		1		1		0		
	=		=		=		=		
Weighted Sub-variable Score	0.00	+	70.00	+	20.00	+		=	90

See sub-variable scoring guidelines on following page

Variable 9 Score 1.00

Sub-variable 9 Scoring Guidelines

Based on the list of stressors identified above, rate the severity of their cumulative effect on vegetation structure and complexity for each vegetation layer.

Variable Score	Condition Class	Scoring Guidelines
1.0 - 0.9	*Reference Standard*	Stressors not present or with an intensity low enough as to not detectably affect the structure, diversity or composition of the vegetation layer.
<0.9 - 0.8	*Highly Functioning*	Stressors present at an intensity levels sufficient to cause detectable, but minor, changes in layer composition. Stress related change should generally be less than 10% for any given attribute (e.g., 10% cover of invasive, 10% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 33% if stressors are confined to patches comprising less than 10% of the wetland.
<0.8 - 0.7	*Functioning*	Stressors present with enough intensity to cause significant changes in the character of vegetation, including alteration of layer coverage, structure complexity and species composition. The vegetation layer retains its essential character though. AA's with a high proportion of non-native grasses will commonly fall in this class. Stress related change should generally be less than 33% for any given attribute (e.g., 33% cover of invasive, 33% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 66% if stressors are confined to patches comprising less than 25% of the wetland.
<0.7 - 0.6	*Functioning Impaired*	Stressor intensity severe enough to cause profound changes to the fundamental character of the vegetation layer. Stress-related change should generally be less than 66% for any given attribute (e.g 66% cover of invasive, 66% reduction in richness or cover) if the stressor is evenly distributed throughout the wetland. Stress related change could be as much as 80% if stressors are confined to patches comprising less than 50% of the wetland.
<0.6	*Non-functioning*	Vegetation layer has been completely removed or altered to the extent that is no longer comparable to the natural structure, diversity and composition.

FACWet Score Card

Scoring Procedure:

1. Transcribe variable scores from each variable data sheet to the corresponding cell in the variable score table.
2. In each Functional Capacity Index (FCI) equation, enter the corresponding variable scores in the equation cells. Do not enter values in the crossed cells lacking labels.
3. Add the variable scores to calculate the total functional points achieved for each function.
4. Divide the total functional points achieved by the functional points possible. The typical number of total points possible is provided, howe if a variable is added or subtracted to FCI equation the total possible points must be adjusted
5. Calculate the Composite FCI, by adding the FCI scores and dividing by the total number of functions scored (usually 7).
6. If scoring is done directly in the Excel spreadsheet, all values will be transferred and calculated automatically.

VARIABLE SCORE TABLE

Buffer & Landscape Context	**Variable 1:**	**Habitat Connectivity - Neighboring Wetland Habitat Loss**	0.82
	Variable 2:	**Habitat Connectivity - Migration/Dispersal Barriers**	0.60
	Variable 3:	**Buffer Capacity**	0.65
Hydrology	**Variable 4:**	**Water Source**	0.65
	Variable 5:	**Water Distribution**	0.60
	Variable 6:	**Water Outflow**	0.68
Abiotic and Biotic Habitat	**Variable 7:**	**Chemical Environment**	0.90
	Variable 8:	**Geomorphology**	0.75
	Variable 9:	**Vegetation Structure and Complexity**	0.95

Functional Capacity Indices

Function 1 -- Support of Characteristic Wildlife Habitat

$V1_{wetloss}$ + $V2_{barriers}$ + $V3_{buffer}$ + (2 x $V9_{veg}$)

							Total Functional Points		Functional Capacity Index
0.82	+ 0.60	+ 0.65	+ 1.90	+	+	=	3.97	÷ 5	= 0.79

Function 2 -- Support of Characteristic Fish/aquatic Habitat

(3 x $V4_{source}$) + (2 x $V5_{dist}$) + 2 x $V6_{outflow}$ + $V7_{chem}$ + $V8_{geom}$

1.95	+ 1.20	+ 1.36	+ 0.90	+ 0.75	+	=	6.16	÷ 9	= 0.68

Function 3 -- Flood Attenuation

$V3_{buffer}$ + 2 x $V4_{source}$ + (2 x $V5_{dist}$) + 2 x $V6_{outflow}$ + $V8_{geom}$ + $V9_{veg}$

0.65	+ 1.30	+ 1.20	+ 1.36	+ 0.75	+ 0.95	=	6.21	÷ 9	= 0.69

Function 4 -- Short- and Long-term Water Storage

V_{source} + (2 x $V5_{dist}$) + 2 x $V6_{outflow}$) $V8_{geom}$

0.65	+ 1.20	+ 1.36	+ 0.75	+	+	=	3.96	÷ 6	= 0.66

Function 5 -- Nutrient/Toxicant Removal

(2 x $V5_{dist}$) + $V7_{chem}$ + $V8_{geom}$

1.20	+ 0.90	+ 0.75	+	+	+	=	2.85	÷ 4	= 0.71

Function 6 -- Sediment Retention/Shoreline Stabilization

$V3_{buffer}$ + (2 x $V8_{geo}$) + (2 x $V9_{veg}$)

0.65	+ 1.50	+ 1.90	+	+	+	=	4.05	÷ 5	= 0.81

Function 7 -- Production Export/Food Chain Support

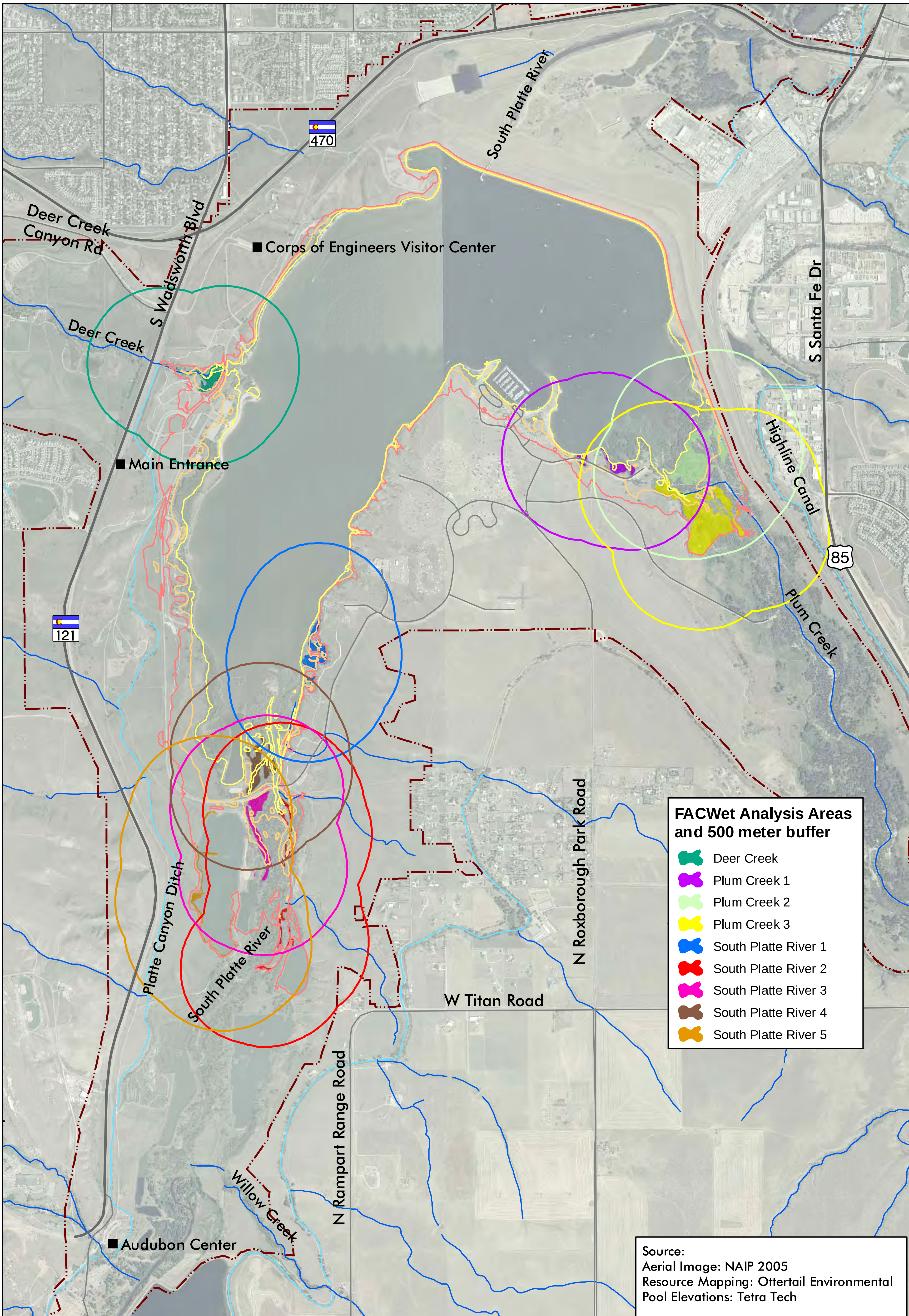
$V1_{wetloss}$ + 2 x $V6_{outflow}$ + $V7_{chem}$ + $V8_{geo}$ + (2 x $V9_{veg}$)

0.82	+ 1.36	+ 0.90	+ 0.75	+ 1.90	+	=	5.73	÷ 7	= 0.82

Sum of Individual FCI Scores **5.17**

Divide by the Number of Functions Scored (usually 7) **÷ 7**

Composite FCI Score **0.74**



Wetland Functional Assessment - Chatfield Reallocation Study

Chatfield State Park
Stream
5432 Pool Elevation
Ditch
5437 Pool Elevation
5444 Pool Elevation

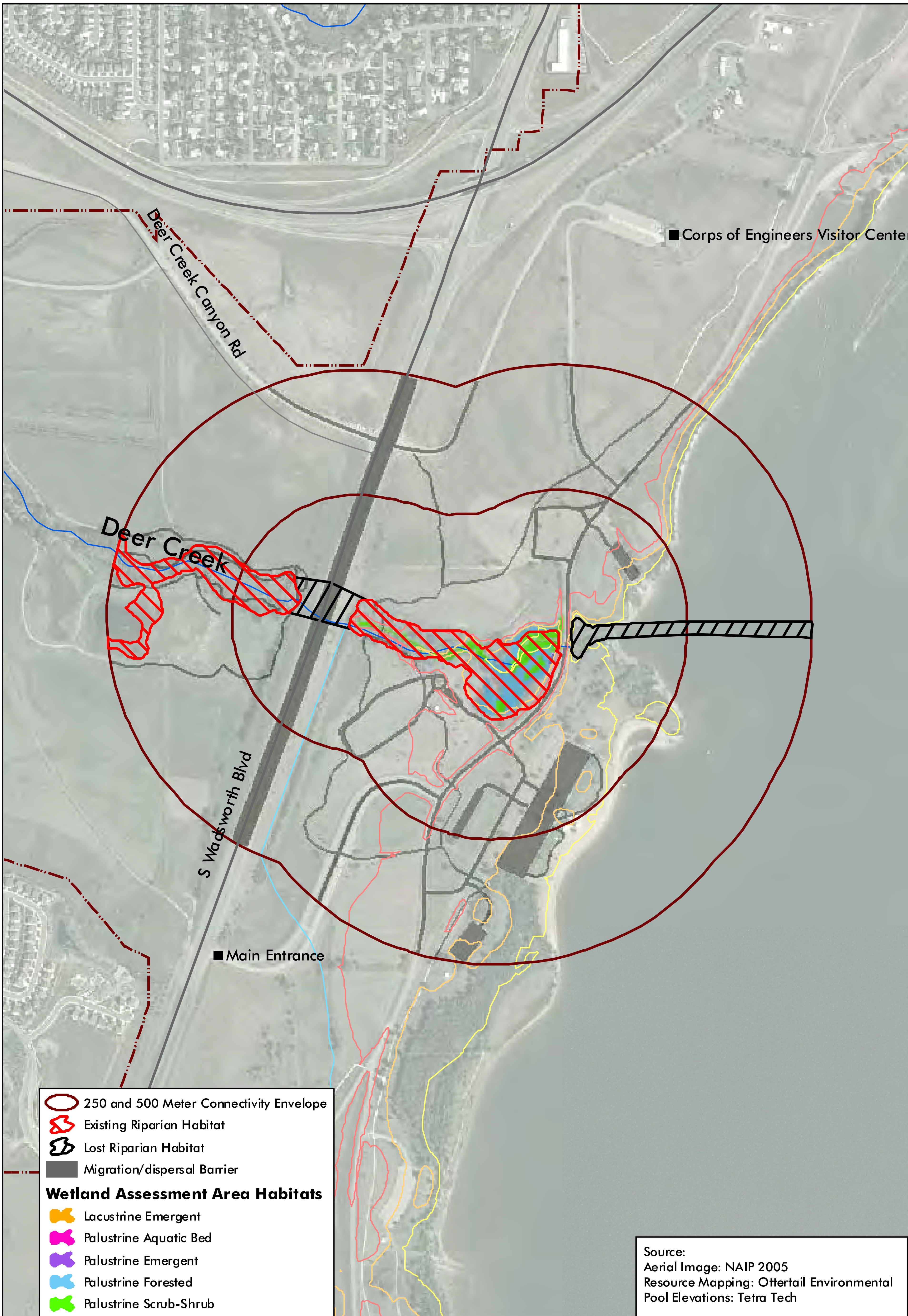
0 1,000 2,000 Feet

N

Figure F-1
Overview of Assessment Areas

File: 4048 Fig F-1 FACwet OV.mxd (GS)
December 18, 2009

ERO Resources Corp.



Wetland Functional Assessment - Chatfield Reallocation Study

Chatfield State Park
Stream
5432 Pool Elevation
Ditch
5437 Pool Elevation
5444 Pool Elevation

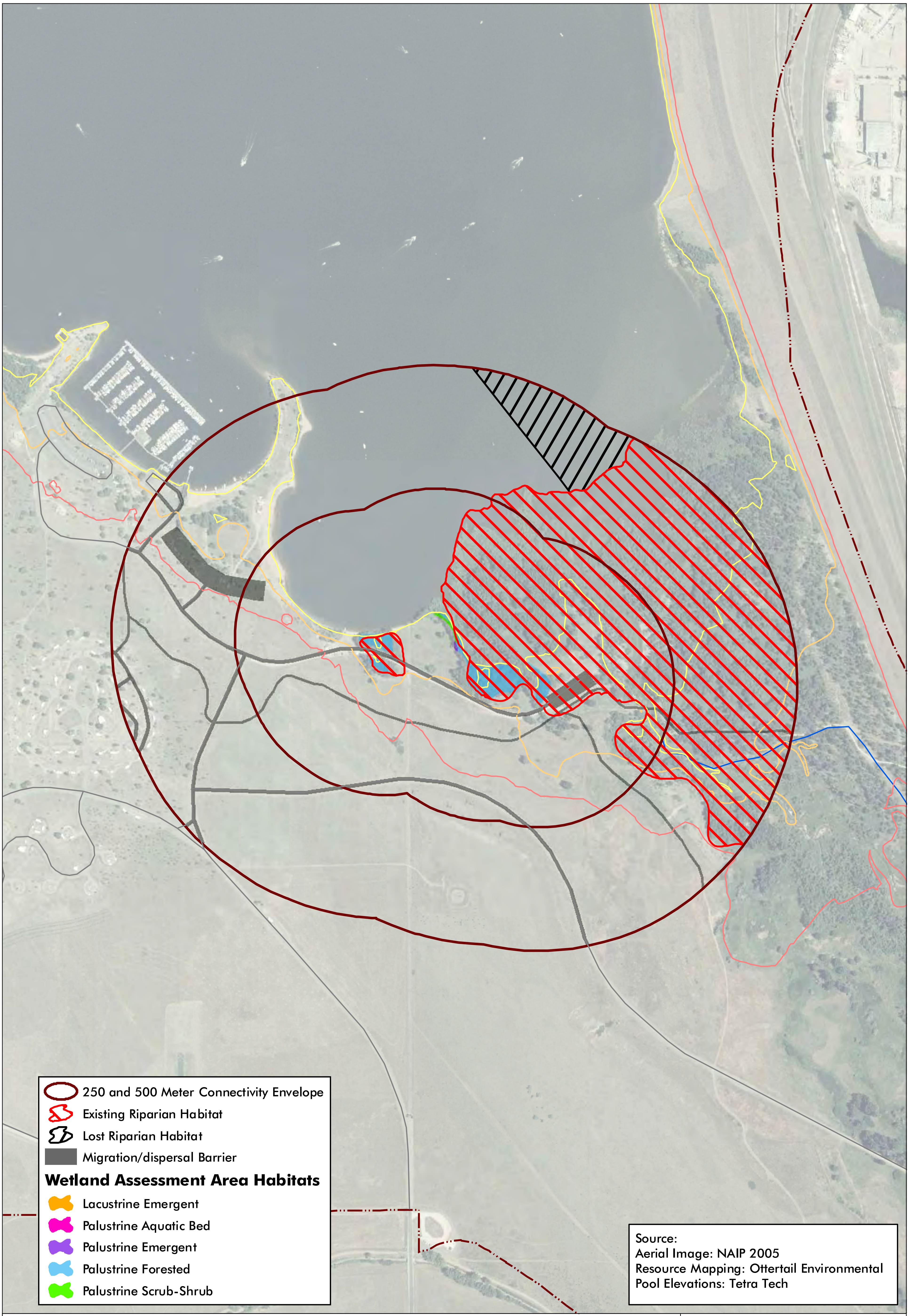
0 300 600 Feet

N

Figure F-2
Deer Creek
Assessment Area

File: 4048 - Fig 2 FACwdc1.mxd (GS)
December 18, 2009

ERO



Wetland Functional Assessment - Chatfield Reallocation Study

Chatfield State Park
Stream
5432 Pool Elevation
Ditch
5437 Pool Elevation
5444 Pool Elevation

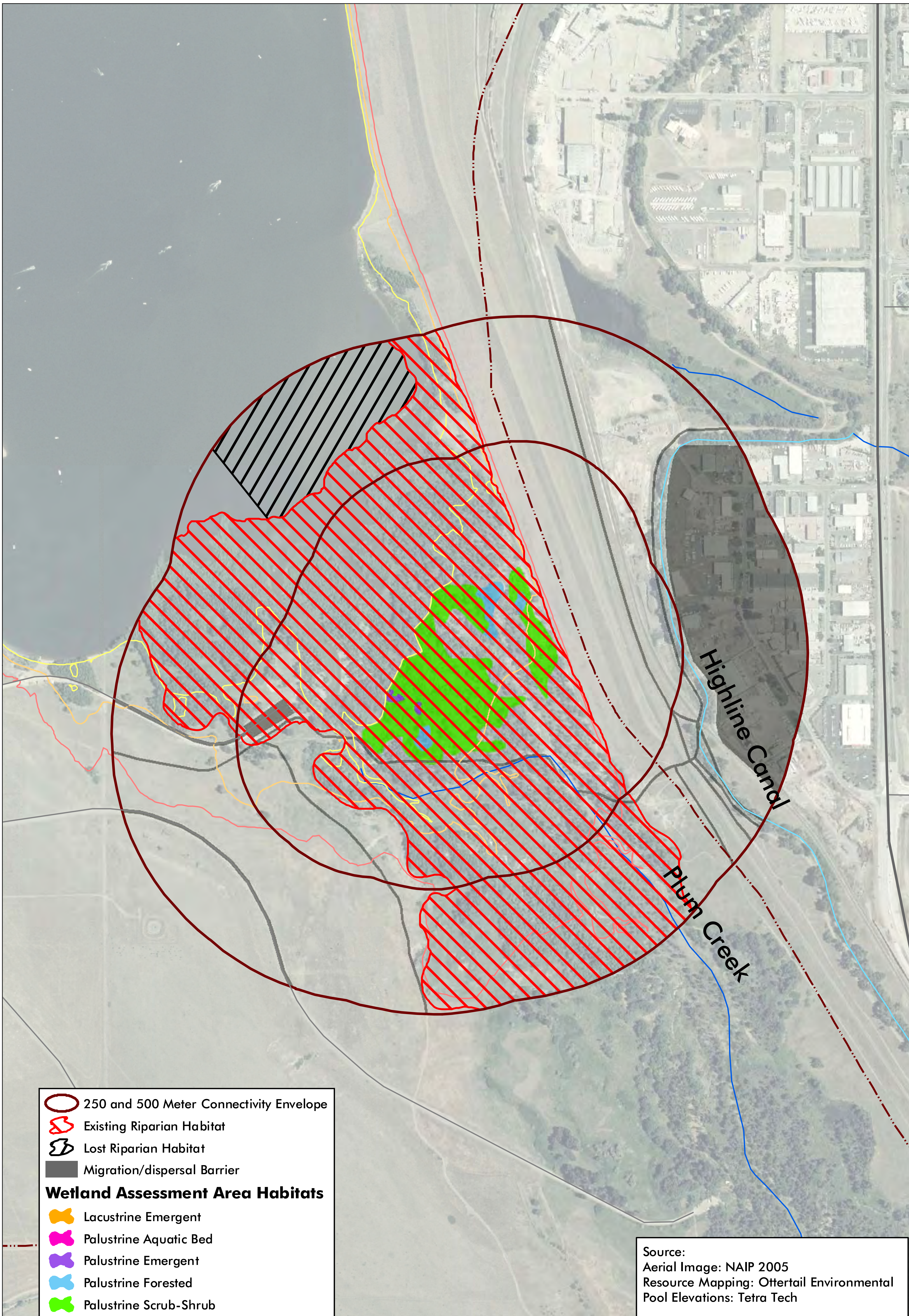
0 300 600 Feet

N

Figure F-3
Plum Creek 1
Assessment Area

File: 4048 - Fig 3 FACw PC1.mxd (GS)
December 18, 2009

ERO Resources Corp.



Wetland Functional Assessment - Chatfield Reallocation Study

Chatfield State Park

5432 Pool Elevation

5437 Pool Elevation

5444 Pool Elevation

Stream

Ditch

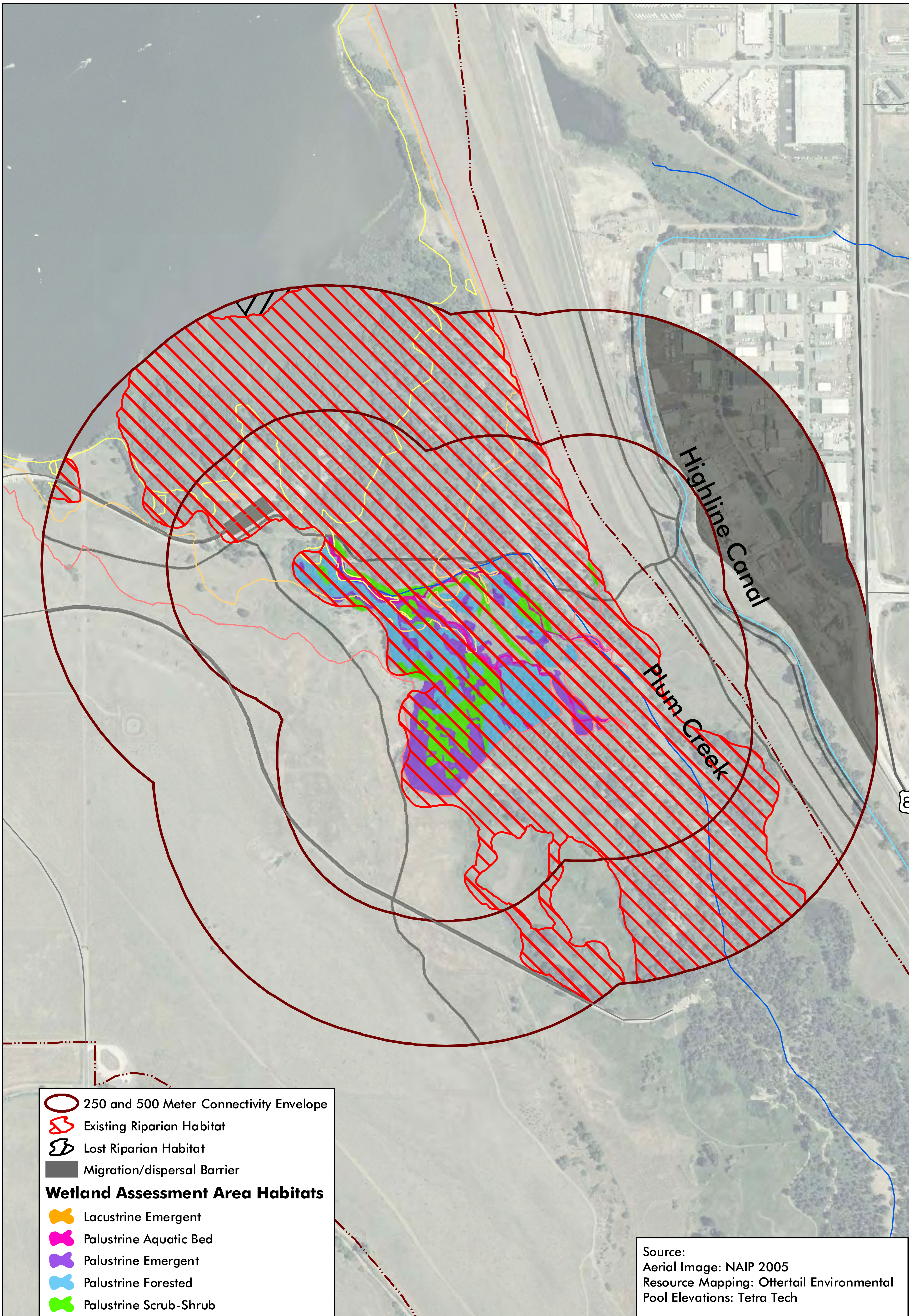
0 300 600 Feet

N

Figure F-4
Plum Creek 2
Assessment Area

File: 4048 - Fig F-4 FACw PC2.mxd (GS)
December 18, 2009

ERO Resources Corp.



Wetland Functional Assessment - Chatfield Reallocation Study

Chatfield State Park
5432 Pool Elevation
5437 Pool Elevation
5444 Pool Elevation
Stream
Ditch

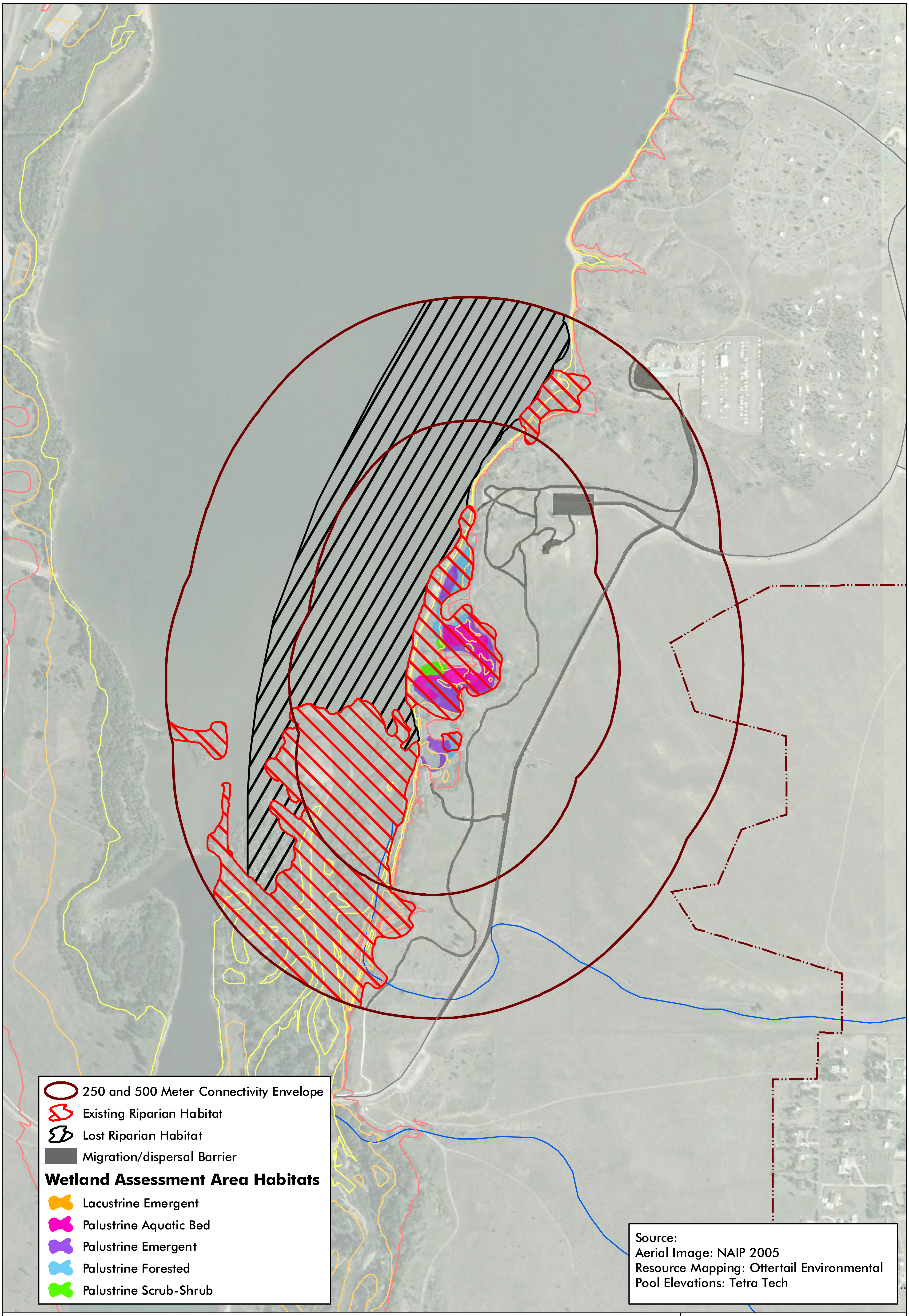
0 300 600
Feet

N

Figure F-5
Plum Creek 3
Assessment Area

File: 4048 - Fig 5 FACw PC3.mxd (GS)
December 18, 2009

ERO
ERO Resources Corp.



Wetland Functional Assessment - Chatfield Reallocation Study

Chatfield State Park
5432 Pool Elevation
5437 Pool Elevation
5444 Pool Elevation
Stream
Ditch

0 300 600 Feet

N

Figure F-6
South Platte River 1
Assessment Area

File: 4048 - Fig F-6 FACw SPR1.mxd (GS)
December 18, 2009

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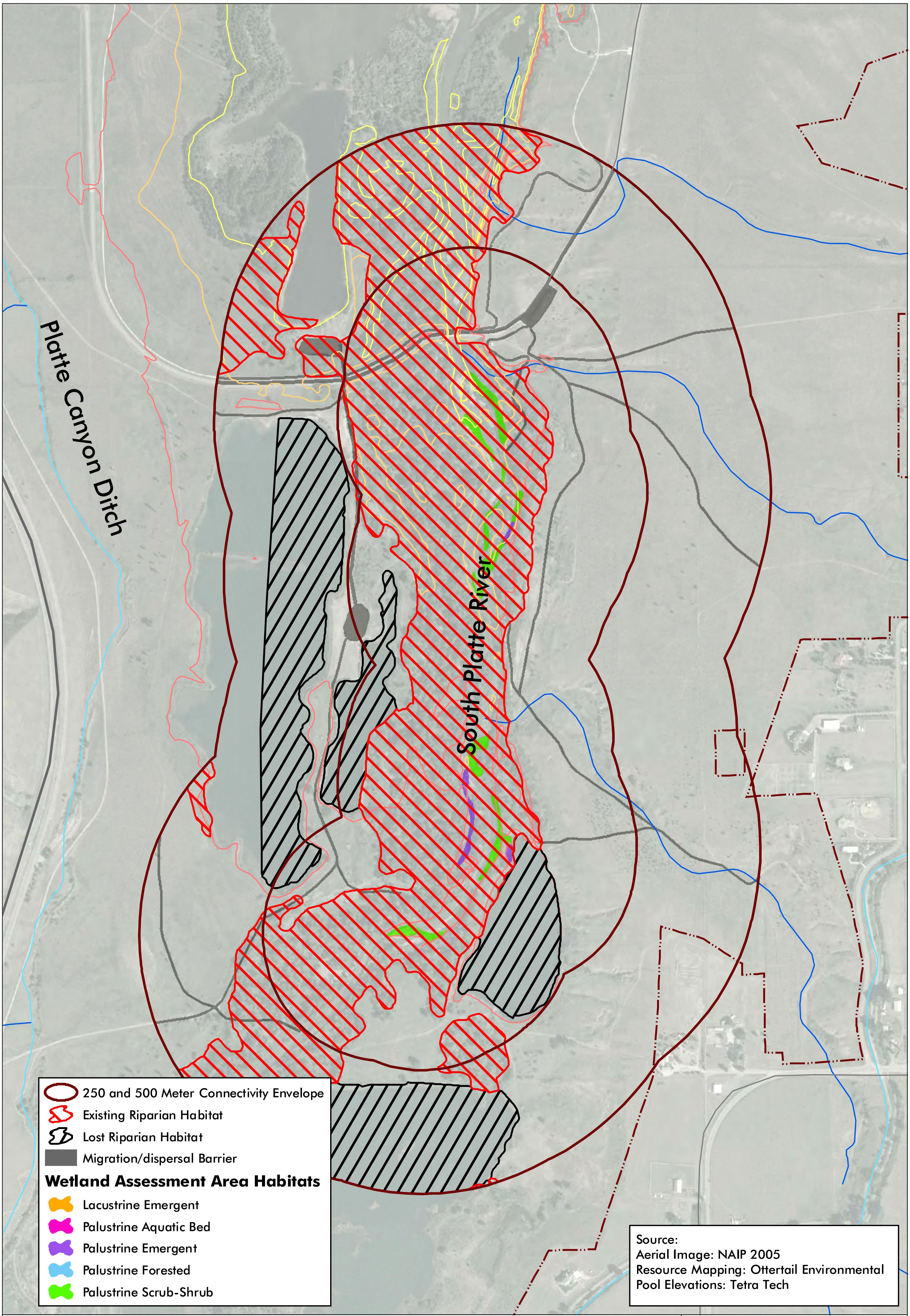

Wetland Functional Assessment - Chatfield Reallocation Study

Figure F-7
South Platte River 2
Assessment Area

File: 4048 Fig F-7 FACw SPR2.mxd (GS)
December 18, 2009

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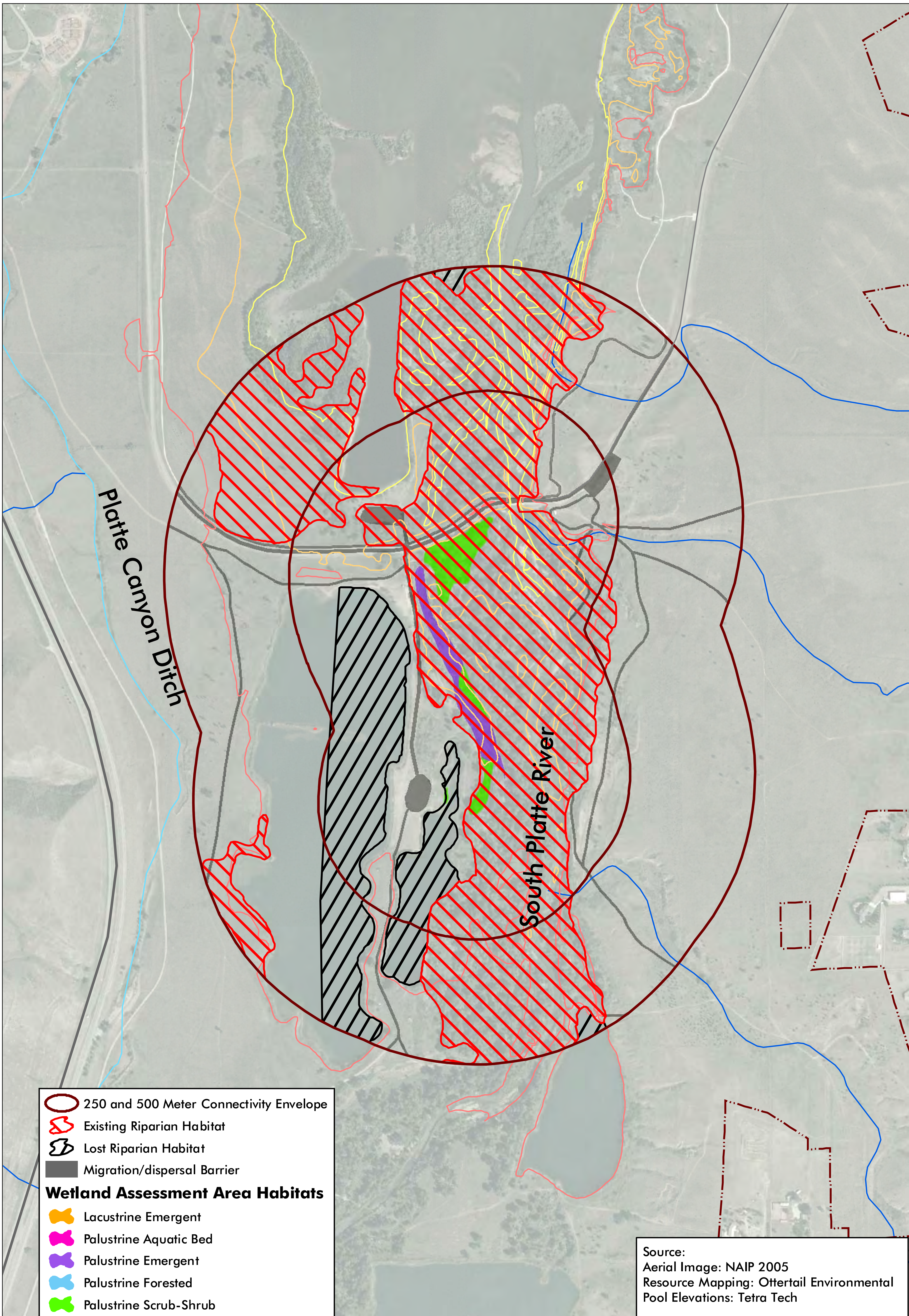


Wetland Functional Assessment - Chatfield Reallocation Study

Chatfield State Park
5432 Pool Elevation
5437 Pool Elevation
5444 Pool Elevation
Stream
Ditch

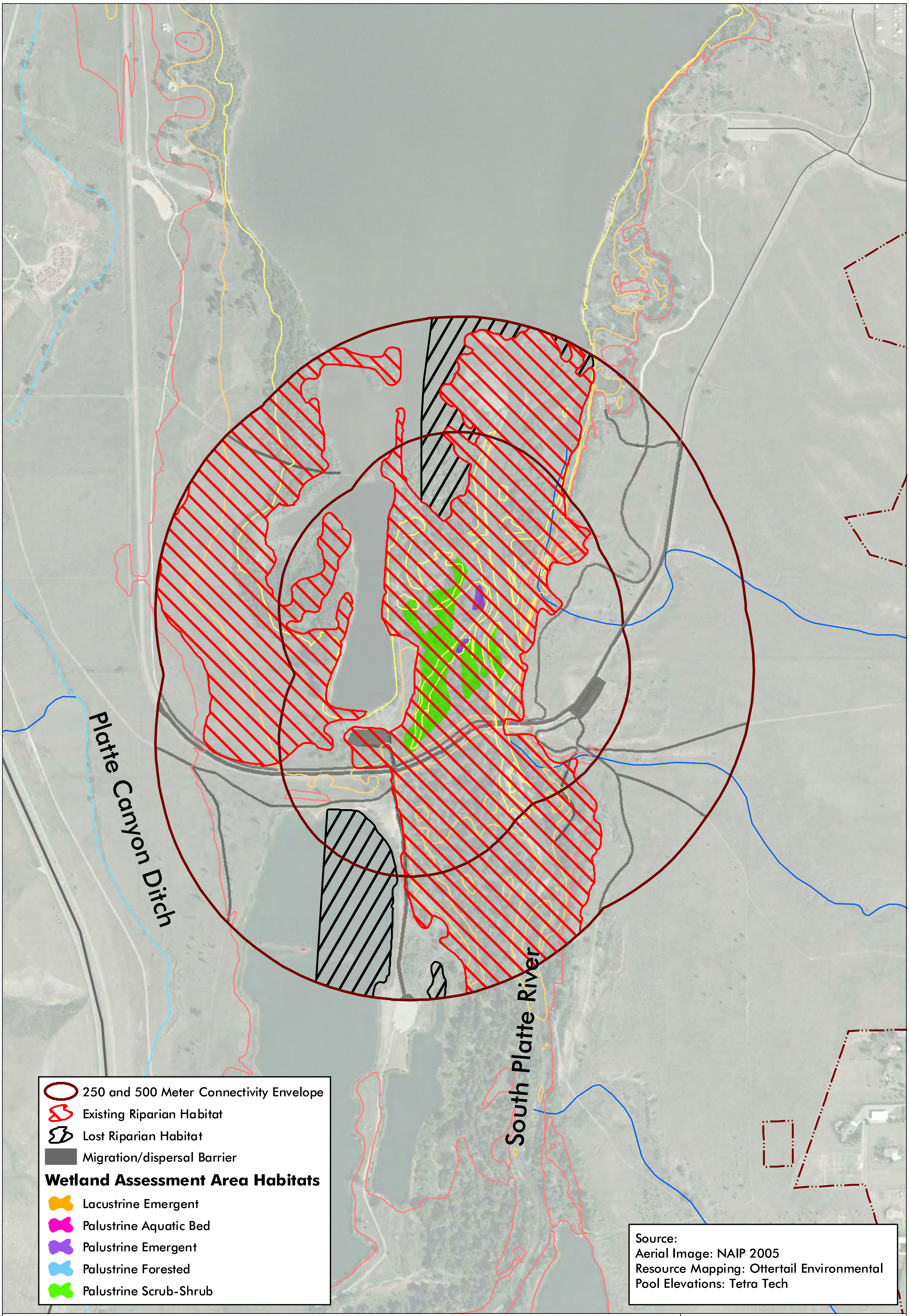
0 300 600 Feet

N

Figure F-8
South Platte River 3
Assessment Area

File: 4048 Fig F-8 FACw SPR3.mxd (GS)
December 18, 2009

ERO Resources Corp.



Wetland Functional Assessment - Chatfield Reallocation Study

Chatfield State Park
Stream
5432 Pool Elevation
Ditch
5437 Pool Elevation
5444 Pool Elevation

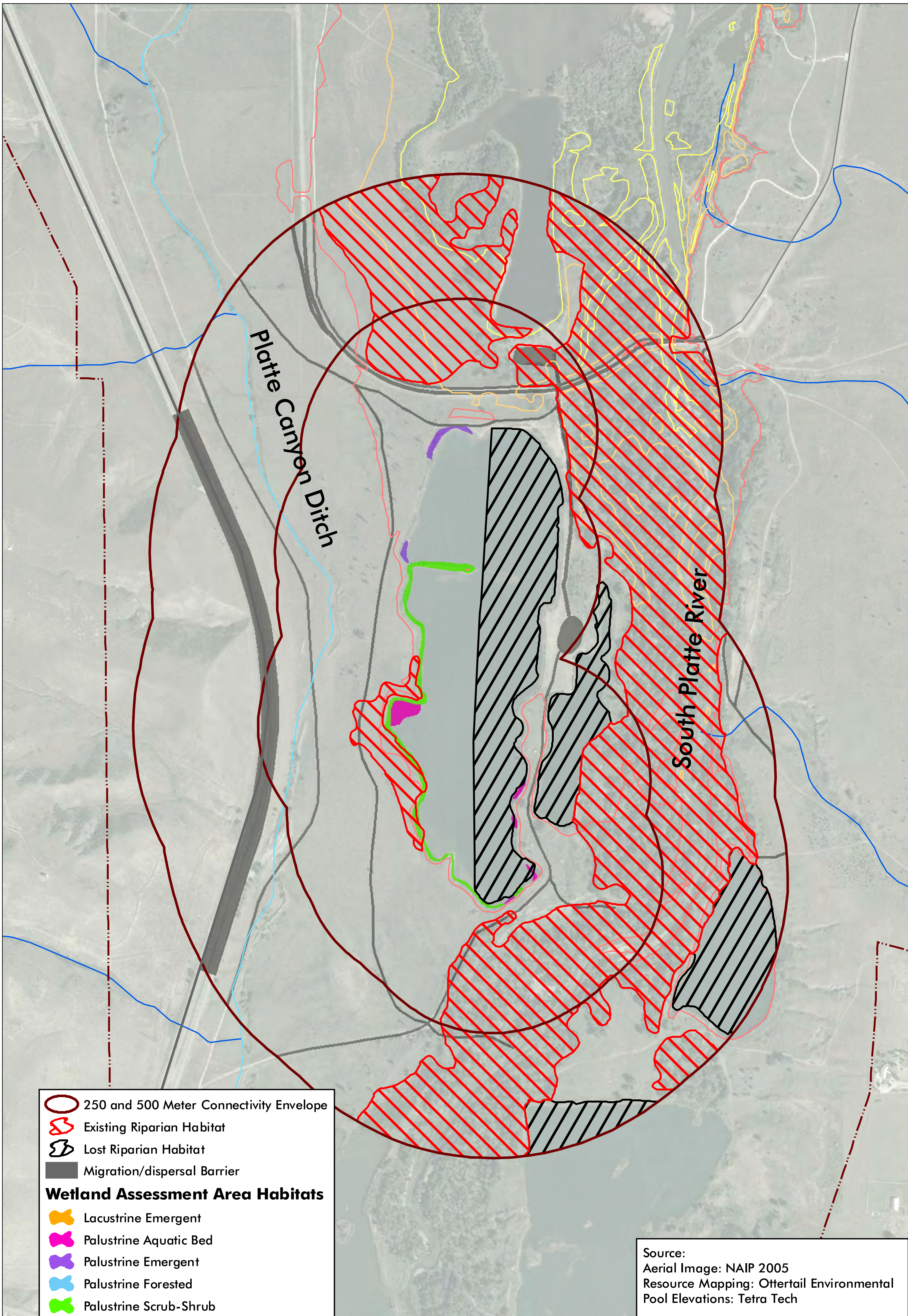
0 300 600 Feet

N

Figure F-9
South Platte River 4
Assessment Area

File: 4048 Fig F-9 FACw SPR4.mxd (GS)
December 18, 2009

ERO Resources Corp.



Wetland Functional Assessment - Chatfield Reallocation Study

Chatfield State Park
5432 Pool Elevation
5437 Pool Elevation
5444 Pool Elevation
Stream
Ditch

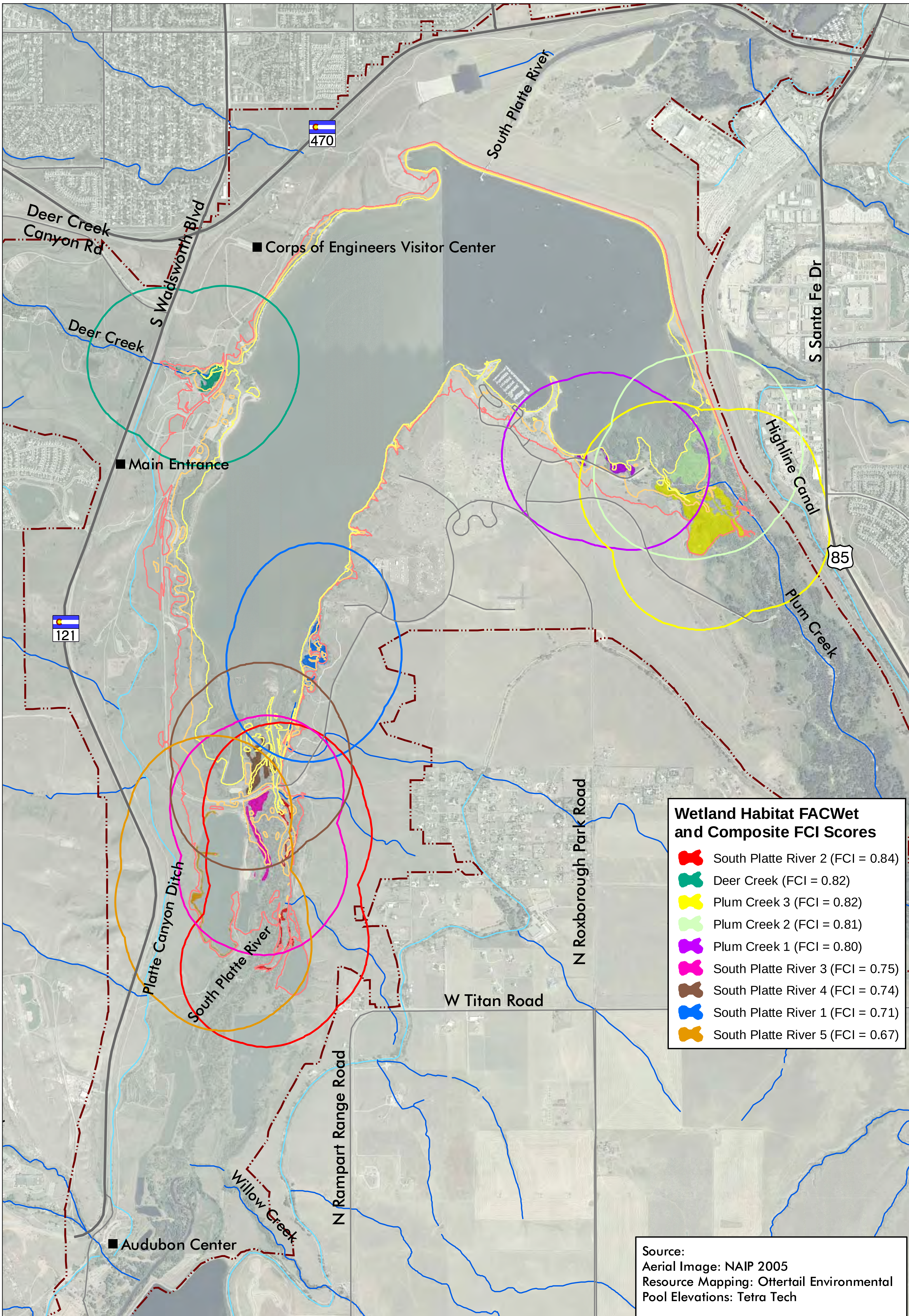
0 300 600 Feet

N

Figure F-10
South Platte River 5
Assessment Area

File: 4048 Fig F-10 FACw SPR5.mxd (GS)
December 18, 2009

ERO Resources Corp.



Wetland Functional Assessment - Chatfield Reallocation Study

Chatfield State Park
5432 Pool Elevation
5437 Pool Elevation
5444 Pool Elevation
Stream
Ditch

0 1,000 2,000 Feet

N

Figure F-11
Wetland habitat FACwet
Composite FCI Scores

File: 4048 Fig F-11 FACw FCI.mxd (GS)
December 18, 2009

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Appendix G - Data and Calculations for Conversion of Wetland FCIs to EFIs

Wetland Habitat Type	Assessment Area	Acres	FCI
Lacustrine Emergent	SPR5*	0.006904	0.67
Lacustrine Emergent	SPR5*	2.51E-05	0.67
Lacustrine Emergent	SPR5*	1.5E-05	0.67
Lacustrine Emergent	SPR5*	3.93E-06	0.67
Lacustrine Emergent	SPR5*	0.000796	0.67
Palustrine Aquatic Bed	PC3	0.00021	0.85
Palustrine Aquatic Bed	PC3	0.000343	0.85
Palustrine Aquatic Bed	PC3	0.025758	0.85
Palustrine Aquatic Bed	PC3	0.073463	0.85
Palustrine Aquatic Bed	PC3	0.01363	0.85
Palustrine Aquatic Bed	PC3	0.005283	0.85
Palustrine Aquatic Bed	PC3	0.00013	0.85
Palustrine Aquatic Bed	PC3	0.006819	0.85
Palustrine Aquatic Bed	PC3	0.007763	0.85
Palustrine Aquatic Bed	PC3	0.00072	0.85
Palustrine Aquatic Bed	PC3	0.023471	0.85
Palustrine Aquatic Bed	PC3	0.007819	0.85
Palustrine Aquatic Bed	PC3	0.000148	0.85
Palustrine Aquatic Bed	PC3	0.001927	0.85
Palustrine Aquatic Bed	PC3	0.47874	0.85
Palustrine Aquatic Bed	PC3	0.199024	0.85
Palustrine Aquatic Bed	PC3	0.001936	0.85
Palustrine Aquatic Bed	PC3	0.00145	0.85
Palustrine Aquatic Bed	PC3	0.013807	0.85
Palustrine Aquatic Bed	PC3	0.007115	0.85
Palustrine Aquatic Bed	PC3	0.073901	0.85
Palustrine Aquatic Bed	PC3	0.604225	0.85
Palustrine Aquatic Bed	PC3	5.64E-06	0.85
Palustrine Aquatic Bed	PC3	1.11E-05	0.85
Palustrine Aquatic Bed	SPR1	0.331469	0.71
Palustrine Aquatic Bed	SPR1	0.317675	0.71
Palustrine Aquatic Bed	SPR1	0.009698	0.71
Palustrine Aquatic Bed	SPR1	1.502398	0.71
Palustrine Aquatic Bed	SPR5	0.493933	0.67
Palustrine Aquatic Bed	SPR5	0.048684	0.67
Palustrine Aquatic Bed	SPR5	0.077175	0.67
Palustrine Aquatic Bed	SPR5	0.055783	0.67
Palustrine Aquatic Bed	SPR5	0.023947	0.67
Palustrine Aquatic Bed	SPR5	5.85E-07	0.67
Palustrine Emergent	SPR5*	0.027613	0.67
Palustrine Emergent	SPR5*	0.066679	0.67
Palustrine Emergent	SPR5*	0.832098	0.67
Palustrine Emergent	SPR5*	0.004619	0.67
Palustrine Emergent	SPR5*	0.023176	0.67
Palustrine Emergent	SPR5*	0.068473	0.67
Palustrine Emergent	SPR5*	0.151419	0.67
Palustrine Emergent	SPR5*	0.002178	0.67
Palustrine Emergent	SPR5*	0.088736	0.67

SPR5* - Wetland polygons located outside of FACWet assessment areas that were assigned the FCI of SPR5 because of similarity in landscape position

Wetland Habitat Type	Assessment Area	Acres	FCI
Palustrine Emergent	SPR5*	0.129848	0.67
Palustrine Emergent	SPR5*	3.66E-05	0.67
Palustrine Emergent	SPR5*	1.77E-05	0.67
Palustrine Emergent	SPR5*	7.12E-05	0.67
Palustrine Emergent	SPR5*	1.3E-05	0.67
Palustrine Emergent	SPR5*	3.5E-05	0.67
Palustrine Emergent	SPR5*	7.03E-07	0.67
Palustrine Emergent	SPR5*	5.15E-05	0.67
Palustrine Emergent	SPR5*	2.08E-05	0.67
Palustrine Emergent	SPR5*	0.000149	0.67
Palustrine Emergent	SPR5*	0.061821	0.67
Palustrine Emergent	SPR5*	0.324187	0.67
Palustrine Emergent	DC1	0.03061	0.82
Palustrine Emergent	DC1	0.001202	0.82
Palustrine Emergent	PC1	0.026749	0.8
Palustrine Emergent	PC2	0.074688	0.81
Palustrine Emergent	PC2	0.139956	0.81
Palustrine Emergent	PC3	5.76E-05	0.85
Palustrine Emergent	PC3	0.042442	0.85
Palustrine Emergent	PC3	0.016095	0.85
Palustrine Emergent	PC3	0.035222	0.85
Palustrine Emergent	PC3	3.18E-05	0.85
Palustrine Emergent	PC3	0.076666	0.85
Palustrine Emergent	PC3	3.66E-05	0.85
Palustrine Emergent	PC3	0.069968	0.85
Palustrine Emergent	PC3	0.088402	0.85
Palustrine Emergent	PC3	1.17E-05	0.85
Palustrine Emergent	PC3	0.070463	0.85
Palustrine Emergent	PC3	0.083538	0.85
Palustrine Emergent	PC3	7.29E-05	0.85
Palustrine Emergent	PC3	2.32E-05	0.85
Palustrine Emergent	PC3	0.539509	0.85
Palustrine Emergent	PC3	0.000373	0.85
Palustrine Emergent	PC3	0.079271	0.85
Palustrine Emergent	PC3	0.015031	0.85
Palustrine Emergent	PC3	0.070773	0.85
Palustrine Emergent	PC3	0.00106	0.85
Palustrine Emergent	PC3	0.13515	0.85
Palustrine Emergent	PC3	0.102453	0.85
Palustrine Emergent	PC3	0.0806	0.85
Palustrine Emergent	PC3	0.275859	0.85
Palustrine Emergent	PC3	0.30734	0.85
Palustrine Emergent	PC3	0.201662	0.85
Palustrine Emergent	PC3	0.786696	0.85
Palustrine Emergent	PC3	0.046531	0.85
Palustrine Emergent	PC3	0.001591	0.85
Palustrine Emergent	PC3	0.045588	0.85
Palustrine Emergent	PC3	0.154887	0.85
Palustrine Emergent	PC3	0.06937	0.85
Palustrine Emergent	PC3	0.055679	0.85

SPR5* - Wetland polygons located outside of FACWet assessment areas that were assigned the FCI of SPR5 because of similarity in landscape position

Wetland Habitat Type	Assessment Area	Acres	FCI
Palustrine Emergent	PC3	0.035605	0.85
Palustrine Emergent	PC3	0.073134	0.85
Palustrine Emergent	PC3	0.372863	0.85
Palustrine Emergent	PC3	0.065406	0.85
Palustrine Emergent	PC3	0.612508	0.85
Palustrine Emergent	PC3	4.31439	0.85
Palustrine Emergent	PC3	2.45E-05	0.85
Palustrine Emergent	PC3	2.18E-06	0.85
Palustrine Emergent	PC3	2.09E-05	0.85
Palustrine Emergent	PC3	1.41E-05	0.85
Palustrine Emergent	SPR1	0.00016	0.71
Palustrine Emergent	SPR1	0.35035	0.71
Palustrine Emergent	SPR1	0.958446	0.71
Palustrine Emergent	SPR1	0.122661	0.71
Palustrine Emergent	SPR1	0.242373	0.71
Palustrine Emergent	SPR1	0.579245	0.71
Palustrine Emergent	SPR1	0.317801	0.71
Palustrine Emergent	SPR1	9.92E-06	0.71
Palustrine Emergent	SPR2	0.092313	0.84
Palustrine Emergent	SPR2	1.77E-06	0.84
Palustrine Emergent	SPR2	0.345444	0.84
Palustrine Emergent	SPR2	0.001072	0.84
Palustrine Emergent	SPR2	0.110425	0.84
Palustrine Emergent	SPR2	0.101643	0.84
Palustrine Emergent	SPR2	0.035565	0.84
Palustrine Emergent	SPR2	5.6E-06	0.84
Palustrine Emergent	SPR3	1.991039	0.75
Palustrine Emergent	SPR3	0.768148	0.75
Palustrine Emergent	SPR4	3.05E-05	0.74
Palustrine Emergent	SPR4	4.55E-06	0.74
Palustrine Emergent	SPR4	0.001133	0.74
Palustrine Emergent	SPR4	0.233869	0.74
Palustrine Emergent	SPR5	0.317087	0.67
Palustrine Emergent	SPR5	0.100254	0.67
Palustrine Forested	SPR5*	0.219203	0.67
Palustrine Forested	SPR5*	0.023112	0.67
Palustrine Forested	SPR5*	0.040692	0.67
Palustrine Forested	SPR5*	0.108215	0.67
Palustrine Forested	SPR5*	0.113965	0.67
Palustrine Forested	SPR5*	0.000666	0.67
Palustrine Forested	SPR5*	0.043305	0.67
Palustrine Forested	SPR5*	0.028001	0.67
Palustrine Forested	SPR5*	0.505615	0.67
Palustrine Forested	SPR5*	7.11E-06	0.67
Palustrine Forested	SPR5*	2.91E-05	0.67
Palustrine Forested	SPR5*	0.000139	0.67
Palustrine Forested	SPR5*	0.000806	0.67
Palustrine Forested	SPR5*	0.002339	0.67
Palustrine Forested	DC1	0.531917	0.82
Palustrine Forested	DC1	2.68E-05	0.82

SPR5* - Wetland polygons located outside of FACWet assessment areas that were assigned the FCI of SPR5 because of similarity in landscape position

Wetland Habitat Type	Assessment Area	Acres	FCI
Palustrine Forested	DC1	7.61E-05	0.82
Palustrine Forested	DC1	7.73E-06	0.82
Palustrine Forested	DC1	2E-05	0.82
Palustrine Forested	DC1	3.14E-05	0.82
Palustrine Forested	DC1	1.672241	0.82
Palustrine Forested	DC1	0.02006	0.82
Palustrine Forested	DC1	0.21813	0.82
Palustrine Forested	PC1	0.000104	0.8
Palustrine Forested	PC1	3.17E-05	0.8
Palustrine Forested	PC1	9.13E-05	0.8
Palustrine Forested	PC1	9.92E-05	0.8
Palustrine Forested	PC1	4.2E-05	0.8
Palustrine Forested	PC1	0.316051	0.8
Palustrine Forested	PC1	0.132582	0.8
Palustrine Forested	PC1	0.414519	0.8
Palustrine Forested	PC1	1.457348	0.8
Palustrine Forested	PC2	0.734483	0.81
Palustrine Forested	PC2	0.181174	0.81
Palustrine Forested	PC2	0.317163	0.81
Palustrine Forested	PC3	8.06E-06	0.85
Palustrine Forested	PC3	6.08E-05	0.85
Palustrine Forested	PC3	1.98E-05	0.85
Palustrine Forested	PC3	0.00998	0.85
Palustrine Forested	PC3	8.32E-05	0.85
Palustrine Forested	PC3	2.26E-05	0.85
Palustrine Forested	PC3	0.126835	0.85
Palustrine Forested	PC3	8.74E-06	0.85
Palustrine Forested	PC3	4.28E-06	0.85
Palustrine Forested	PC3	0.017685	0.85
Palustrine Forested	PC3	3.86E-05	0.85
Palustrine Forested	PC3	0.006638	0.85
Palustrine Forested	PC3	1.974136	0.85
Palustrine Forested	PC3	5.96E-06	0.85
Palustrine Forested	PC3	0.928009	0.85
Palustrine Forested	PC3	0.476111	0.85
Palustrine Forested	PC3	0.071526	0.85
Palustrine Forested	PC3	0.204685	0.85
Palustrine Forested	PC3	0.261703	0.85
Palustrine Forested	PC3	0.144013	0.85
Palustrine Forested	PC3	2.508944	0.85
Palustrine Forested	PC3	0.553067	0.85
Palustrine Forested	PC3	1.272237	0.85
Palustrine Forested	PC3	0.019271	0.85
Palustrine Forested	PC3	0.137591	0.85
Palustrine Forested	PC3	2.314986	0.85
Palustrine Forested	PC3	4.55E-05	0.85
Palustrine Forested	PC3	1.45E-05	0.85
Palustrine Forested	SPR1	0.639124	0.71
Palustrine Forested	SPR1	0.111154	0.71
Palustrine Forested	SPR1	0.172534	0.71

SPR5* - Wetland polygons located outside of FACWet assessment areas that were assigned the FCI of SPR5 because of similarity in landscape position

Wetland Habitat Type	Assessment Area	Acres	FCI
Palustrine Forested	SPR1	0.156081	0.71
Palustrine Forested	SPR1	4.73E-06	0.71
Palustrine Scrub-Shrub	SPR5*	0.042469	0.67
Palustrine Scrub-Shrub	SPR5*	0.021435	0.67
Palustrine Scrub-Shrub	SPR5*	0.000287	0.67
Palustrine Scrub-Shrub	SPR5*	0.011586	0.67
Palustrine Scrub-Shrub	SPR5*	0.015821	0.67
Palustrine Scrub-Shrub	SPR5*	0.174288	0.67
Palustrine Scrub-Shrub	SPR5*	5.88E-05	0.67
Palustrine Scrub-Shrub	SPR5*	0.041827	0.67
Palustrine Scrub-Shrub	SPR5*	0.067905	0.67
Palustrine Scrub-Shrub	SPR5*	3.45E-05	0.67
Palustrine Scrub-Shrub	SPR5*	0.001629	0.67
Palustrine Scrub-Shrub	SPR5*	0.01638	0.67
Palustrine Scrub-Shrub	SPR5*	0.025184	0.67
Palustrine Scrub-Shrub	SPR5*	0.238888	0.67
Palustrine Scrub-Shrub	SPR5*	1.78E-05	0.67
Palustrine Scrub-Shrub	SPR5*	0.027705	0.67
Palustrine Scrub-Shrub	SPR5*	0.000192	0.67
Palustrine Scrub-Shrub	SPR5*	0.31471	0.67
Palustrine Scrub-Shrub	SPR5*	0.56142	0.67
Palustrine Scrub-Shrub	SPR5*	0.526247	0.67
Palustrine Scrub-Shrub	SPR5*	0.052351	0.67
Palustrine Scrub-Shrub	SPR5*	0.000351	0.67
Palustrine Scrub-Shrub	SPR5*	0.054873	0.67
Palustrine Scrub-Shrub	SPR5*	0.038373	0.67
Palustrine Scrub-Shrub	SPR5*	0.039545	0.67
Palustrine Scrub-Shrub	SPR5*	0.071838	0.67
Palustrine Scrub-Shrub	SPR5*	2E-06	0.67
Palustrine Scrub-Shrub	SPR5*	5.98E-05	0.67
Palustrine Scrub-Shrub	SPR5*	2.06E-05	0.67
Palustrine Scrub-Shrub	SPR5*	4.27E-05	0.67
Palustrine Scrub-Shrub	SPR5*	2.91E-06	0.67
Palustrine Scrub-Shrub	SPR5*	0.000107	0.67
Palustrine Scrub-Shrub	SPR5*	1.74E-05	0.67
Palustrine Scrub-Shrub	SPR5*	2.69E-06	0.67
Palustrine Scrub-Shrub	SPR5*	3.83E-05	0.67
Palustrine Scrub-Shrub	SPR5*	5.27E-05	0.67
Palustrine Scrub-Shrub	SPR5*	3.12E-05	0.67
Palustrine Scrub-Shrub	SPR5*	8.06E-05	0.67
Palustrine Scrub-Shrub	SPR5*	1.15E-05	0.67
Palustrine Scrub-Shrub	SPR5*	0.000128	0.67
Palustrine Scrub-Shrub	SPR5*	1.19E-06	0.67
Palustrine Scrub-Shrub	SPR5*	0.000178	0.67
Palustrine Scrub-Shrub	SPR5*	0.000405	0.67
Palustrine Scrub-Shrub	SPR5*	0.000233	0.67
Palustrine Scrub-Shrub	SPR5*	5.84E-06	0.67
Palustrine Scrub-Shrub	SPR5*	9.93E-06	0.67
Palustrine Scrub-Shrub	SPR5*	1.59E-05	0.67
Palustrine Scrub-Shrub	SPR5*	8.92E-05	0.67

SPR5* - Wetland polygons located outside of FACWet assessment areas that were assigned the FCI of SPR5 because of similarity in landscape position

Wetland Habitat Type	Assessment Area	Acres	FCI
Palustrine Scrub-Shrub	SPR5*	0.000157	0.67
Palustrine Scrub-Shrub	SPR5*	0.028903	0.67
Palustrine Scrub-Shrub	SPR5*	0.000247	0.67
Palustrine Scrub-Shrub	SPR5*	0.000135	0.67
Palustrine Scrub-Shrub	SPR5*	0.016698	0.67
Palustrine Scrub-Shrub	SPR5*	0.036092	0.67
Palustrine Scrub-Shrub	SPR5*	0.172929	0.67
Palustrine Scrub-Shrub	SPR5*	0.109325	0.67
Palustrine Scrub-Shrub	SPR5*	0.062549	0.67
Palustrine Scrub-Shrub	SPR5*	0.012187	0.67
Palustrine Scrub-Shrub	SPR5*	1.44E-06	0.67
Palustrine Scrub-Shrub	SPR5*	0.060788	0.67
Palustrine Scrub-Shrub	DC1	6.55E-05	0.82
Palustrine Scrub-Shrub	DC1	0.11581	0.82
Palustrine Scrub-Shrub	DC1	0.000222	0.82
Palustrine Scrub-Shrub	DC1	1.41E-06	0.82
Palustrine Scrub-Shrub	DC1	1.02E-05	0.82
Palustrine Scrub-Shrub	DC1	0.099713	0.82
Palustrine Scrub-Shrub	DC1	0.149639	0.82
Palustrine Scrub-Shrub	DC1	0.047646	0.82
Palustrine Scrub-Shrub	DC1	2.28E-06	0.82
Palustrine Scrub-Shrub	DC1	0.094793	0.82
Palustrine Scrub-Shrub	DC1	0.114683	0.82
Palustrine Scrub-Shrub	DC1	0.240368	0.82
Palustrine Scrub-Shrub	DC1	0.006279	0.82
Palustrine Scrub-Shrub	DC1	0.074244	0.82
Palustrine Scrub-Shrub	DC1	0.011248	0.82
Palustrine Scrub-Shrub	DC1	0.36231	0.82
Palustrine Scrub-Shrub	DC1	0.006279	0.82
Palustrine Scrub-Shrub	PC1	0.092978	0.8
Palustrine Scrub-Shrub	PC2	0.343338	0.81
Palustrine Scrub-Shrub	PC2	0.06148	0.81
Palustrine Scrub-Shrub	PC2	2.12E-05	0.81
Palustrine Scrub-Shrub	PC2	0.408657	0.81
Palustrine Scrub-Shrub	PC2	2.87E-05	0.81
Palustrine Scrub-Shrub	PC2	1.75E-06	0.81
Palustrine Scrub-Shrub	PC2	4.63E-06	0.81
Palustrine Scrub-Shrub	PC2	7.57E-06	0.81
Palustrine Scrub-Shrub	PC2	3.23E-05	0.81
Palustrine Scrub-Shrub	PC2	2.11E-05	0.81
Palustrine Scrub-Shrub	PC2	1.011091	0.81
Palustrine Scrub-Shrub	PC2	0.829847	0.81
Palustrine Scrub-Shrub	PC2	1.153413	0.81
Palustrine Scrub-Shrub	PC2	1.248222	0.81
Palustrine Scrub-Shrub	PC2	7.608885	0.81
Palustrine Scrub-Shrub	PC2	1.472184	0.81
Palustrine Scrub-Shrub	PC2	0.915722	0.81
Palustrine Scrub-Shrub	PC3	4.86E-05	0.85
Palustrine Scrub-Shrub	PC3	7.24E-08	0.85
Palustrine Scrub-Shrub	PC3	3.62E-08	0.85

SPR5* - Wetland polygons located outside of FACWet assessment areas that were assigned the FCI of SPR5 because of similarity in landscape position

Wetland Habitat Type	Assessment Area	Acres	FCI
Palustrine Scrub-Shrub	PC3	0.146208	0.85
Palustrine Scrub-Shrub	PC3	1.39E-07	0.85
Palustrine Scrub-Shrub	PC3	0.563998	0.85
Palustrine Scrub-Shrub	PC3	0.003805	0.85
Palustrine Scrub-Shrub	PC3	0.209058	0.85
Palustrine Scrub-Shrub	PC3	0.007382	0.85
Palustrine Scrub-Shrub	PC3	0.000756	0.85
Palustrine Scrub-Shrub	PC3	1.68E-05	0.85
Palustrine Scrub-Shrub	PC3	0.062265	0.85
Palustrine Scrub-Shrub	PC3	0.015234	0.85
Palustrine Scrub-Shrub	PC3	0.018026	0.85
Palustrine Scrub-Shrub	PC3	0.177814	0.85
Palustrine Scrub-Shrub	PC3	2.57E-05	0.85
Palustrine Scrub-Shrub	PC3	2.36E-05	0.85
Palustrine Scrub-Shrub	PC3	0.067448	0.85
Palustrine Scrub-Shrub	PC3	0.004284	0.85
Palustrine Scrub-Shrub	PC3	0.127087	0.85
Palustrine Scrub-Shrub	PC3	0.032478	0.85
Palustrine Scrub-Shrub	PC3	0.012697	0.85
Palustrine Scrub-Shrub	PC3	0.476629	0.85
Palustrine Scrub-Shrub	PC3	0.004206	0.85
Palustrine Scrub-Shrub	PC3	0.356484	0.85
Palustrine Scrub-Shrub	PC3	0.090527	0.85
Palustrine Scrub-Shrub	PC3	0.148361	0.85
Palustrine Scrub-Shrub	PC3	0.314363	0.85
Palustrine Scrub-Shrub	PC3	0.016885	0.85
Palustrine Scrub-Shrub	PC3	0.002508	0.85
Palustrine Scrub-Shrub	PC3	0.0076	0.85
Palustrine Scrub-Shrub	PC3	0.000882	0.85
Palustrine Scrub-Shrub	PC3	0.002676	0.85
Palustrine Scrub-Shrub	PC3	0.77562	0.85
Palustrine Scrub-Shrub	PC3	0.000798	0.85
Palustrine Scrub-Shrub	PC3	2.257538	0.85
Palustrine Scrub-Shrub	PC3	0.024091	0.85
Palustrine Scrub-Shrub	PC3	0.100368	0.85
Palustrine Scrub-Shrub	PC3	0.961332	0.85
Palustrine Scrub-Shrub	PC3	0.119227	0.85
Palustrine Scrub-Shrub	PC3	2.62E-06	0.85
Palustrine Scrub-Shrub	SPR1	0.056778	0.71
Palustrine Scrub-Shrub	SPR1	0.244001	0.71
Palustrine Scrub-Shrub	SPR1	0.039906	0.71
Palustrine Scrub-Shrub	SPR1	0.038771	0.71
Palustrine Scrub-Shrub	SPR2	6.16E-05	0.84
Palustrine Scrub-Shrub	SPR2	0.068227	0.84
Palustrine Scrub-Shrub	SPR2	0.070292	0.84
Palustrine Scrub-Shrub	SPR2	0.000602	0.84
Palustrine Scrub-Shrub	SPR2	0.066084	0.84
Palustrine Scrub-Shrub	SPR2	0.560781	0.84
Palustrine Scrub-Shrub	SPR2	4.79E-05	0.84
Palustrine Scrub-Shrub	SPR2	0.267349	0.84

SPR5* - Wetland polygons located outside of FACWet assessment areas that were assigned the FCI of SPR5 because of similarity in landscape position

Wetland Habitat Type	Assessment Area	Acres	FCI
Palustrine Scrub-Shrub	SPR2	0.107906	0.84
Palustrine Scrub-Shrub	SPR2	0.13619	0.84
Palustrine Scrub-Shrub	SPR2	0.005275	0.84
Palustrine Scrub-Shrub	SPR2	0.135032	0.84
Palustrine Scrub-Shrub	SPR2	0.218162	0.84
Palustrine Scrub-Shrub	SPR2	1.25E-06	0.84
Palustrine Scrub-Shrub	SPR2	2E-05	0.84
Palustrine Scrub-Shrub	SPR2	0.077894	0.84
Palustrine Scrub-Shrub	SPR2	0.452927	0.84
Palustrine Scrub-Shrub	SPR2	0.496466	0.84
Palustrine Scrub-Shrub	SPR2	0.446529	0.84
Palustrine Scrub-Shrub	SPR2	0.056521	0.84
Palustrine Scrub-Shrub	SPR2	0.004548	0.84
Palustrine Scrub-Shrub	SPR2	0.010861	0.84
Palustrine Scrub-Shrub	SPR2	4.48E-05	0.84
Palustrine Scrub-Shrub	SPR2	1.51E-06	0.84
Palustrine Scrub-Shrub	SPR3	2.561438	0.75
Palustrine Scrub-Shrub	SPR3	0.298122	0.75
Palustrine Scrub-Shrub	SPR3	0.041621	0.75
Palustrine Scrub-Shrub	SPR3	0.051975	0.75
Palustrine Scrub-Shrub	SPR3	0.102918	0.75
Palustrine Scrub-Shrub	SPR3	0.528727	0.75
Palustrine Scrub-Shrub	SPR3	0.050302	0.75
Palustrine Scrub-Shrub	SPR4	6.59E-05	0.74
Palustrine Scrub-Shrub	SPR4	1.027399	0.74
Palustrine Scrub-Shrub	SPR4	0.000728	0.74
Palustrine Scrub-Shrub	SPR4	6.81E-05	0.74
Palustrine Scrub-Shrub	SPR4	1.18E-05	0.74
Palustrine Scrub-Shrub	SPR4	0.999425	0.74
Palustrine Scrub-Shrub	SPR4	1.24E-07	0.74
Palustrine Scrub-Shrub	SPR4	0.000224	0.74
Palustrine Scrub-Shrub	SPR4	2.841469	0.74
Palustrine Scrub-Shrub	SPR4	0.00464	0.74
Palustrine Scrub-Shrub	SPR4	4.28E-05	0.74
Palustrine Scrub-Shrub	SPR5	0.002067	0.67
Palustrine Scrub-Shrub	SPR5	0.034418	0.67
Palustrine Scrub-Shrub	SPR5	2.1861	0.67
Palustrine Scrub-Shrub	SPR5	3.47E-06	0.67

SPR5* - Wetland polygons located outside of FACWet assessment areas that were assigned the FCI of SPR5 because of similarity in landscape position

Wetland Habitat EFI = $\sum^{n}_{I=1} W_i$ FCIAA$_i$ / $\sum^{n}_{I=1} W_i$

(Component From Formula in Text)	AA	W_i	Total Acres W_i	FCIAA	W_i FCIAA$_i$	$\sum^{n}_{I=1} W_i$ FCIAA$_i$	WEFI
Wetland Habitat Type	**Assessment Area (AA)**	**Acres of Wetland Habitat Type in AA**	**Total Acres of Wetland Habitat Type**	**Functional Capacity Index (FCI)**	**Weighted Acres of Wetland Habitat Type**	**Sum of Weighted Acres**	**Wetland Habitat EFI**
Lacustrine Emergent	SPR5*	0.006903912		0.67	0.004625621		
Lacustrine Emergent	SPR5*	2.51091E-05		0.67	1.68231E-05		
Lacustrine Emergent	SPR5*	1.49625E-05		0.67	1.00249E-05		
Lacustrine Emergent	SPR5*	3.92541E-06		0.67	2.63002E-06		
Lacustrine Emergent	SPR5*	0.000796176		0.67	0.000533438		
Lacustrine Emergent			0.007744			0.005188537	**0.67**
Palustrine Aquatic Bed	PC3	0.000209644		0.85	0.000178197		
Palustrine Aquatic Bed	PC3	0.000342832		0.85	0.000291407		
Palustrine Aquatic Bed	PC3	0.025758457		0.85	0.021894688		
Palustrine Aquatic Bed	PC3	0.073462852		0.85	0.062443424		
Palustrine Aquatic Bed	PC3	0.01363032		0.85	0.011585772		
Palustrine Aquatic Bed	PC3	0.005282538		0.85	0.004490158		
Palustrine Aquatic Bed	PC3	0.000130083		0.85	0.000110571		
Palustrine Aquatic Bed	PC3	0.006818926		0.85	0.005796088		
Palustrine Aquatic Bed	PC3	0.007763491		0.85	0.006598967		
Palustrine Aquatic Bed	PC3	0.000719688		0.85	0.000611734		
Palustrine Aquatic Bed	PC3	0.02347081		0.85	0.019950188		
Palustrine Aquatic Bed	PC3	0.007819099		0.85	0.006646234		
Palustrine Aquatic Bed	PC3	0.000147612		0.85	0.00012547		
Palustrine Aquatic Bed	PC3	0.001926567		0.85	0.001637582		
Palustrine Aquatic Bed	PC3	0.478739678		0.85	0.406928726		
Palustrine Aquatic Bed	PC3	0.199023746		0.85	0.169170184		
Palustrine Aquatic Bed	PC3	0.001935982		0.85	0.001645585		
Palustrine Aquatic Bed	PC3	0.001450358		0.85	0.001232804		
Palustrine Aquatic Bed	PC3	0.01380716		0.85	0.011736086		
Palustrine Aquatic Bed	PC3	0.007114856		0.85	0.006047627		
Palustrine Aquatic Bed	PC3	0.073900616		0.85	0.062815524		
Palustrine Aquatic Bed	PC3	0.604224592		0.85	0.513590903		
Palustrine Aquatic Bed	PC3	5.64251E-06		0.85	4.79613E-06		
Palustrine Aquatic Bed	PC3	1.10713E-05		0.85	9.41064E-06		
Palustrine Aquatic Bed	SPR1	0.331468858		0.71	0.235342889		
Palustrine Aquatic Bed	SPR1	0.31767481		0.71	0.225549115		
Palustrine Aquatic Bed	SPR1	0.009697869		0.71	0.006885487		
Palustrine Aquatic Bed	SPR1	1.502397666		0.71	1.066702343		
Palustrine Aquatic Bed	SPR5	0.493933478		0.67	0.330935431		
Palustrine Aquatic Bed	SPR5	0.048683763		0.67	0.032618121		
Palustrine Aquatic Bed	SPR5	0.077175469		0.67	0.051707565		
Palustrine Aquatic Bed	SPR5	0.05578261		0.67	0.037374349		
Palustrine Aquatic Bed	SPR5	0.023947309		0.67	0.016044697		
Palustrine Aquatic Bed	SPR5	5.84557E-07		0.67	3.91653E-07		
Palustrine Aquatic Bed			4.408459			3.318702517	**0.752803**
Palustrine Emergent	SPR5*	0.027613245		0.67	0.018500874		
Palustrine Emergent	SPR5*	0.066679488		0.67	0.044675257		
Palustrine Emergent	SPR5*	0.832098079		0.67	0.557505713		
Palustrine Emergent	SPR5*	0.004619418		0.67	0.00309501		
Palustrine Emergent	SPR5*	0.023176487		0.67	0.015528246		
Palustrine Emergent	SPR5*	0.068472509		0.67	0.045876581		
Palustrine Emergent	SPR5*	0.151419213		0.67	0.101450873		
Palustrine Emergent	SPR5*	0.00217821		0.67	0.001459401		
Palustrine Emergent	SPR5*	0.088736437		0.67	0.059453413		
Palustrine Emergent	SPR5*	0.129848359		0.67	0.0869984		
Palustrine Emergent	SPR5*	3.65755E-05		0.67	2.45056E-05		

SPR5* - Wetland polygons located outside of FACWet assessment areas that were assigned the FCI of SPR5 because of similarity in landscape position

Wetland Habitat EFI = $\sum^{n}_{I=1} W_i$ FCIAA$_i$ / $\sum^{n}_{I=1} W_i$

(Component From Formula in Text)	AA	W_i	Total Acres W_i	FCIAA	W_i FCIAA$_i$	$\sum^{n}_{I=1} W_i$ FCIAA$_i$	WEFI
Wetland Habitat Type	**Assessment Area (AA)**	**Acres of Wetland Habitat Type in AA**	**Total Acres of Wetland Habitat Type**	**Functional Capacity Index (FCI)**	**Weighted Acres of Wetland Habitat Type**	**Sum of Weighted Acres**	**Wetland Habitat EFI**
Palustrine Emergent	SPR5*	1.77181E-05		0.67	1.18711E-05		
Palustrine Emergent	SPR5*	7.12339E-05		0.67	4.77267E-05		
Palustrine Emergent	SPR5*	1.30307E-05		0.67	8.73057E-06		
Palustrine Emergent	SPR5*	3.49711E-05		0.67	2.34307E-05		
Palustrine Emergent	SPR5*	7.0333E-07		0.67	4.71231E-07		
Palustrine Emergent	SPR5*	5.14891E-05		0.67	3.44977E-05		
Palustrine Emergent	SPR5*	2.08395E-05		0.67	1.39625E-05		
Palustrine Emergent	SPR5*	0.000149371		0.67	0.000100078		
Palustrine Emergent	SPR5*	0.061820868		0.67	0.041419982		
Palustrine Emergent	SPR5*	0.324186688		0.67	0.217205081		
Palustrine Emergent	DC1	0.030609942		0.82	0.025100152		
Palustrine Emergent	DC1	0.001202269		0.82	0.000985861		
Palustrine Emergent	PC1	0.02674949		0.8	0.021399592		
Palustrine Emergent	PC2	0.074688229		0.81	0.060497466		
Palustrine Emergent	PC2	0.139955643		0.81	0.113364071		
Palustrine Emergent	PC3	5.76056E-05		0.85	4.89648E-05		
Palustrine Emergent	PC3	0.042442347		0.85	0.036075995		
Palustrine Emergent	PC3	0.016094927		0.85	0.013680688		
Palustrine Emergent	PC3	0.035221697		0.85	0.029938442		
Palustrine Emergent	PC3	3.17753E-05		0.85	2.7009E-05		
Palustrine Emergent	PC3	0.076666393		0.85	0.065166434		
Palustrine Emergent	PC3	3.6608E-05		0.85	3.11168E-05		
Palustrine Emergent	PC3	0.069968394		0.85	0.059473135		
Palustrine Emergent	PC3	0.088401667		0.85	0.075141417		
Palustrine Emergent	PC3	1.16853E-05		0.85	9.93255E-06		
Palustrine Emergent	PC3	0.070463271		0.85	0.05989378		
Palustrine Emergent	PC3	0.083538127		0.85	0.071007408		
Palustrine Emergent	PC3	7.28978E-05		0.85	6.19632E-05		
Palustrine Emergent	PC3	2.3169E-05		0.85	1.96937E-05		
Palustrine Emergent	PC3	0.539509086		0.85	0.458582723		
Palustrine Emergent	PC3	0.000372579		0.85	0.000316693		
Palustrine Emergent	PC3	0.079270832		0.85	0.067380207		
Palustrine Emergent	PC3	0.015031233		0.85	0.012776548		
Palustrine Emergent	PC3	0.070772996		0.85	0.060157047		
Palustrine Emergent	PC3	0.001060301		0.85	0.000901256		
Palustrine Emergent	PC3	0.135149975		0.85	0.114877479		
Palustrine Emergent	PC3	0.102453205		0.85	0.087085224		
Palustrine Emergent	PC3	0.080599741		0.85	0.06850978		
Palustrine Emergent	PC3	0.275858881		0.85	0.234480048		
Palustrine Emergent	PC3	0.307339702		0.85	0.261238747		
Palustrine Emergent	PC3	0.201662308		0.85	0.171412962		
Palustrine Emergent	PC3	0.786695889		0.85	0.668691506		
Palustrine Emergent	PC3	0.046531192		0.85	0.039551513		
Palustrine Emergent	PC3	0.001590747		0.85	0.001352135		
Palustrine Emergent	PC3	0.045588164		0.85	0.03874994		
Palustrine Emergent	PC3	0.154887198		0.85	0.131654119		
Palustrine Emergent	PC3	0.069370112		0.85	0.058964595		
Palustrine Emergent	PC3	0.055679372		0.85	0.047327466		
Palustrine Emergent	PC3	0.03560474		0.85	0.030264029		
Palustrine Emergent	PC3	0.073133973		0.85	0.062163877		
Palustrine Emergent	PC3	0.372863162		0.85	0.316933687		
Palustrine Emergent	PC3	0.065405737		0.85	0.055594876		
Palustrine Emergent	PC3	0.612508077		0.85	0.520631866		
Palustrine Emergent	PC3	4.314390278		0.85	3.667231736		

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Calculation of Weighted Arithmetic Mean (EFI) for Wetland Habitat Types

Wetland Habitat EFI = $\sum^{n}_{I=1} W_i$ FCIAA$_i$ / $\sum^{n}_{I=1} W_i$

(Component From Formula in Text)	AA	W_i	Total Acres W_i	FCIAA	W_i FCIAA$_i$	$\sum^{n}_{I=1} W_i$ FCIAA$_i$	WEFI
Wetland Habitat Type	**Assessment Area (AA)**	**Acres of Wetland Habitat Type in AA**	**Total Acres of Wetland Habitat Type**	**Functional Capacity Index (FCI)**	**Weighted Acres of Wetland Habitat Type**	**Sum of Weighted Acres**	**Wetland Habitat EFI**
Palustrine Emergent	PC3	2.44885E-05		0.85	2.08152E-05		
Palustrine Emergent	PC3	2.18064E-06		0.85	1.85354E-06		
Palustrine Emergent	PC3	2.09201E-05		0.85	1.77821E-05		
Palustrine Emergent	PC3	1.41013E-05		0.85	1.19861E-05		
Palustrine Emergent	SPR1	0.000160431		0.71	0.000113906		
Palustrine Emergent	SPR1	0.350350058		0.71	0.248748542		
Palustrine Emergent	SPR1	0.958445547		0.71	0.680496339		
Palustrine Emergent	SPR1	0.12266132		0.71	0.087089538		
Palustrine Emergent	SPR1	0.242373109		0.71	0.172084908		
Palustrine Emergent	SPR1	0.579245334		0.71	0.411264187		
Palustrine Emergent	SPR1	0.31780076		0.71	0.22563854		
Palustrine Emergent	SPR1	9.92496E-06		0.71	7.04672E-06		
Palustrine Emergent	SPR2	0.092313211		0.84	0.077543098		
Palustrine Emergent	SPR2	1.77208E-06		0.84	1.48855E-06		
Palustrine Emergent	SPR2	0.345443512		0.84	0.29017255		
Palustrine Emergent	SPR2	0.001072364		0.84	0.000900785		
Palustrine Emergent	SPR2	0.110425359		0.84	0.092757301		
Palustrine Emergent	SPR2	0.101642538		0.84	0.085379732		
Palustrine Emergent	SPR2	0.035564615		0.84	0.029874277		
Palustrine Emergent	SPR2	5.59984E-06		0.84	4.70387E-06		
Palustrine Emergent	SPR3	1.991038607		0.75	1.493278955		
Palustrine Emergent	SPR3	0.768147634		0.75	0.576110726		
Palustrine Emergent	SPR4	3.04689E-05		0.74	2.2547E-05		
Palustrine Emergent	SPR4	4.54523E-06		0.74	3.36347E-06		
Palustrine Emergent	SPR4	0.001133477		0.74	0.000838773		
Palustrine Emergent	SPR4	0.233869234		0.74	0.173063233		
Palustrine Emergent	SPR5	0.317086539		0.67	0.212447981		
Palustrine Emergent	SPR5	0.100254361		0.67	0.067170422		
Palustrine Emergent			17.64995			13.92725266	**0.789082**
Palustrine Forested	SPR5*	0.219202899		0.67	0.146865942		
Palustrine Forested	SPR5*	0.023112291		0.67	0.015485235		
Palustrine Forested	SPR5*	0.040691678		0.67	0.027263424		
Palustrine Forested	SPR5*	0.108214894		0.67	0.072503979		
Palustrine Forested	SPR5*	0.113965019		0.67	0.076356563		
Palustrine Forested	SPR5*	0.000665676		0.67	0.000446003		
Palustrine Forested	SPR5*	0.043305131		0.67	0.029014438		
Palustrine Forested	SPR5*	0.028000882		0.67	0.018760591		
Palustrine Forested	SPR5*	0.505615446		0.67	0.338762349		
Palustrine Forested	SPR5*	7.11084E-06		0.67	4.76426E-06		
Palustrine Forested	SPR5*	2.91369E-05		0.67	1.95217E-05		
Palustrine Forested	SPR5*	0.00013949		0.67	9.34581E-05		
Palustrine Forested	SPR5*	0.000805542		0.67	0.000539713		
Palustrine Forested	SPR5*	0.00233932		0.67	0.001567344		
Palustrine Forested	DC1	0.531917434		0.82	0.436172296		
Palustrine Forested	DC1	2.68366E-05		0.82	2.2006E-05		
Palustrine Forested	DC1	7.61452E-05		0.82	6.2439E-05		
Palustrine Forested	DC1	7.73346E-06		0.82	6.34144E-06		
Palustrine Forested	DC1	2.00032E-05		0.82	1.64026E-05		
Palustrine Forested	DC1	3.13902E-05		0.82	2.57399E-05		
Palustrine Forested	DC1	1.67224123		0.82	1.371237809		
Palustrine Forested	DC1	0.020060365		0.82	0.016449499		
Palustrine Forested	DC1	0.218129779		0.82	0.178866419		
Palustrine Forested	PC1	0.000103885		0.8	8.3108E-05		
Palustrine Forested	PC1	3.1676E-05		0.8	2.53408E-05		

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Calculation of Weighted Arithmetic Mean (EFI) for Wetland Habitat Types

Wetland Habitat EFI = $\sum^{n}_{I=1} W_i\ FCIAA_i / \sum^{n}_{I=1} W_i$

(Component From Formula in Text)	AA	W_i	Total Acres W_i	FCIAA	W_i FCIAA$_i$	$\sum^{n}_{I=1} W_i\ FCIAA_i$	WEFI
Wetland Habitat Type	**Assessment Area (AA)**	**Acres of Wetland Habitat Type in AA**	**Total Acres of Wetland Habitat Type**	**Functional Capacity Index (FCI)**	**Weighted Acres of Wetland Habitat Type**	**Sum of Weighted Acres**	**Wetland Habitat EFI**
Palustrine Forested	PC1	9.13475E-05		0.8	7.3078E-05		
Palustrine Forested	PC1	9.91523E-05		0.8	7.93218E-05		
Palustrine Forested	PC1	4.19533E-05		0.8	3.35626E-05		
Palustrine Forested	PC1	0.316051127		0.8	0.252840902		
Palustrine Forested	PC1	0.132581593		0.8	0.106065274		
Palustrine Forested	PC1	0.414518713		0.8	0.33161497		
Palustrine Forested	PC1	1.457347548		0.8	1.165878039		
Palustrine Forested	PC2	0.734482679		0.81	0.59493097		
Palustrine Forested	PC2	0.181173604		0.81	0.146750619		
Palustrine Forested	PC2	0.317162583		0.81	0.256901693		
Palustrine Forested	PC3	8.06188E-06		0.85	6.85259E-06		
Palustrine Forested	PC3	6.0785E-05		0.85	5.16673E-05		
Palustrine Forested	PC3	1.97808E-05		0.85	1.68137E-05		
Palustrine Forested	PC3	0.00998047		0.85	0.0084834		
Palustrine Forested	PC3	8.3155E-05		0.85	7.06817E-05		
Palustrine Forested	PC3	2.25778E-05		0.85	1.91911E-05		
Palustrine Forested	PC3	0.126834518		0.85	0.10780934		
Palustrine Forested	PC3	8.74066E-06		0.85	7.42956E-06		
Palustrine Forested	PC3	4.27823E-06		0.85	3.6365E-06		
Palustrine Forested	PC3	0.017684704		0.85	0.015031999		
Palustrine Forested	PC3	3.86472E-05		0.85	3.28501E-05		
Palustrine Forested	PC3	0.006637984		0.85	0.005642287		
Palustrine Forested	PC3	1.974135772		0.85	1.678015406		
Palustrine Forested	PC3	5.95564E-06		0.85	5.06229E-06		
Palustrine Forested	PC3	0.928008604		0.85	0.788807313		
Palustrine Forested	PC3	0.476111033		0.85	0.404694378		
Palustrine Forested	PC3	0.071526296		0.85	0.060797352		
Palustrine Forested	PC3	0.20468509		0.85	0.173982327		
Palustrine Forested	PC3	0.261703297		0.85	0.222447802		
Palustrine Forested	PC3	0.144012786		0.85	0.122410868		
Palustrine Forested	PC3	2.508943504		0.85	2.132601978		
Palustrine Forested	PC3	0.553067309		0.85	0.470107213		
Palustrine Forested	PC3	1.272236942		0.85	1.081401401		
Palustrine Forested	PC3	0.019270552		0.85	0.016379969		
Palustrine Forested	PC3	0.137590524		0.85	0.116951945		
Palustrine Forested	PC3	2.314985774		0.85	1.967737908		
Palustrine Forested	PC3	4.55267E-05		0.85	3.86977E-05		
Palustrine Forested	PC3	1.45108E-05		0.85	1.23342E-05		
Palustrine Forested	SPR1	0.639124341		0.71	0.453778282		
Palustrine Forested	SPR1	0.111154241		0.71	0.078919511		
Palustrine Forested	SPR1	0.172533807		0.71	0.122499003		
Palustrine Forested	SPR1	0.156080805		0.71	0.110817372		
Palustrine Forested	SPR1	4.73389E-06		0.71	3.36106E-06		
Palustrine Forested			19.18892			15.72540479	**0.819505**
Palustrine Scrub-Shrub	SPR5*	0.042469248		0.67	0.028454396		
Palustrine Scrub-Shrub	SPR5*	0.021435448		0.67	0.01436175		
Palustrine Scrub-Shrub	SPR5*	0.00028731		0.67	0.000192498		
Palustrine Scrub-Shrub	SPR5*	0.011586007		0.67	0.007762625		
Palustrine Scrub-Shrub	SPR5*	0.015820541		0.67	0.010599763		
Palustrine Scrub-Shrub	SPR5*	0.174288265		0.67	0.116773138		
Palustrine Scrub-Shrub	SPR5*	5.87767E-05		0.67	3.93804E-05		
Palustrine Scrub-Shrub	SPR5*	0.041827321		0.67	0.028024305		
Palustrine Scrub-Shrub	SPR5*	0.067904769		0.67	0.045496195		
Palustrine Scrub-Shrub	SPR5*	3.44766E-05		0.67	2.30993E-05		

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Wetland Habitat EFI = $\sum^{n}_{I=1} W_i$ FCIAA$_i$ / $\sum^{n}_{I=1} W_i$

(Component From Formula in Text)	AA	W_i	Total Acres W_i	FCIAA	W_i FCIAA$_i$	$\sum^{n}_{I=1} W_i$ FCIAA$_i$	WEFI
Wetland Habitat Type	**Assessment Area (AA)**	**Acres of Wetland Habitat Type in AA**	**Total Acres of Wetland Habitat Type**	**Functional Capacity Index (FCI)**	**Weighted Acres of Wetland Habitat Type**	**Sum of Weighted Acres**	**Wetland Habitat EFI**
Palustrine Scrub-Shrub	SPR5*	0.001628665		0.67	0.001091206		
Palustrine Scrub-Shrub	SPR5*	0.016380075		0.67	0.01097465		
Palustrine Scrub-Shrub	SPR5*	0.02518406		0.67	0.01687332		
Palustrine Scrub-Shrub	SPR5*	0.238888167		0.67	0.160055072		
Palustrine Scrub-Shrub	SPR5*	1.78045E-05		0.67	1.1929E-05		
Palustrine Scrub-Shrub	SPR5*	0.02770452		0.67	0.018562029		
Palustrine Scrub-Shrub	SPR5*	0.00019247		0.67	0.000128955		
Palustrine Scrub-Shrub	SPR5*	0.314709536		0.67	0.210855389		
Palustrine Scrub-Shrub	SPR5*	0.561420334		0.67	0.376151624		
Palustrine Scrub-Shrub	SPR5*	0.526247242		0.67	0.352585652		
Palustrine Scrub-Shrub	SPR5*	0.052351105		0.67	0.03507524		
Palustrine Scrub-Shrub	SPR5*	0.000350791		0.67	0.00023503		
Palustrine Scrub-Shrub	SPR5*	0.054873257		0.67	0.036765082		
Palustrine Scrub-Shrub	SPR5*	0.038373292		0.67	0.025710106		
Palustrine Scrub-Shrub	SPR5*	0.03954528		0.67	0.026495337		
Palustrine Scrub-Shrub	SPR5*	0.07183815		0.67	0.04813156		
Palustrine Scrub-Shrub	SPR5*	1.99778E-06		0.67	1.33851E-06		
Palustrine Scrub-Shrub	SPR5*	5.98044E-05		0.67	4.00689E-05		
Palustrine Scrub-Shrub	SPR5*	2.06133E-05		0.67	1.38109E-05		
Palustrine Scrub-Shrub	SPR5*	4.26698E-05		0.67	2.85887E-05		
Palustrine Scrub-Shrub	SPR5*	2.91198E-06		0.67	1.95103E-06		
Palustrine Scrub-Shrub	SPR5*	0.000107493		0.67	7.20205E-05		
Palustrine Scrub-Shrub	SPR5*	1.74277E-05		0.67	1.16766E-05		
Palustrine Scrub-Shrub	SPR5*	2.69292E-06		0.67	1.80426E-06		
Palustrine Scrub-Shrub	SPR5*	3.83016E-05		0.67	2.56621E-05		
Palustrine Scrub-Shrub	SPR5*	5.27192E-05		0.67	3.53219E-05		
Palustrine Scrub-Shrub	SPR5*	3.11991E-05		0.67	2.09034E-05		
Palustrine Scrub-Shrub	SPR5*	8.05651E-05		0.67	5.39786E-05		
Palustrine Scrub-Shrub	SPR5*	1.14853E-05		0.67	7.69513E-06		
Palustrine Scrub-Shrub	SPR5*	0.000128045		0.67	8.57899E-05		
Palustrine Scrub-Shrub	SPR5*	1.19352E-06		0.67	7.99658E-07		
Palustrine Scrub-Shrub	SPR5*	0.000177823		0.67	0.000119141		
Palustrine Scrub-Shrub	SPR5*	0.00040479		0.67	0.000271209		
Palustrine Scrub-Shrub	SPR5*	0.000233367		0.67	0.000156356		
Palustrine Scrub-Shrub	SPR5*	5.83808E-06		0.67	3.91151E-06		
Palustrine Scrub-Shrub	SPR5*	9.92765E-06		0.67	6.65153E-06		
Palustrine Scrub-Shrub	SPR5*	1.58675E-05		0.67	1.06312E-05		
Palustrine Scrub-Shrub	SPR5*	8.91797E-05		0.67	5.97504E-05		
Palustrine Scrub-Shrub	SPR5*	0.00015727		0.67	0.000105371		
Palustrine Scrub-Shrub	SPR5*	0.028902942		0.67	0.019364971		
Palustrine Scrub-Shrub	SPR5*	0.000246809		0.67	0.000165362		
Palustrine Scrub-Shrub	SPR5*	0.000134538		0.67	9.01404E-05		
Palustrine Scrub-Shrub	SPR5*	0.016698134		0.67	0.01118775		
Palustrine Scrub-Shrub	SPR5*	0.036092395		0.67	0.024181905		
Palustrine Scrub-Shrub	SPR5*	0.172928624		0.67	0.115862178		
Palustrine Scrub-Shrub	SPR5*	0.10932496		0.67	0.073247723		
Palustrine Scrub-Shrub	SPR5*	0.062549421		0.67	0.041908112		
Palustrine Scrub-Shrub	SPR5*	0.012186702		0.67	0.00816509		
Palustrine Scrub-Shrub	SPR5*	1.43738E-06		0.67	9.63048E-07		
Palustrine Scrub-Shrub	SPR5*	0.060787806		0.67	0.04072783		
Palustrine Scrub-Shrub	DC1	6.5503E-05		0.82	5.37125E-05		
Palustrine Scrub-Shrub	DC1	0.11580965		0.82	0.094963913		
Palustrine Scrub-Shrub	DC1	0.000222027		0.82	0.000182062		
Palustrine Scrub-Shrub	DC1	1.41356E-06		0.82	1.15912E-06		

SPR5* - Wetland polygons located outside of FACWet assessment areas that were assigned the FCI of SPR5 because of similarity in landscape position

Calculation of Weighted Arithmetic Mean (EFI) for Wetland Habitat Types

Wetland Habitat EFI = $\sum^{n}_{I=1} W_i\ FCIAA_i / \sum^{n}_{I=1} W_i$

(Component From Formula in Text)	AA	W_i	Total Acres W_i	FCIAA	W_i FCIAA$_i$	$\sum^{n}_{I=1} W_i\ FCIAA_i$	WEFI
Wetland Habitat Type	**Assessment Area (AA)**	**Acres of Wetland Habitat Type in AA**	**Total Acres of Wetland Habitat Type**	**Functional Capacity Index (FCI)**	**Weighted Acres of Wetland Habitat Type**	**Sum of Weighted Acres**	**Wetland Habitat EFI**
Palustrine Scrub-Shrub	DC1	1.01714E-05		0.82	8.34056E-06		
Palustrine Scrub-Shrub	DC1	0.099712845		0.82	0.081764533		
Palustrine Scrub-Shrub	DC1	0.149639028		0.82	0.122704003		
Palustrine Scrub-Shrub	DC1	0.047646331		0.82	0.039069992		
Palustrine Scrub-Shrub	DC1	2.28478E-06		0.82	1.87352E-06		
Palustrine Scrub-Shrub	DC1	0.094793456		0.82	0.077730634		
Palustrine Scrub-Shrub	DC1	0.114683132		0.82	0.094040168		
Palustrine Scrub-Shrub	DC1	0.240367947		0.82	0.197101716		
Palustrine Scrub-Shrub	DC1	0.006278959		0.82	0.005148746		
Palustrine Scrub-Shrub	DC1	0.074244409		0.82	0.060880415		
Palustrine Scrub-Shrub	DC1	0.0112482		0.82	0.009223524		
Palustrine Scrub-Shrub	DC1	0.362309668		0.82	0.297093928		
Palustrine Scrub-Shrub	DC1	0.006278959		0.82	0.005148746		
Palustrine Scrub-Shrub	PC1	0.092978089		0.8	0.074382471		
Palustrine Scrub-Shrub	PC2	0.343338003		0.81	0.278103782		
Palustrine Scrub-Shrub	PC2	0.061479783		0.81	0.049798624		
Palustrine Scrub-Shrub	PC2	2.12039E-05		0.81	1.71751E-05		
Palustrine Scrub-Shrub	PC2	0.408656786		0.81	0.331011997		
Palustrine Scrub-Shrub	PC2	2.86557E-05		0.81	2.32111E-05		
Palustrine Scrub-Shrub	PC2	1.74947E-06		0.81	1.41707E-06		
Palustrine Scrub-Shrub	PC2	4.62883E-06		0.81	3.74935E-06		
Palustrine Scrub-Shrub	PC2	7.56704E-06		0.81	6.1293E-06		
Palustrine Scrub-Shrub	PC2	3.23165E-05		0.81	2.61764E-05		
Palustrine Scrub-Shrub	PC2	2.113E-05		0.81	1.71153E-05		
Palustrine Scrub-Shrub	PC2	1.011090696		0.81	0.818983464		
Palustrine Scrub-Shrub	PC2	0.829847163		0.81	0.672176202		
Palustrine Scrub-Shrub	PC2	1.153413262		0.81	0.934264742		
Palustrine Scrub-Shrub	PC2	1.248222414		0.81	1.011060155		
Palustrine Scrub-Shrub	PC2	7.608885444		0.81	6.16319721		
Palustrine Scrub-Shrub	PC2	1.472183682		0.81	1.192468782		
Palustrine Scrub-Shrub	PC2	0.915722248		0.81	0.741735021		
Palustrine Scrub-Shrub	PC3	4.85762E-05		0.85	4.12898E-05		
Palustrine Scrub-Shrub	PC3	7.23859E-08		0.85	6.1528E-08		
Palustrine Scrub-Shrub	PC3	3.61661E-08		0.85	3.07412E-08		
Palustrine Scrub-Shrub	PC3	0.146207736		0.85	0.124276575		
Palustrine Scrub-Shrub	PC3	1.38853E-07		0.85	1.18025E-07		
Palustrine Scrub-Shrub	PC3	0.563998116		0.85	0.479398399		
Palustrine Scrub-Shrub	PC3	0.003805489		0.85	0.003234666		
Palustrine Scrub-Shrub	PC3	0.209057983		0.85	0.177699285		
Palustrine Scrub-Shrub	PC3	0.00738173		0.85	0.006274471		
Palustrine Scrub-Shrub	PC3	0.000755896		0.85	0.000642512		
Palustrine Scrub-Shrub	PC3	1.6814E-05		0.85	1.42919E-05		
Palustrine Scrub-Shrub	PC3	0.062265047		0.85	0.05292529		
Palustrine Scrub-Shrub	PC3	0.015234077		0.85	0.012948966		
Palustrine Scrub-Shrub	PC3	0.018025611		0.85	0.015321769		
Palustrine Scrub-Shrub	PC3	0.177814023		0.85	0.151141919		
Palustrine Scrub-Shrub	PC3	2.56577E-05		0.85	2.1809E-05		
Palustrine Scrub-Shrub	PC3	2.357E-05		0.85	2.00345E-05		
Palustrine Scrub-Shrub	PC3	0.067448337		0.85	0.057331087		
Palustrine Scrub-Shrub	PC3	0.00428384		0.85	0.003641264		
Palustrine Scrub-Shrub	PC3	0.127087113		0.85	0.108024046		
Palustrine Scrub-Shrub	PC3	0.032478321		0.85	0.027606573		
Palustrine Scrub-Shrub	PC3	0.012696742		0.85	0.010792231		
Palustrine Scrub-Shrub	PC3	0.476628658		0.85	0.40513436		

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Calculation of Weighted Arithmetic Mean (EFI) for Wetland Habitat Types

Wetland Habitat EFI = $\sum^{n}_{I=1} W_i FCIAA_i / \sum^{n}_{I=1} W_i$

(Component From Formula in Text)	AA	W_i	Total Acres W_i	FCIAA	W_i FCIAA$_i$	$\sum^{n}_{I=1} W_i FCIAA_i$	WEFI
Wetland Habitat Type	**Assessment Area (AA)**	**Acres of Wetland Habitat Type in AA**	**Total Acres of Wetland Habitat Type**	**Functional Capacity Index (FCI)**	**Weighted Acres of Wetland Habitat Type**	**Sum of Weighted Acres**	**Wetland Habitat EFI**
Palustrine Scrub-Shrub	PC3	0.004205671		0.85	0.00357482		
Palustrine Scrub-Shrub	PC3	0.356483505		0.85	0.303010979		
Palustrine Scrub-Shrub	PC3	0.090527331		0.85	0.076948232		
Palustrine Scrub-Shrub	PC3	0.148361218		0.85	0.126107035		
Palustrine Scrub-Shrub	PC3	0.314362555		0.85	0.267208172		
Palustrine Scrub-Shrub	PC3	0.016885032		0.85	0.014352277		
Palustrine Scrub-Shrub	PC3	0.002508404		0.85	0.002132143		
Palustrine Scrub-Shrub	PC3	0.007599821		0.85	0.006459848		
Palustrine Scrub-Shrub	PC3	0.00088169		0.85	0.000749436		
Palustrine Scrub-Shrub	PC3	0.002676276		0.85	0.002274835		
Palustrine Scrub-Shrub	PC3	0.775619709		0.85	0.659276752		
Palustrine Scrub-Shrub	PC3	0.000798112		0.85	0.000678395		
Palustrine Scrub-Shrub	PC3	2.257538398		0.85	1.918907638		
Palustrine Scrub-Shrub	PC3	0.02409079		0.85	0.020477172		
Palustrine Scrub-Shrub	PC3	0.100367711		0.85	0.085312554		
Palustrine Scrub-Shrub	PC3	0.96133211		0.85	0.817132293		
Palustrine Scrub-Shrub	PC3	0.119226831		0.85	0.101342807		
Palustrine Scrub-Shrub	PC3	2.62296E-06		0.85	2.22952E-06		
Palustrine Scrub-Shrub	SPR1	0.056777951		0.71	0.040312346		
Palustrine Scrub-Shrub	SPR1	0.24400103		0.71	0.173240731		
Palustrine Scrub-Shrub	SPR1	0.039905889		0.71	0.028333181		
Palustrine Scrub-Shrub	SPR1	0.03877135		0.71	0.027527659		
Palustrine Scrub-Shrub	SPR2	6.16121E-05		0.84	5.17542E-05		
Palustrine Scrub-Shrub	SPR2	0.068227287		0.84	0.057310921		
Palustrine Scrub-Shrub	SPR2	0.070292356		0.84	0.059045579		
Palustrine Scrub-Shrub	SPR2	0.000601732		0.84	0.000505455		
Palustrine Scrub-Shrub	SPR2	0.066084159		0.84	0.055510693		
Palustrine Scrub-Shrub	SPR2	0.560780526		0.84	0.471055642		
Palustrine Scrub-Shrub	SPR2	4.79018E-05		0.84	4.02375E-05		
Palustrine Scrub-Shrub	SPR2	0.267348745		0.84	0.224572946		
Palustrine Scrub-Shrub	SPR2	0.107905863		0.84	0.090640925		
Palustrine Scrub-Shrub	SPR2	0.136190211		0.84	0.114399777		
Palustrine Scrub-Shrub	SPR2	0.005274693		0.84	0.004430742		
Palustrine Scrub-Shrub	SPR2	0.135032491		0.84	0.113427292		
Palustrine Scrub-Shrub	SPR2	0.218162488		0.84	0.18325649		
Palustrine Scrub-Shrub	SPR2	1.24704E-06		0.84	1.04751E-06		
Palustrine Scrub-Shrub	SPR2	1.99514E-05		0.84	1.67592E-05		
Palustrine Scrub-Shrub	SPR2	0.077893563		0.84	0.065430593		
Palustrine Scrub-Shrub	SPR2	0.452927374		0.84	0.380458994		
Palustrine Scrub-Shrub	SPR2	0.496466283		0.84	0.417031677		
Palustrine Scrub-Shrub	SPR2	0.44652866		0.84	0.375084074		
Palustrine Scrub-Shrub	SPR2	0.056520515		0.84	0.047477233		
Palustrine Scrub-Shrub	SPR2	0.004547761		0.84	0.003820119		
Palustrine Scrub-Shrub	SPR2	0.01086114		0.84	0.009123358		
Palustrine Scrub-Shrub	SPR2	4.4829E-05		0.84	3.76563E-05		
Palustrine Scrub-Shrub	SPR2	1.51013E-06		0.84	1.26851E-06		
Palustrine Scrub-Shrub	SPR3	2.561438269		0.75	1.921078701		
Palustrine Scrub-Shrub	SPR3	0.298121516		0.75	0.223591137		
Palustrine Scrub-Shrub	SPR3	0.041620706		0.75	0.03121553		
Palustrine Scrub-Shrub	SPR3	0.051975393		0.75	0.038981545		
Palustrine Scrub-Shrub	SPR3	0.102918167		0.75	0.077188626		
Palustrine Scrub-Shrub	SPR3	0.528727434		0.75	0.396545576		
Palustrine Scrub-Shrub	SPR3	0.050301868		0.75	0.037726401		
Palustrine Scrub-Shrub	SPR4	6.59212E-05		0.74	4.87817E-05		

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Wetland Habitat EFI = $\sum^{n}_{I=1} W_i\, FCIAA_i / \sum^{n}_{I=1} W_i$

(Component From Formula in Text)	**AA**	**W_i**	**Total Acres W_i**	**FCIAA**	**W_i FCIAA$_i$**	**$\sum^{n}_{I=1} W_i\, FCIAA_i$**	**WEFI**
Wetland Habitat Type	**Assessment Area (AA)**	**Acres of Wetland Habitat Type in AA**	**Total Acres of Wetland Habitat Type**	**Functional Capacity Index (FCI)**	**Weighted Acres of Wetland Habitat Type**	**Sum of Weighted Acres**	**Wetland Habitat EFI**
Palustrine Scrub-Shrub	SPR4	1.027398892		0.74	0.76027518		
Palustrine Scrub-Shrub	SPR4	0.000727525		0.74	0.000538369		
Palustrine Scrub-Shrub	SPR4	6.81295E-05		0.74	5.04158E-05		
Palustrine Scrub-Shrub	SPR4	1.18217E-05		0.74	8.74807E-06		
Palustrine Scrub-Shrub	SPR4	0.999425117		0.74	0.739574586		
Palustrine Scrub-Shrub	SPR4	1.23979E-07		0.74	9.17443E-08		
Palustrine Scrub-Shrub	SPR4	0.000224371		0.74	0.000166035		
Palustrine Scrub-Shrub	SPR4	2.841468603		0.74	2.102686766		
Palustrine Scrub-Shrub	SPR4	0.004639767		0.74	0.003433428		
Palustrine Scrub-Shrub	SPR4	4.283E-05		0.74	3.16942E-05		
Palustrine Scrub-Shrub	SPR5	0.002066841		0.67	0.001384784		
Palustrine Scrub-Shrub	SPR5	0.034418182		0.67	0.023060182		
Palustrine Scrub-Shrub	SPR5	2.186099524		0.67	1.464686681		
Palustrine Scrub-Shrub	SPR5	3.47235E-06		0.67	2.32648E-06		
Palustrine Scrub-Shrub			40.71801			32.06672008	**0.787532**

SPR5* - Wetland polygons located outside of FACWet assessment areas that were assigned the FCI of SPR5 because of similarity in landscape position

Appendix H – FA Committee meeting minutes and emails with attachments

Mary Powell

From: Ron Beane [/o=ero/ou=eroserver/cn=recipients/cn=rbeane]
Sent: Monday, July 07, 2008 2:54 PM
To: 'Peter_plage@fws.gov'; Klute, David; Jackson, Tina; Steve Dougherty; Tom Ryon; 'Gary.drendel@tteci.com'; Sitoski, Karen M Nwo; Ken Brink; Cecily H. Y. Mui; Peake, Elizabeth B Nwo; Brookesfox; Ray And Erin Sperger; Carpenter, Lance; Seth Gallagher
Cc: Mary Powell
Subject: Chatfield Reallocation Technical Workshop

Chatfield Ecological Functions Technical Workshop (terrestrial)

ERO Resources would like to hold a technical workshop to discuss a proposed approach to evaluating ecological functions at Chatfield Reservoir. Information gathered during this workshop will be incorporated into the "systems" mitigation approach for wildlife and wetland impacts of the proposed Chatfield Reallocation project. The terrestrial habitat (anything above the surface of the water) at Chatfield Reservoir provides shared ecological functions for the three primary ecological issues (Preble's meadow jumping mouse, avian habitat, and wetlands) identified during the Chatfield Reallocation process. ERO is developing an ecological services approach for evaluating system-wide impacts adapted from existing modeling tools such as Habitat Evaluation Procedures and Habitat Equivalency Analysis. ERO will present this approach during this technical workshop to solicit feedback and input from local regulatory and technical experts.

Goal: Reach Consensus on the approach and assignment of Ecological Function Values to be carried forward in the analysis.

Objectives:

1. Develop a standard unit for evaluating three diverse ecological attributes that can be used in the Corps Incremental Costing Analysis (ICA)
2. Provide a process for evaluating mitigation that incorporates the complimentary habitat requirements of these three ecological attributes: protected species (Preble's), avian community, wetlands functions

The meeting is scheduled for Monday, July 28th from 9-12 am at The Colorado Division of Wildlife Denver Headquarters - 6060 Broadway. More information will be provided prior to the meeting.

Please confirm your attendance with Ron Beane or Mary Powell at ERO Resources.

Ron Beane

Senior Wildlife Biologist/Principal

ERO Resources Corp.

1842 Clarkson St.

Mary Powell

From: Ron Beane [/o=ero/ou=eroserver/cn=recipients/cn=rbeane]
Sent: Tuesday, July 08, 2008 10:54 AM
To: Mary Powell
Subject: FW: Chatfield Reallocation Technical Workshop

-----Original Message-----
From: Carey, Timothy T NWO [mailto:Timothy.T.Carey@usace.army.mil]
Sent: Tuesday, July 08, 2008 8:37 AM
To: Peter_Plage@fws.gov; Ron Beane
Cc: Franklin, J Scott NWO
Subject: RE: Chatfield Reallocation Technical Workshop

Pete & Ron -

By the end of this summer my office plans to start using FACWet (Functional Assessment for Colorado Wetlands), which was developed by Dr. Brad Johnson at CSU through a contract with CDOT. Scott Franklin in my office is the POC for FACWet. It's my understanding he's already discussed use of FACWet for the Chatfield Reallocation with Mary Powell.

Tim

-----Original Message-----
From: Peter_Plage@fws.gov [mailto:Peter_Plage@fws.gov]
Sent: Monday, July 07, 2008 3:14 PM
To: Ron Beane
Cc: Carey, Timothy T NWO
Subject: Re: Chatfield Reallocation Technical Workshop

Ron,

You mention regulatory experts. Should a person on Tim Carey's staff be present as an expert in wetlands values? How about EPA?

Peter Plage
Colorado Field Office, U.S. Fish and Wildlife Service P.O. Box 25486, DFC (MS 65412) Denver, CO 80225-0486

Phone 303-236-4750
Fax 303-236-4005

"Ron Beane" <rbeane@eroresources.com>

07/07/2008 02:53 PM To
<Peter_Plage@fws.gov>, "Klute, David" <David.Klute@state.co.us>,
<Tina.Jackson@state.co.us>, "Steve Dougherty" <sdougherty@eroresources.com>,
"Tom Ryon" <tryon@ottertail.us>, <Gary.Drendel@tteci.com>,
<karen.m.sitoski@usace.army.mil>, <ken.brink@state.co.us>,
<cecilym@sspr.org>, "Peake, Elizabeth B NWO"
<Elizabeth.B.Peake@usace.army.mil>, <brookesfox@comcast.net>,
<ersperger@gmail.com>, "Carpenter, Lance" <Lance.Carpenter@state.co.us>,
"Seth Gallagher" <Seth.gallagher@rmbo.org> cc "Mary Powell"
<mpowell@eroresources.com> Subject Chatfield Reallocation Technical Workshop

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Please confirm your attendance with Ron Beane or Mary Powell at ERO Resources.

Ron Beane
Senior Wildlife Biologist/Principal
ERO Resources Corp.
1842 Clarkson St.
Denver, CO 80218
Ph (303) 830-1188
Fax (303) 830-1199
Cell (303) 907-5082

ERO Resources Corp.
1842 Clarkson Street
Denver, CO 80218
(303) 830-1188
Fax: 830-1199
www.eroresources.com
ero@eroresources.com

Chatfield Reallocation Functional Assessment Methods

Meeting Minutes for

July 28, 2008

9:00 am to 12:00 pm

Colorado Division of Wildlife, 6060 Broadway, Denver, Colorado

Attendees:

Eric Laux (via teleconference) – U.S. Army Corp of Engineers (Corps)
Betty Peake (via teleconference) – Corps
Karen Sitoski – Corps
Scott Franklin – Corps
David Klute – Colorado Division of Wildlife (CDOW)
Tina Jackson – CDOW
Pete Plage – U.S. Fish and Wildlife Service
Cecily Mui – South Suburban Park and Recreation District/South Platte Park
Ann Bonnell – Audubon Society of Greater Denver/South Platte Group of the Sierra Club
Brooke Fox – Chatfield Basin Conservation Network
Tom Ryon – Ottertail Environmental
Steve Dougherty – ERO Resources Corp. (ERO)
Ron Beane – ERO
Jana Pederson – ERO
Mary L. Powell – ERO

Meeting Summary:

The purpose of the meeting was to present work done to date by ERO, Ottertail, and TetraTech on developing a method to assess impacts using an ecological functions approach. The presentation consisted of a Power Point slide show. The majority of the meeting was spent going through the presentation and discussing questions and comments raised during the presentation.

1. Introductions

2. Power Point presentation of functional assessment approach (see attached outline of presentation)
3. Questions, answers, and discussions
    a. Extensive questions and discussion about how the functional values for Preble's, bird, and wetland habitats were determined.
    b. The group decided to refine functional values during a future meeting.
    c. In general, the group felt the functional assessment approach has value, but needs refinement with group input.
    d. In general, the group thought that "translating" the on-site resource mapping done for the EIS into equivalent CDOW riparian mapping was a reasonable approach to developing a uniform way to determine functional values for impacts and potential mitigation.
4. Set time and date for next meeting (9:00AM to 12:PM, August 28th, 2008)

1

2 **Introduction**

Project background
- Ongoing EIS Process
- Three Integrated Terrestrial Resources
- “Systems” Mitigation Approach
  - Landscape vs. Piecemeal
  - Ecologically Beneficial
  - Accounts for Overlap in Resources
  - Consistent w/ Douglas County Master Plan/CBCN

3 **Introduction**

Issues
  - Resources Mapped Independently On-site
  - Need for Complimentary Mapping Off-site
- **Goals and Objectives**
  - Create “common currency” for impacts to avifauna, wetlands, and Preble’s
  - Screening for potential mitigation sites
  - Incremental Cost Analysis

4 **Approach**

1. Research existing models
a. Habitat Evaluation Procedure (HEP)
b. Habitat Suitability Index (HSI)
c. Habitat Equivalency Analysis (HEA)
d. Resource Equivalency Analysis (REA)
e. Montana Wetland Functional Assessment
f. Functional Assessment of Colorado Wetlands (FACWet)

5 **Approach**

2. Model Selection/Rejection
a. Criteria
   i. Capture overlap of resources
   ii. Transferable to potential off-site mitigation areas
   iii. Use existing mapping
   iv. Outputs are appropriate for economic analysis

6 **Approach**

3. Develop Project-Specific Model
a. Assess existing information on and off site
b. Reconcile mapping for three resources
c. Identify off site mapping (CDOW)
d. Equate on site mapping with CDOW mapping
e. Assign ecological function index values
f. Compare on and off site
g. Calculate impacts as functional units

7 **Flow Chart of Approach**

8 **Flow Chart of Approach**

9 **On-Site Resource Mapping**

Chatfield Reallocation EIS
Alternative Pool
Elevations

10 **On-Site Resource Mapping**

11 **On-Site Resource Mapping**

12 **On-Site Resource Mapping**

13 **On-Site Resource Mapping**

14 **Flow Chart of Approach**

15 **Off-Site Resource Mapping**

16 **Flow Chart of Approach**

17 **Developing EFIs**

On-site and Off-site Ecological Function Index (EFI)

18 **Developing EFIs**

CDOW – Chatfield EIS Mapping Units Equivalency

19 **Flow Chart of Approach**

20 **Cumulative EFI Mapping**

21 **Cumulative EFI Mapping**

22 **Cumulative EFI mapping**

Off-site CDOW
Resource Ecological Function Index

23 **Flow Chart of Approach**

24 **Cumulative EFI Mapping**

25 **Flow Chart of Approach**

26 **Debit Analysis**

Debit Analysis

EFU Debits

27 **Credit Analysis**

Credit Analysis

- On-site Enhancement
- Off-site Preservation and/or Enhancement

28 **Credit Analysis**

Credit Analysis

Identify Parcels and Baseline EFUs

29 **Next Steps**

Discount and Markup Factors

- Discounts
  - Zoning
- Mark-ups
  - Connectivity
  - Acquisition Tools (Fee & CE, CE, Contract)

– Proximity
– Others?

30 **Next Steps**

Discount and Markup Factors

– Determine incremental gain from mitigation
  - Effects of future development on EFUs with and without preservation and with and without enhancements

31 **Next Steps**

Implementation

a. Developing mitigation opportunity screening criteria
b. Field assessment protocol
c. ??

32 **Next Steps**

Monitoring and Adaptive Management

a. Inundation milestones
b. Mitigation prior to or concurrent with impacts
c. Develop site-specific management plans
d. Track “credits”
e. Consequences for mitigation shortcomings

33

Group Input

- Acceptance of Approach?
- Values of EFI
- Discount and Markup Factors

34

On-site Mitigation

35

“Pay-as-you-go” Mitigation

1

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On-site Mitigation

35

“Pay-as-you-go” Mitigation

Mary Powell

From: Mary Powell [/o=ero/ou=eroserver/cn=recipients/cn=mpowell]
Sent: Thursday, August 21, 2008 3:04 PM
To: Peake, Elizabeth B Nwo; 'Eric.a.laux@usace.army.mil'; Steve Dougherty; Tom Ryon; 'Gary.drendel@tteci.com'; Klute, David; 'Peter_plage@fws.gov'; Franklin, J Scott Nwo; Sitoski, Karen M Nwo; Cecily H. Y. Mui; Jackson, Tina; Abennell@juno.com; Brookesfox
Subject: Next Functional Units Workshop

Attachments: (chatfield ecological functions.xls) stubbed.htm; (chatfield ecological functions_blank.xls) stubbed.htm; (ecological functions of bird habitat 8-20-08.doc) stubbed.htm; (ecological functions of pmjm habitat-8-20-08.doc) stubbed.htm

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This email is to confirm that we are scheduled to meet on Thursday August 28th at the Corps' office at Chatfield. We had originally planned on meeting at 9:00 AM. Due to various schedules, I'd like to move the start time to 9:30 AM.

The primary purpose of the meeting will be to revisit the functional index numbers that ERO and Ottertail have assigned to terrestrial wildlife habitat. To help you get thinking about the project I've attached a spreadsheet that has the currently proposed numbers and a blank spreadsheet that you can doodle on. I've also attached a summary of the approach used by ERO and Ottertail to assign index numbers to the habitat components related to birds and Preble's.

Finally, it has been suggested that at least a core group of people continue to meet regularly to keep the mitigation plan moving forward. If we shoot to meet about 2 weeks after the 28th, we'll be looking at September 11 or 12. Please bring your calendars on Thursday so that we can set up the next meeting.

Thanks!

Mary L. Powell

Natural Resource Specialist
Vice President

ERO Resources Corp. . 1842 Clarkson St. . Denver, CO 80218 . 303.830.1188 . Fax: 830.1199 . www.eroresources.com <blocked::http://www.eroresources.com/>

Chatfield Ecological Functions

Chatfield EIS Mapping Unit	Habitat Ecological Functions Values (EFV)				Wetland Ecological Functions Values (EFV)						Total EFI
	Breeding	Winter/ Migration	Forage	Cover	Flood Atten.	Surface water storage	Sed./Nutrient Retention	Shoreline Stabilization	Groundwater Recharge	Food Chain	
Wildlife Habitat (Community)											
Chatfield EIS Bird Habitat											
Shoreline	0.25	0.75	0.5	0.25							1.75
Shrub (riparian)	1	1	1	1							4
Trees (mixed age riparian)	1	1	1	1							4
Upland	0.25	0.5	1	0.5							2.25
Water	0.5	0.75	0.5	0.25							2
Wetland/Non-Woody	1	0.5	1	1							3.5
Mature Cottonwood	1	1	1	1							4
None	0	0	0	0							0
Non-Habitat	0	0	0	0							0
Chatfield EIS PMJM Habitat											0
High Value Riparian	1	1	1	1							4
Low Value Riparian	0.5	0.25	0.75	0.5							2
Upland	0	0.1	0.65	0.25							1
Non-Habitat	0	0	0	0							0
None*	0	0	0	0							0
Chatfield EIS Wetland Habitat											
Lacustrine Emergent					0	0	0.3	0.6	1	0.8	2.7
Palustrine Aquatic Bed					0	0	0.3	0	1	0.3	1.6
Palustrine Emergent					0.5	0.9	0.9	0.9	1	0.8	5
Palustrine Scrub-Shrub					0.9	0.8	0.9	0.9	1	0.7	5.2
Palustrine Forested					0.6	0.7	0.9	0.6	1	0.8	4.6
None					0	0	0	0	0	0	0

Notes:

* = (area outside range of PMJM)

= Functions not applicable

For wetlands

Did not use T&E, wildlife, recreation, or aquatic for functions. Covered elsewhere.

Chatfield EIS Bird Habitat	Shoreline	Riparian Shrub	Riparian Trees	Upland	Water	Wetland/ Non-Woody	Mature Cotton-wood	None	Non-Habitat	Generalist
BBA Equivalent			Lowland Riparian (LRD, SLC, TTR?)	Grassland (TSG, TMGP, TMXP)	Lakes/ Streams (OWL, OWS)	Emergent (AEM, ASU)	Lowland Riparian (Mature LRD)	Urban ??		
	KILL		BUOR	WEME	MALL	MALL		HOSP		MODO
	COSN		YEWA	HOLA	GWTE	GWTE		HOFI		AMRO
	SORA		WEKI	LABU	BEKI	AMCO		EUST		RTHA
(birds listed by habitat	SPSA		BBMA	LASP		CITE		COGR		
in Kingery 1996 and	VIRA		NOFL	KILL		BWTE		ROPI		
recoreded on CSP)			GHOW	CONI		RWBB		EUCD		
			HOWE	BUOW		YHBB				
			EAKI	SWHA		COYE				
			AM.KE			BRBB				
			WWPE			NOHA				
						VIRA				
						SORA				
Added based on Site Surveys/BBA										
		WIFL	YBCH		CAGO	AMBI	GBH			
		LAZBU	BTHU		WHPE		DCCO			
		BLGR	COHA				WODU			
		SOSP	AMRE				YBCC			
		GRCA	HAWO				LEFL			
		SPTO	BCCH				REVI			
			BAEA	BAEA	BAEA		Thrush sp.			
Winter										
		DEJU	BCCH	FEHA	Waterfowl					
			BAEA	HOLA						
Other Wildlife			Big game cover			Bull frog				
			NLFrog			NLFrog				
			CGSnake			CGSnake	CGSnake			

Seasonal/ foraging
TES Species
Locally/regionally rare
Birds of Conservation Concern

Chatfield Ecological Functions

Chatfield EIS Mapping Unit	Habitat Ecological Functions Values (EFV)				Wetland Ecological Functions Values (EFV)						Total EFI
	Breeding	Winter/ Migration	Forage	Cover	Flood Atten.	Surface water storage	Sed./Nutrient Retention	Shoreline Stabilization	Groundwater Recharge	Food Chain	
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Notes:
* = (area outside range of PMJM)
= Functions not applicable

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Did not use T&E, wildlife, recreation, or aquatic for functions. Covered elsewhere.

Bird Habitat Descriptions and Associated Information

Considering areas that may be inundated by the proposed project, biologists created a habitat map for the EIS (Figure 3-11) of six bird habitats, including wetlands, woodlands (including mature cottonwood forest and other woodlands as subcategories), shrublands, open water, shorelines, and upland habitats. Although this habitat map does not comprise habitats throughout the entire Chatfield Lake Project Area, it provides a tool to assess impacts to bird habitats surrounding Chatfield Reservoir resulting from the implementation of selected alternatives. This area of inundation represents the EIS ecological study area (Study Area). Biologists used high-resolution aerial photography to map habitats in the field. The field maps were digitized into a GIS where they could be further summarized and analyzed.

Table 4-9. Estimate of Acres of Wildlife Habitats at Chatfield Reservoir Inundated Beyond Current Operations by Alternative

Habitat Type	Alternatives 1 and 2	Alternative 3	Alternative 4
Mature Cottonwood	0.0	42.5	15.3
Other Trees	0.0	130.7	82.9
Shrub	0.0	31.5	13.7
Upland	0.0	217.7	66.8
Wetland/Non-woody	0.0	22.9	9.0
Shoreline	0.0	22.2	9.9
Water	0.0	70.5	<0.1
Non-Habitat	0.0	49.0	17.4
Total	0.0	587	215

The following discussion describes each of the wildlife habitat types as selected from the mapping effort.

Mature Cottonwood – These are areas along the South Platte River that have old, large cottonwood trees with high canopy cover and represent mature bottomland forest. The habitat type is dominated by plains cottonwoods (*Populus deltoides*) but there are also narrowleaf cottonwood (*Populus angustifolia*), peachleaf willow (*Salix amygdaloides*), as well as other deciduous species. The understory is relatively open and is comprised of riparian grasses and forbs as well as some shrubs including coyote willow (*Salix exigua*).

Other Trees – these are the remaining forested areas within the Study Area. This habitat comprises the riparian areas dominated by plains and narrow-leaf cottonwoods, peach-leaf willows, and boxelder (*Acer negundo*). They include the even aged stands of cottonwoods along the reservoir edges as well as the multi-aged stands at the mouths of Deer Creek, Plum Creek, and the South Platte River that are in various successional stages. These forests do not have substantial areas of mature cottonwood. Understory can be bare, as when adjacent to shorelines, to thick with grasses, forbs and shrubs.

Shrubs- this habitat type is comprised of riparian shrubs, mostly coyote willow, and other associated shrubs adjacent to streams and floodplains. This may include crack willow (*Salix fragilis*), chokecherry (*Prunus virginiana*), snowberry (*Symphoricarpos albus*), and skunkbush sumac (*Rhus trilobata*). Other shrub types are found in upland areas within the Chatfield Lake Project Area, but are not found in the Study Area. These include pockets of scrubland habitat interspersed in swales within the upland habitat, but are not included in the habitat mapping as they are not in the Study Area.

Uplands – these include areas dominated by grasses including smooth brome (*Bromus inermis*), crested wheatgrass (*Agropyron cristatum*), western wheatgrass (*Pascopyrum smithii*), blue grama (*Bouteloua gracilis*), and sand dropseed (*Sporobolus cryptandrus*). These can also include weedy areas on upper creek terraces that include Canada thistle (*Cirsium arvense*), cheatgrass (*Bromus tectorum*), and knapweed (*Centaurea* sp.).

Wetland/Non-woody – this habitat type includes riparian and shoreline areas that do not contain trees or shrubs and are mostly comprised of wetland associated plants. This includes cattails (*Typha* sp.), rushes (*Juncus* sp.), sedges (*Carex* sp.), reed canarygrass (*Phalaris arundinacea*), common reed (*Phragmites australis*), and quackgrass (*Elymus repens*). These are typically areas that are inundated due to spring flooding, summer rain storms, or reservoir levels.

Shoreline – these are unvegetated areas around the reservoir and inlets. They can be gravelly, sandy, or silty.

Water – Open water habitat include those areas on Chatfield Reservoir and surrounding ponds.

Non-habitat – Non-habitat includes paved areas and other man-made structures.

In addition to habitat mapping and at the request of USFWS, biologists conducted point count surveys in June 2006 in three of the habitats described above that collectively comprise the riparian system (see Appendix Q of the EIS). This information was used to better characterize breeding birds in riparian areas likely to be affected by the proposed project including herbaceous wetlands/non-woody areas, riparian shrublands, and woodlands. Twelve point count stations (50-meter radius) were established in these three habitat types; each type having four stations each. Wetland/non-woody areas included herbaceous wetlands, mudflats, and backwaters that were associated with riparian areas. Riparian shrublands included areas dominated by coyote willow. Tree-dominated woodland areas included successional and mature forest types. Successional forest types included cottonwood, box elder, and narrow-leaf cottonwood forests that are even aged or simply smaller in stature. Mature forest types were comprised of large cottonwood trees that represent mature bottomland forest. The mature forests are restricted to areas along the South Platte River.

The findings in Table 3-3 are based on one breeding season of field data (2006) and information from Audubon Society of Greater Denver. Additional years of field data would increase precision. Field data were summarized by calculating averages of species richness, abundance, and diversity. A dominant species is listed for each habitat type.

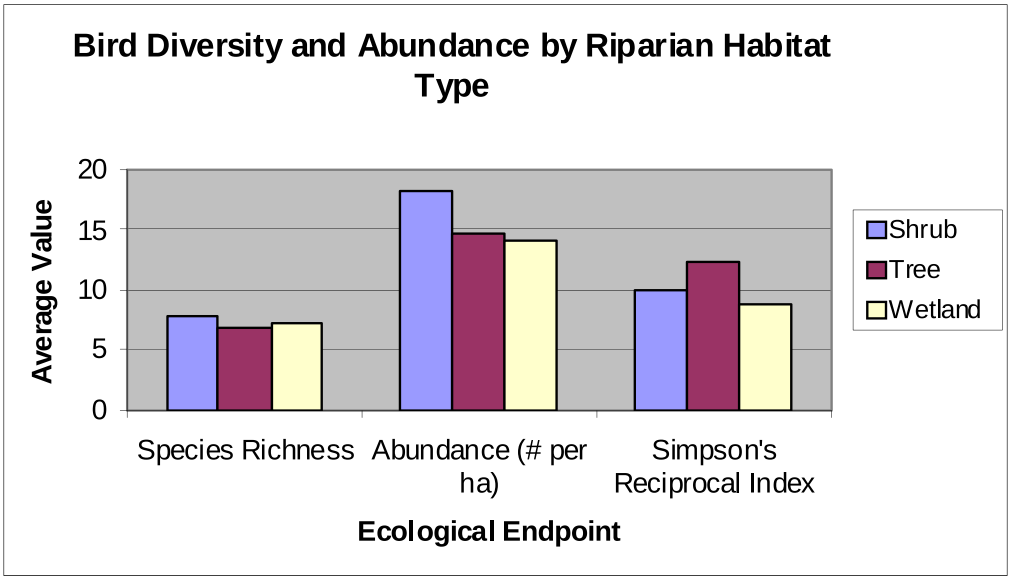
Table 3-3. Breeding Bird Ecological Parameters[1] by Riparian Habitat Type

Habitat Type	Species Richness	Abundance (# per ha)[5]	Diversity[2]	Dominant Species[3]
Wetlands	7.13	14.16	8.87	Red-winged blackbird or common yellowthroat[4]
Shrublands	7.88	18.30	9.90	Song sparrow, spotted towhee
Woodlands	6.75	14.64	12.37	Yellow warbler, hairy woodpeckers, great horned owls

[1] Parameter values are averages; n = 8
[2] Simpson's Reciprocal Index of Diversity
[3] Dominant species observed during June 2006 surveys
[4] Cattail dominated or sedge/rush dominated, respectively
[5] 1 hectare (ha) equals approximately 2.5 acres.

Based on the results of the June 2006 point count surveys, a total of 43 bird species was identified in at least one of the riparian habitat types. Riparian shrublands comprised the greatest variety of species (species richness = 7.88, Table 3-3, Figure 3-10) and had the greatest number of birds per area. Woodlands had the lowest variety of species, but the species present tended to be relatively even in abundance resulting in the greatest diversity of the three habitat types sampled (Figure 3-10).

Figure 3-10. Bird Diversity in Riparian Habitats at Chatfield



Each habitat type supports a different community of bird species, with additional bird species using two or all three habitat types. The most dramatic difference is between wetlands and woody vegetation, such as woodlands and shrubs. Wetlands support a distinct group of birds including shorebirds, red-winged blackbirds, killdeer, and yellow warblers depending on the type and height of vegetation present. Red-winged blackbirds and many shorebirds nest exclusively in wetland habitats; however, killdeer and yellow warbles are more widespread. Woody vegetation supports a variety of passerines, woodpeckers, and owls not found in wetlands.

Less dramatic is the difference in bird communities among woodlands and shrublands. Spotted towhees, willow flycatchers, and gray catbirds are most often found in shrublands. Woodlands support many cavity nesting birds, including woodpeckers, black-capped chickadees, and house wrens. Woodlands with thick understory support yellow-breasted chats, Bullock's orioles, red-eyed vireos, and many warbler species. Open woodlands support western wood-peewees, least flycatchers, and American redstarts.

One forest type that is rather unique along the foothills and plains interface of Colorado's Front Range is mature cottonwood forest. The study area has over 50 acres of mature cottonwood forest along the South Platte River that offer a variety of habitats as understory, midstory, and canopy layers. This forest type is rich in diversity and provides habitat niches for a variety of birds including red-eyed vireos and thrushes.

In more general terms, the study area provides riparian and wetland habitats for birds and other wildlife species. In Colorado's semiarid environment, riparian and wetland habitats are essential to many wildlife species. Riparian habitats harbor 2 to 10 times as many individual birds as do adjacent, non-riparian, vegetation (Rich 2002). Many species depend on riparian habitats for at least some part of their life cycle. In terms of breeding birds, species that nest in riparian habitats over 90 percent of the time are considered "riparian obligate species." Species that nest over 60 percent of the time in riparian habitats are considered "riparian dependent species." Table 3-4 lists bird species observed during the 2006 breeding season that are either riparian obligates or dependent species.

Table 3-4. Bird Species Supported by Riparian Habitats at Chatfield Reservoir.

Bird Species	Riparian Use[1]	Riparian Habitat Observed[2]
American Redstart	O	Wet
Belted Kingfisher	O	Wet
Broad-tailed Hummingbird	O	Wet, Shrub, Wood
Common Yellowthroat	O	Wet
Song Sparrow	O	Wet, Shrub, Wood
Willow Flycatcher	O	Wet
Yellow Warbler	O	Wet, Shrub, Wood
Yellow-breasted Chat	O	Wet, Shrub, Wood
American Goldfinch	D	Wet, Shrub, Wood
Black-Capped Chickadee	D	Shrub, Wood
Bullock's Oriole	D	Wood
Gray Catbird	D	Wet, Shrub
House Wren	D	Wet, Shrub, Wood
Red-eyed Vireo	D	Wood
Tree Swallow	D	Wet
Western Wood-Peewee	D	Wet, Shrub, Wood

Source: Bird Species – 2006 Chatfield Breeding Bird Surveys (see Appendix Q)
[1] Riparian Use: Obligate (O) or Dependent (D) (based on Rich 2002)
[2] Riparian Habitat Observed: Wetlands (Wet); Shrublands (Shrub); Woodland (Wood)

The Bureau of Land Management (BLM) states that the presence of the yellow-breasted chat and song sparrow indicates healthy riparian habitats especially along the South Platte River (BLM no date). This coupled with the presence of many other obligate and dependent riparian bird species indicate that the riparian habitats within the study area are in good health.

Ecological Functions of Bird Habitat

The Ecological Functions Model focused on the services and functions of each of the mapped habitat types for both birds and Preble's meadow jumping mouse (PMJM). Evaluation of avian habitat intentionally did not look at individual species, but rather focused on the ecological services each habitat provides to the overall avian community.

Bird habitats at Chatfield should be considered as breeding, wintering and migration/stopover habitat. The study area is considered ideal breeding, wintering, and stop-over habitat providing fresh water, protection from predators, and food resources (Duncan et al. 2001). Breeding habitat provides all the resources necessary for courtship, nesting, raising young and sustaining both adults and young until the young migrate or are fully independent. Winter habitat provides the resources necessary to sustain a bird through winter, including food, protection from the elements, and protection from predators. Stop-over habitat allows birds to regain mass lost during migration and allows birds to replenish themselves in order to continue migration. The stop-over habitat is likely most important to small forest dwelling birds that typically require frequent stops during migration. The forested portions of the study area, especially along the South Platte River and Plum Creek, provide all the resources forest dwelling birds need during migration. Given the large body of water and the extensive shoreline, the study area is important stop-over habitat for waterbirds and shorebirds as well.

Ecological services provided at Chatfield State Park (CSP) and regionally for the avian community typically are:

1. Breeding
2. Wintering
3. Migration/stopover
4. Forage
5. Cover

Forage and cover are considered critical resources for the breeding, wintering and migration services provided to resident birds. In addition to the service provided to the resident avian community CSP also provides forage and cover service to species breeding or wintering off-site. For example, golden eagles, great blue herons, and white pelican all forage on CSP in summer, bur primarily nest or roost off-site. Similarly, bald eagles and Canada geese use CSP for roosting cover in winter, but much of their foraging occurs more regionally.

Ecological Function Values (EFV) were assigned to each bird habitat mapping unit based on habitat services described above. EFV for avian habitat followed a similar approach to PMJM with values assigned based on the habitats and point count surveys described above (TetraTech 2006), Breeding Bird Atlas (BBA) I results (Kingery1996), preliminary results of BBA II, a twelve-year bird census of Chatfield SP (Kingery undated), species grouping by habitat types described in Kingery (1996), Christmas Bird Count (CBC) data, and professional judgment based on ERO's and Ottertail's combined extensive experience conducting avian surveys in grasslands, riparian woodlands, and shrublands in Douglas and Jefferson counties. The general criteria used in assigning avian values include:

- Importance to local avian community
- General quality of the habitat unit, including multi-strata vegetation, plant species diversity, other indices of quality (e.g., riparian areas support many obligate and riparian dependant species)
- General ability of the habitats as they exist, both on and off-site, to meet the habitat needs, year-round or seasonally, of the avian communities that occupy them (bird groupings on spreadsheet)
- Species richness/diversity as an indicator of breeding value
- Vegetation structure as an indicator of cover value

Other Services considered, but not used (could be added as a column and then scaled to 1) include:

- Habitats used by State/CNHP sensitive species (can include garter snake and NL frog for more general "wildlife habitat function" – This would boost the overall WFI for Mature cottonwood for rare birds since most rare species are habitat specialists and slightly boost riparian trees and wetlands if include herps)

PMJM Habitats used at Chatfield State Park

Three habitat types were used to map PMJM habitat within the EIS study area. They are:
1) High Quality Riparian Habitat
2) Low Quality Riparian Habitat
3) Upland Habitat

High Quality Riparian Habitat – those habitat areas that support multi-strata woody riparian vegetation including willow shrubs and contain relatively high plant diversity especially in the understory.

Low Quality Riparian Habitat – habitat areas that support multi-strata woody riparian vegetation that do not support relatively high plant diversity or that are lacking in woody riparian vegetation (i.e., missing multi-strata), but still contain herbaceous plants of adequate diversity.

Uplands – areas outside of the normal riparian zone that provide upland grasses and shrubs of substantial cover and provide forage for the PMJM. Nearly all uplands adjacent to high or low quality riparian habitat meet this definition.

Ecological Functions of PMJM Habitat

The Ecological Functions Model focused on the services and functions of each of the mapped habitat types for both birds and Preble's meadow jumping mouse (PMJM). Ecological services of PMJM habitat generally are described by the U.S. Fish and Wildlife Service (63 FR 26517, 1998) and Colorado Division of Wildlife (Shenk and Eussen 1998, Shenk unpublished). The draft recovery plan for PMJM (USFWS 2003) states that delineation of PMJM habitat "needs to include all the necessary resources for the mice to nest/breed, find cover, travel, feed and hibernate". Based on this information ecological services provided at Chatfield State Park (CSP) for PMJM generally consist of:

1. Breeding
2. Hibernating
3. Foraging
4. Protection from predators (cover)

Ecological Function Values (EFV) were assigned to each PMJM habitat mapping unit based on habitat affinities described in the literature (Trainor et al. 2005, Bakeman and Deans 1997, Meaney et al, 1997, Schoor 2001, Clippinger 2002) the PMJM Draft Recovery Plan, the final designation of critical habitat (68 FR 37276) and professional judgment based on ERO's and Ottertail's combined extensive experience of studying and trapping PMJM for over 16 years within Colorado Front Range and specifically within Douglas County. The general criteria used in assigning PMJM values include:

- General quality of the habitat unit (e.g., general cover including multi-strata vegetation and plant diversity (Trainor et al. 2005) as an indictor of cover value,

- Importance of habitat to provide general cover and forage including thick understory vegetation and down woody debris as an indication of forage and breeding value,
- Juxtaposition of riparian habitat to uplands (e.g., adjacent or isolated) and active stream channel (e.g., river, stream, or pond in terms of relative ability to maintain or create new habitat) as an indicator of foraging value,
- PMJM presence as indicator of breeding/foraging value,
- Vegetation structure and habitat unit juxtaposition as an indicator of hibernation potential.

ERO Resources Corp.
1842 Clarkson Street
Denver, CO 80218
(303) 830-1188
Fax: 830-1199
www.eroresources.com
ero@eroresources.com

Chatfield Reallocation Functional Assessment Methods

Meeting Minutes for

August 28, 2008

9:30 am to 12:30 pm

Army Corps of Engineers Tri-Lakes Project Office

9307 S. Wadsworth Blvd., Littleton, Colorado

Attendees:

Eric Laux (via teleconference) – U.S. Army Corp of Engineers (Corps)
Betty Peake (via teleconference) – Corps
Karen Sitoski – Corps
Pete Plage – U.S. Fish and Wildlife Service (Service)
Cecily Mui – South Suburban Park and Recreation District/South Platte Park
Ann Bonnell – Audubon Society of Greater Denver/South Platte Group of the Sierra Club
Mike Mueller – Sierra Club
Brooke Fox – Chatfield Basin Conservation Network
Tom Ryon – Ottertail Environmental
Steve Dougherty – ERO Resources Corp. (ERO)
Ron Beane – ERO
Jana Pederson – ERO
Mary L. Powell – ERO

Meeting Summary:

The purpose of the meeting was to begin assigning functional values to Preble's, bird, and wetland habitat in the EIS study area. The values will be used to calculate numbers of functional units impacted by the currently preferred EIS alternative.

1. Introductions
2. There was discussion about the method used to map on-site Preble's habitat as High, Low, Upland, Non-habitat. Some of the discussion was framed in the context of the effect of non-native species.

   a. A number of agencies, including EPA and the Service, have developed definitions of riparian habitat and descriptions of the important functions they serve.

   b. Some descriptions of riparian areas mention the importance of diverse native communities.

   c. Some attendees suggested the possible need to do additional mapping of riparian areas to take into account weeds or to differently categorize Preble's habitat.

   d. The group was reminded that the mapping used for the functional assessments must be based on mapping used for the EIS process and that the existing mapping had been previously agreed to by the Service.

3. The group discussed in more detail what types of habitats are included in the Preble's mapping. Mapping primarily based on structural components of vegetation communities.

4. General discussion of birds and bird habitat mapping

   a. Bird habitat mapped by structure of vegetation communities (with mature cottonwood separated out from the "trees" category).

   b. Non-vegetated habitat was also mapped (shoreline and water)

   c. Discussion of what bird species are being considered

      i. Depending on the list being used, more that 300 species of birds could be under consideration.

      ii. Species lists available include: Chatfield checklist, Audubon, EIS point count, Breeding Bird Atlas, South Platte Park, NDIS county lists.

   d. Group decided to table bird topic in favor of addressing less complex Preble's topic.

5. Detailed discussion of functional value of Preble's habitat in relation to species habitat needs (breeding, winter, travel, forage, cover)

   a. Came to a consensus on what Preble's generally needs for each activity. Decided to eliminate the travel category because it is duplicative of other categories.

   b. Established scale for habitat values (1 = optional, 0.75 = good, 0.50 = fair, 0.25 = poor, 0.00 = not used).

   c. Filled out functional index chart for habitat needs by mapping units (see attached chart).

6. Agreed that Preble's function index values were set and would not be revisited.
7. Returned to discussion of birds.
    a. An alternative approach to assigning functional values to bird habitat mapping units was presented and discussed. Would use a "yes/no" method for whether each bird species made use of mapped habitats for four different functions (breeding, winter, cover, forage).
    b. Discussed ways to pare down the level of effort associated with more than 300 bird species.
    c. Group agreed that ERO would attempt to group species into guilds based on habitat affinities.
    d. Corps pointed out that shoreline and water habitats would not be reduced due to project and that accounting for their functions is not necessary.
    e. Group also decided that it was also probably not necessary to include upland habitat in the functional assessment.
    f. Agreed to devote next meeting to birds.
8. Set time and date for next meeting (9:30AM to 12:00PM, Sept. 12th, 2008, location TBD).

Mary Powell

From: Mary Powell [/o=ero/ou=eroserver/cn=recipients/cn=mpowell]
Sent: Tuesday, September 09, 2008 4:06 PM
To: Peake, Elizabeth B Nwo; 'Eric.a.laux@usace.army.mil'; Tom Ryon; Ron Beane; Brookesfox; Jana Pedersen; Steve Dougherty; 'Gary.drendel@tteci.com'; 'Peter_plage@fws.gov'; Ann Bonnell; Cecily H. Y. Mui; Klute, David; 'Mmuller@nilenet.com'; Sitoski, Karen M Nwo
Cc: Franklin, J Scott Nwo; Jackson, Tina
Subject: Chatfield Reallocation EIS Functions Meeting

Attachments: (chatfield bird list - process.xls) stubbed.htm; (draft fa meetings minutes.pdf) stubbed.htm; (greenway foundation map.pdf) stubbed.htm

(chatfield bird list - proces... (draft fa meetings minutes.pdf... (greenway ›undation map.pdf)

This is to confirm that we will be meeting this Friday, September 12 to continue our work on creating an ecological function-based method to determine impacts and mitigation associated for the conceptual mitigation plan for the Chatfield Reallocation EIS.

The meeting will be held at the Greenway Foundation office at 5299 DTC Blvd., Suite 710 (see attached map). Currently, the office will not be available until 10:00AM. Unless I get adamant responses that 10:00AM will not work, please plan on phoning in or arriving at the meeting at 10:00AM. If there is significant outcry, we can make special arrangements to get in earlier.

To refresh everybody's memories, we wrapped up assigning values for Preble's habitat at our last meeting (see attached chart for final Preble's habitat values).

The upcoming meeting will be focused on birds. Please review the attached spreadsheet that Ron has prepared. The first page of the spreadsheet shows a cumulative species list developed from several sources. The second page shows the proposed reduced list. The third page documents how the reduced list was generated. Ron is continuing to work on placing the species into guilds based on habitat affinities. If the draft guild list is available prior to Friday, I'll send it out.

I've also attached draft meeting minutes from our meetings on July 28th and August 28th. Please let me know if you have any comments on the minutes.

Thanks.

Mary L. Powell

Natural Resource Specialist
Vice President

Habitat	CommonName	SciName	EIS	BBA	Point Counts	Chatfield Census	Chatfield Checklist Summer	Chatfield Checklist Winter	Chatfield Checklist Migrant	Jeffco/Douglas NDIS Abundance
Shore	American Avocet	Recurvirostra americana	X	x					x	Rare-Uncommon
Emergent	American Coot	Fulica americana	X	X			X			Fairly Common
Generalist	American Crow	Corvus brachyrhynchos	X		X		X	x	x	Fairly Common
Water	American Dipper	Cinclus mexicanus	X				X	x	x	Rare-Uncommon
Riparian Forest	American Goldfinch	Carduelis tristis	X	X	X		x	x	x	U - Fairly Common
Ferest Generalis	American Kestrel	Falco sparverius	X	X		X	X	X	X	Fairly Common
	American Peregrine Falcon	Falco peregrinus anatum	X						x	Unknown
Shore	American Pipit	Anthus rubescens	X						x	Fairly Common
Riparian	American Redstart	Setophaga ruticilla	X	X	X	X	x		x	Casual/Accidental
Generalist	American Robin	Turdus migratorius	X	X	X	X	X	X	X	Common
Riparian	American Tree Sparrow	Spizella arborea	X					X		Unknown
Water	American White Pelican	Pelecanus erythrorhynchos	X		X		?		x	Common
Water	American Wigeon	Anas americana	X						x	Rare
Shore	Baird's Sandpiper	Calidris bairdii	X						x	Unknown
Generalist	Bald Eagle	Haliaeetus leucocephalus	X					x	?	Casual/Accidental
Riparian Forest	Bank Swallow	Riparia riparia	X						x	U - Common
Structures	Barn Owl	Tyto alba		X						Rare
Riparian	Barn Swallow	Hirundo rustica	X	X	X		X			Abundant
Riparain	Belted Kingfisher	Ceryle alcyon	X	X	X	X	X			Uncommon
Water	Black Tern	Chlidonias niger	X						x	Unknown
Generalist	Black-billed Magpie	Pica pica	X	X	X	X	X	X	X	Common
Riparian	Black-capped Chickadee	Poecile atricapillus	X	X	X	X	X	X	X	Fairly Common
Riparian Shrub	Black-crowned Night-Heron	Nycticorax nycticorax	X	X					x	Fairly Common
Riparian Forest	Black-headed Grosbeak	Pheucticus melanocephalus	X	X			x			Fairly Common
Riparian Edges	Blue Grosbeak	Guiraca caerulea	X	X		X	x			U - Fairly Common
Riparian	Blue Jay	Cyanocitta cristata	X	X			?	?	x	U - Fairly Common
Rip/Upl Shrub	Blue-gray Gnatcatcher	Polioptila caerulea	X	X	X		x			Rare - UC
Water	Blue-winged Teal	Anas discors	X	X			x			U - Fairly Common
Generalist	Bohemian Waxwing	Bombycilla garrulus	X					x		Unknown
Water	Bonaparte's Gull	Larus philadelphia	X						x	Unknown
Generalist	Brewer's Blackbird	Euphagus cyanocephalus	X	X	X		x			Common
Riparain/Genera	Brewer's Sparrow	Spizella breweri	X	X					x	Rare
Conifer	Broad-tailed Hummingbird	Selasphorus platycercus	X	X	X	X	x			Fairly Common
Riparian	Broad-winged Hawk	Buteo platypterus	X						x	Unknown
Riparian	Brown Creeper	Certhia americana	X					x		Uncommon
Riparian	Brown Thrasher	Toxostoma rufum	X						x	Unk - Very Rare
Generalist open	Brown-headed Cowbird	Molothrus ater	X	X	X	X	x			Common
Water	Bufflehead	Bucephala albeola	X						x	Unknown
Cottonwood	Bullock's Oriole	Icterus bullockii	X	X	X	X	X			Common

Water	California Gull	Larus californicus	X				X			Unknown
Water	Canada Goose	Branta canadensis	X	X		X	X	X	X	Abundant
Water	Canvasback	Aythya valisineria	X						x	Unknown
Cliffs	Canyon Wren	Catherpes mexicanus	X				x	x	x	Uncommon
Water	Cattle Egret	Bubulcus ibis	X							Unknown
Generalist	Cedar Waxwing	Bombycilla cedrorum	X	X			x			Uncommon
Generalist	Chipping Sparrow	Spizella passerina	X						X	Common
Water	Cinnamon Teal	Anas cyanoptera	X	X			x			Uncommon
Riparian Genera	Clay-colored Sparrow	Spizella pallida	X						x	Unknown
Structures	Cliff Swallow	Petrochelidon pyrrhonota	X	X			X			Abundant
Water	Common Goldeneye	Bucephala clangula	X					X		Unknown
Riparian	Common Grackle	Quiscalus quiscula	X	X	X	X	X			C - Abundant
Water	Common Loon	Gavia immer	X						x	Unknown
Water	Common Merganser	Mergus merganser	X	X			X	X	X	Uncommon
Generalist	Common Nighthawk	Chordeiles minor	X	X			x			Fairly Common
Generalist	Common Raven	Corvus corax	X					x		Fairly Common
Emergent/WM	Wilson's (Common) Snipe	Gallinago gallinago	X	X			x	x	x	Uncommon
Water	Common Tern	Sterna hirundo	X						x	Unknown
Emergents	Common Yellowthroat	Geothlypis trichas	X	X	X	X	X			U - Fairly Common
Woodlands	Cooper's Hawk	Accipiter cooperii	X	X				?	x	Uncommon
Woodlands	Cordilleran Flycatcher	Empidonax occidentalis	X						x	Fairly Common
Woodland/shrub	Dark-eyed Junco	Junco hyemalis	X					X		Common
Water / Riparian	Double-crested Cormorant	Phalacrocorax auritus	X			X	X			Common
Riparian	Downy Woodpecker	Picoides pubescens	X	X		X	x	x	x	Uncommon
Montane	Dusky Flycatcher	Empidonax oberholseri	X						x	Uncommon
Water	Eared Grebe	Podiceps nigricollis	X						x	Unknown
Riparian	Eastern Kingbird	Tyrannus tyrannus	X	X		X	x			Uncommon - FC
Riparian	Eastern Phoebe	Sayornis phoebe	X						x	Unknown
Riparian	Eastern Screech-Owl	Otus asio	X	X			x	x	x	Uncommon
Generalist	European Starling	Sturnus vulgaris	X	X	X	X	X	X	X	Abundant
Riparian Forest	Evening Grosbeak	Coccothraustes vespertinus	X						x	Fairly Common
Grassland	Ferruginous Hawk	Buteo regalis	X					?	x	Unk - Rare
Water	Forster's Tern	Sterna forsteri	X						x	Unknown
Water	Franklin's Gull	Larus pipixcan	X						x	Unknown
Water	Gadwall	Anas strepera	X						x	Rare
Cliffs/Generalist	Golden Eagle	Aquila chrysaetos	X				x	x	x	Uncommon
Grassland	Grasshopper Sparrow	Ammodramus savannarum	X				x			Uncommon
Riparian Shrub	Gray Catbird	Dumetella carolinensis	X	X	X	X	x			Uncommon
Riparian/Shore	Great Blue Heron	Ardea herodias	X	X		X	X			Common
Generalist	Great Horned Owl	Bubo virginianus	X	X		X	X	X	X	Fairly Common
Shore/WM	Greater Yellowlegs	Tringa melanoleuca	X						x	Unknown
Riparian / water	Green Heron	Butorides virescens	X						x	Unknown
Riparian Shrub	Green-tailed Towhee	Pipilo chlorurus	X	X					x	Common

Water	Green-winged Teal	Anas crecca	X	X				X		Uncommon
Riparian Trees	Hairy Woodpecker	Picoides villosus	X	X			?		x	Uncommon
Conifer	Hammond's Flycatcher	Empidonax hammondii	X						x	Uncommon
Riparian Genera	Harris' Sparrow	Zonotrichia querula	X					X		Unknown
Woodlands	Hermit Thrush	Catharus guttatus	X						x	Common
Water	Herring Gull	Larus argentatus	X						x	Unknown
Water	Hooded Merganser	Lophodytes cucullatus	X						x	Unknown
Water	Horned Grebe	Podiceps auritus	X						x	Unknown
Grassland	Horned Lark	Eremophila alpestris	X	X			x	x	x	Uncommon - C
Generalist	House Finch	Carpodacus mexicanus	X	X			X	X	X	Abundant
Agri - Urban	House Sparrow	Passer domesticus	X	X			X	X	X	Abundant
Riparian	House Wren	Troglodytes aedon	X	X	X	X	X			Common
Woodland edge	Indigo Bunting	Passerina cyanea	X	X		X	x			R - Uncommon
Sh/WM/GL	Killdeer	Charadrius vociferus	X	X	X		x	x	x	Common
Grassland	Lapland Longspur	Calcarius lapponicus	X					x		Unknown
Grassland	Lark Bunting	Calamospiza melanocorys	X						x	Unk - Common
Generalist	Lark Sparrow	Chondestes grammacus	X				x			Common - FC
Upl shrub	Lazuli Bunting	Passerina amoena	X	X		X	x			UC - Fairly Common
Shore	Least Sandpiper	Calidris minutilla	X						x	Unknown
Riparian Forest	Lesser Goldfinch	Carduelis psaltria	X	X		X	x			Common - FC
Water	Lesser Scaup	Aythya affinis	X						x	Unknown
Shore/WM	Lesser Yellowlegs	Tringa flavipes	X						x	Unknown
Riparian Trees	Lewis' Woodpecker	Melanerpes lewis	X							Uncommon
Riparian	Lincoln's Sparrow	Melospiza lincolnii	X						x	UC - Common
Generalist	Loggerhead Shrike	Lanius ludovicianus	X						x	Rare - UC
Shore	Long-billed Dowitcher	Limnodromus scolopaceus	X						x	Unknown
Riparian	Long-eared Owl	Asio otus	X	X			x	x	x	Rare
Riparian Forest	MacGillivray's Warbler	Oporornis tolmiei	X						x	Uncommon
Water	Mallard	Anas platyrhynchos	X	X	X	X	X	X	X	Abundant
Shore	Marbled Godwit	Limosa fedoa	X						x	Unknown
Emergent	Marsh Wren	Cistothorus palustris	X					x		Fairly Common
Generalist	Merlin	Falco columbarius	X					x		Unknown
Generalist	Mountain Bluebird	Sialia currucoides	X						x	Common
Riparian	Mountain Chickadee	Poecile gambeli	X					x		Common
Generalist	Mourning Dove	Zenaida macroura	X	X	X	X	X			Abundant
Riparian	Northern Flicker	Colaptes auratus	X	X	X	X				Fairly Common
	Northern Goshawk	Accipiter gentilis	X						x	Very Rare - Rare
Emergegnt / Gra	Northern Harrier	Circus cyaneus	X					x		Rare - UNK
Generalist	Northern Mockingbird	Mimus polyglottos	X				x			Rare - UC
Water	Northern Pintail	Anas acuta	X						x	Unknown - UC
Riparian / banks	Northern Rough-winged Swallow	Stelgidopteryx serripennis	X	X		X			x	Uncommon
Water	Northern Shoveler	Anas clypeata	X						x	Rare
Grassland / Ripa	Northern Shrike	Lanius excubitor	X					x		Unknown

Water / Emerger	Northern Waterthrush	Seiurus noveboracensis	X						x	Unknown
Riparian Trees	Olive-sided Flycatcher	Contopus cooperi	X						x	Uncommon
Riparian Forest	Orange-crowned Warbler	Vermivora celata	X						x	Rare - Unk
Water	Osprey	Pandion haliaetus	X						x	Unknown
Water	Pacific Loon	Gavia pacifica	X						x	Unknown
Shore	Pectoral Sandpiper	Calidris melanotos	X						x	Unknown
Water	Pied-billed Grebe	Podilymbus podiceps	X				x			Uncommon - FC
Generalist	Pine Siskin	Carduelis pinus	X					x		Common
Upl Woodlands	Plumbeous Vireo	Vireo plumbeus	X						x	Fairly Common
Cliffs / Grasslanc	Prairie Falcon	Falco mexicanus	X					x		Rare - UC
Water	Red-breasted Merganser	Mergus serrator	X						x	Unknown
Conifer	Red-breasted Nuthatch	Sitta canadensis	X						x	Uncommon
Cottonwood	Red-eyed Vireo	Vireo olivaceus	X	X	X	X	x			Very Rare
Water	Redhead	Aythya americana	X						x	Rare - UNK
Riparian Trees	Red-headed Woodpecker	Melanerpes erythrocephalus	X						x	Rare - UNK
Riparian Edges	Red-tailed Hawk	Buteo jamaicensis	X	X		X	X	X	X	Fairly Common
Emergent	Red-winged Blackbird	Agelaius phoeniceus	X	X	X	X	X	X	X	Abundant
Water	Ring-billed Gull	Larus delawarensis	X				X	X	X	Unknown
Water	Ring-necked Duck	Aythya collaris	X						x	Unknown
Generalist	Rock Dove	Columba livia	X				x	x	x	Abundant
Generalist	Rock Wren	Salpinctes obsoletus	X	X						Uncommon - FC
Riparian Forest	Rose-breasted Grosbeak	Pheucticus ludovicianus	X						x	Casual/Accidental
Grass/ upl shrub	Rough-legged Hawk	Buteo lagopus	X					x		Unknown
Woodlands	Ruby-crowned Kinglet	Regulus calendula	X					x		Common
Water	Ruddy Duck	Oxyura jamaicensis	X						x	Unknown
Generalist	Sage Thrasher	Oreoscoptes montanus	X						x	Unknown - Rare
Shore/water	Sanderling	Calidris alba	X						x	Unknown
Grassland	Savannah Sparrow	Passerculus sandwichensis	X						x	Uncommon
Grassland - upl s	Say's Phoebe	Sayornis saya	X		X		?		x	Uncommon
Shore	Semipalmated Plover	Charadrius semipalmatus	X							Unknown
Shore	Semipalmated Sandpiper	Calidris pusilla	X						x	Unknown
Woodlands	Sharp-shinned Hawk	Accipiter striatus	X	X					x	Rare - UC
Rip / Emerg / Sh	Snowy Egret	Egretta thula	X						x	Unknown
Shore	Solitary Sandpiper	Tringa solitaria	X						x	Unknown
Riparian / Emerg	Song Sparrow	Melospiza melodia	X	X	X	X	X	X	X	Fairly Common
Emergent/wet m	Sora	Porzana carolina	X	X			x			Uncommon
Shore	Spotted Sandpiper	Actitis macularia	X	X	X		x			Uncommon - FC
Riparian Shrub	Spotted Towhee	Pipilo maculatus	X	X	X	X	X	X	X	Fairly Common
Conifer	Steller's Jay	Cyanocitta stelleri	X						x	Fairly Common
Grassland - Gen	Swainson's Hawk	Buteo swainsoni	X	X			x			Uncommon - FC
Riparian	Swainson's Thrush	Catharus ustulatus	X						x	Rare - UNK
Riparain Shrub	Swamp Sparrow	Melospiza georgiana	X						x	Unknown
	Townsend's Solitaire	Myadestes townsendi	X							Uncommon

Woodlands (R/C	Townsend's Warbler	Dendroica townsendi	X						x	Unknown
Riparian	Tree Swallow	Tachycineta bicolor	X	X	X	X	x			Fairly Common
Water	Tundra Swan	Cygnus columbianus	X						x	Unknown
Generalist	Turkey Vulture	Cathartes aura	X				?		x	Uncommon
Grassland	Vesper Sparrow	Pooecetes gramineus	X				?		X	FC - Common
Riparian	Violet-green Swallow	Tachycineta thalassina	X						x	Common
Emergent	Virginia Rail	Rallus limicola	X	X			x	x	x	Uncommon
Riparian Forest	Virginia's Warbler	Vermivora virginiae	X				x			Fairly Common
Riparian	Warbling Vireo	Vireo gilvus	X	X	X	X	x			Common
Woodlands	Western Bluebird	Sialia mexicana	X						x	Uncommon - FC
Grassland	Western Burrowing Owl	Athene cunicularia		X						Rare
Water	Western Grebe	Aechmophorus occidentalis	X						X	Unknown
Riparian - open	Western Kingbird	Tyrannus verticalis	X	X		X	X			Common
Grassland	Western Meadowlark	Sturnella neglecta	X	X		X	X			Common
Shore	Western Sandpiper	Calidris mauri	X						x	Unknown
UPL Shrub	Western Scrub Jay	Aphelocoma californica	X				x	x	x	Uncommon
Riparian	Western Tanager	Piranga ludoviciana	X						x	Fairly Common
Riparian	Western Wood-Pewee	Contopus sordidulus	X	X	X	X	X			FC - Common
Riparian	White-breasted Nuthatch	Sitta carolinensis	X		X		x	x	x	Fairly Common
Woodlands	White-crowned Sparrow	Zonotrichia leucophrys	X					x		Rare - Common
Emergent	White-faced Ibis	Plegadis chihi	X						x	Unknown
Riparian	White-throated Sparrow	Zonotrichia albicollis	X						x	Unknown
Cliffs	White-throated Swift	Aeronautes saxatalis	X				x			UNK - Common
Shore	Willet	Catoptrophorus semipalmatus	X						x	Unknown
Riparian Willow	Willow Flycatcher	Empidonax traillii	X		X				x	Rare
Shore/water	Wilson's Phalarope	Phalaropus tricolor	X						x	Rare
Riparian Forest	Wilson's Warbler	Wilsonia pusilla	X						x	Fairly Common
Riparian Shrub	Winter Wren	Troglodytes troglodytes	X					x		Unknown
Riparian	Wood Duck	Aix sponsa	X	X			x			Rare - Uncommon
Riparian Forest	Yellow Warbler	Dendroica petechia	X	X	X	X	X			Fairly Common
Cottonwood	Yellow-billed Cuckoo	Coccyzus americanus	X	X		X	x			Rare
Riparian Shrub	Yellow-breasted Chat	Icteria virens	X	X	X	X	x			UC - Fairly Common
Emergent	Yellow-headed Blackbird	Xanthocephalus xanthocephalu	X	X			x			Common
Riparian Forest	Yellow-rumped Warbler	Dendroica coronata	X						X	Common
Riparian Trees	Least Flycatcher		X	X	X		x			Not listed
Water	Thayer's Gull		X						x	Not Listed
Riparian Trees	Northeren Parula		X						x	Not Listed
	Eastern Wood-pewee			X						Not Listed

Habitat	Common Name	SciName	EIS	BBA	Point Counts	Chatfield Census	Chatfield Checklist Summer	Chatfield Checklist Winter	Chatfield Checklist Migrant	Jeffco/Douglas NDIS Abundance	Kingery /A&R Seasonal Use	Comments
Wetland / NW	American Coot	Fulica americana	X	X			X			Fairly Common		
Stream	American Dipper	Cinclus mexicanus	X				X	x	x	Rare-Uncommon		Locally occurs
Riparian Trees	American Goldfinch	Carduelis tristis	X	X	X		x	x	x	U - Fairly Common	Y	
Riparian Trees	American Redstart	Setophaga ruticilla	X	X	X	X	x		x	Casual/Accidental		Locally occurs
Riparian Trees	American Tree Sparrow	Spizella arborea	X					X		Unknown		
Riparian Trees	Bank Swallow	Riparia riparia	X						x	U - Common	M	
Structures	Barn Owl	Tyto alba		X						Rare		Locally occurs
Riparian Trees	Barn Swallow	Hirundo rustica	X	X	X		X			Abundant		
Riparian Trees	Belted Kingfisher	Ceryle alcyon	X	X	X	X	X			Uncommon		
Riparian Trees	Black-capped Chickadee	Poecile atricapillus	X	X	X	X	X	X	X	Fairly Common		
Riparian Shrub	Black-crowned Night-Heron	Nycticorax nycticorax	X	X					x	Fairly Common	Y	
Riparian Trees	Black-headed Grosbeak	Pheucticus melanocephalus	X	X			x			Fairly Common	M	S - rare lowland riparian
Riparian Edges	Blue Grosbeak	Guiraca caerulea	X	X		X	x			U - Fairly Common		
Riparian Trees	Blue Jay	Cyanocitta cristata	X	X			?	?	x	U - Fairly Common		
Rip/Upland Shrub	Blue-gray Gnatcatcher	Polioptila caerulea	X	X	X		x			Rare - UC		Locally common
Riparian Trees	Broad-winged Hawk	Buteo platypterus	X						x	Unknown		
Riparian Trees	Brown Creeper	Certhia americana	X					x		Uncommon	W - Rip/ S Con	
Cottonwood	Bullock's Oriole	Icterus bullockii	X	X	X	X	X			Common		
Cliffs	Canyon Wren	Catherpes mexicanus	X				x	x	x	Uncommon		
Riparian Trees	Clay-colored Sparrow	Spizella pallida	X						x	Unknown	M	
Structures	Cliff Swallow	Petrochelidon pyrrhonota	X	X			X			Abundant	S - near water	
Riparian Trees	Common Grackle	Quiscalus quiscula	X	X	X	X	X			C - Abundant		
Water - woodlands	Common Merganser	Mergus merganser	X	X			X	X	X	Uncommon	Y	Need cavity to nest

Habitat	Common Name	SciName	EIS	BBA	Point Counts	Chatfield Census	Chatfield Checklist Summer	Winter	Migrant	Jeffco/Douglas NDIS Abundance	Kingery /A&R Seasonal Use	Comments
Wetland/ NW/WM	Wilson's (Common) Snipe	Gallinago gallinago	X	X			x	x	x	Uncommon		
Wetland/ NW	Common Yellowthroat	Geothlypis trichas	X	X	X	X	X			U - Fairly Common		
Woodlands	Cooper's Hawk	Accipiter cooperii	X	X				?	x	Uncommon		
Woodlands	Cordilleran Flycatcher	Empidonax occidentalis	X						x	Fairly Common	M	S - montane
Woodland/shrub	Dark-eyed Junco	Junco hyemalis	X					X		Common		
Water / Riparian	Double-crested Cormorant	Phalacrocorax auritus	X			X	X			Common		
Riparian Trees	Downy Woodpecker	Picoides pubescens	X	X		X	x	x	x	Uncommon	Y	
Riparian Trees	Eastern Kingbird	Tyrannus tyrannus	X	X		X	x			Uncommon - FC		
Riparian Trees	Eastern Phoebe	Sayornis phoebe	X						x	Unknown		
Riparian Trees	Eastern Screech-Owl	Otus asio	X	X			x	x	x	Uncommon		
Riparian Trees	Evening Grosbeak	Coccothraustes vespertinus	X						x	Fairly Common	M W	Montane - Y
Riparian Shrub	Gray Catbird	Dumetella carolinensis	X	X	X	X	x			Uncommon		
Riparian/Shore	Great Blue Heron	Ardea herodias	X	X		X	X			Common		
Riparian Shrub	Green-tailed Towhee	Pipilo chlorurus	X	X					x	Common		
Riparian Trees	Hairy Woodpecker	Picoides villosus	X	X			?		x	Uncommon	Y	
Riparian shrub Grass	Harris' Sparrow	Zonotrichia querula	X					X		Unknown	Rare M W	
Woodlands	Hermit Thrush	Catharus guttatus	X						x	Common	M	
Riparian Trees	House Wren	Troglodytes aedon	X	X	X	X	X			Common		
Woodland edge	Indigo Bunting	Passerina cyanea	X	X		X	x			R - Uncommon		
Sh/WM/GL	Killdeer	Charadrius vociferus	X	X	X		x	x	x	Common		
Riparian Trees	Lesser Goldfinch	Carduelis psaltria	X	X		X	x			Common - FC	S M	
Riparian Trees	Lewis' Woodpecker	Melanerpes lewis	X							Uncommon	Y	
Riparian Trees	Lincoln's Sparrow	Melospiza lincolnii	X						x	UC - Common	M	S - Foothills - west
Riparian Trees	Long-eared Owl	Asio otus	X	X			x	x	x	Rare		Locally occurs
Riparian Trees	MacGillivray's Warbler	Oporornis tolmiei	X						x	Uncommon	M	
Wetlands / Water	Mallard	Anas platyrhynchos	X	X	X	X	X	X	X	Abundant		
Wetland/ NW	Marsh Wren	Cistothorus palustris	X					x		Fairly Common		
Riparian Trees	Mountain Chickadee	Poecile gambeli	X					x		Common		
Riparian Trees	Northern Flicker	Colaptes auratus	X	X	X	X				Fairly Common		

Habitat	Common Name	SciName	EIS	BBA	Point Counts	Chatfield Census	Chatfield Checklist Summer	Winter	Migrant	Jeffco/Douglas NDIS Abundance	Kingery /A&R Seasonal Use	Comments
Wetland/ NW / Upland	Northern Harrier	Circus cyaneus	X					x		Rare - UNK		Locally occurs
Riparian / banks	Northern Rough-winged Swallow	Stelgidopteryx serripennis	X	X		X			x	Uncommon		
Upland / Riparian edge	Northern Shrike	Lanius excubitor	X					x		Unknown		
Water / Wetland/ NW	Northern Waterthrush	Seiurus noveboracensis	X						x	Unknown		
Riparian Trees	Olive-sided Flycatcher	Contopus cooperi	X						x	Uncommon	S M	
Water/ Wetlands	Pied-billed Grebe	Podilymbus podiceps	X				x			Uncommon - FC		
Cottonwood	Red-eyed Vireo	Vireo olivaceus	X	X	X	X	x			Very Rare		Locally occurs
Riparian Trees	Red-headed Woodpecker	Melanerpes erythrocephalus	X						x	Rare - UNK	S M	
Woodlands	Red-tailed Hawk	Buteo jamaicensis	X	X		X	X	X	X	Fairly Common		
Wetland/ NW	Red-winged Blackbird	Agelaius phoeniceus	X	X	X	X	X	X	X	Abundant		
Woodlands	Ruby-crowned Kinglet	Regulus calendula	X					x		Common	W	
Woodlands	Sharp-shinned Hawk	Accipiter striatus	X	X					x	Rare - UC		Locally breeds
Rip / Wetlands / Shore	Snowy Egret	Egretta thula	X						x	Unknown		
Riparian / Wetlands	Song Sparrow	Melospiza melodia	X	X	X	X	X	X	X	Fairly Common	Y	
Wetlands/ NW	Sora	Porzana carolina	X	X			x			Uncommon		
Shore/stream	Spotted Sandpiper	Actitis macularia	X	X	X		x			Uncommon - FC	S/M	
Riparian Shrub	Spotted Towhee	Pipilo maculatus	X	X	X	X	X	X	X	Fairly Common		
Riparian Shrub	Swamp Sparrow	Melospiza georgiana	X						x	Unknown	Rare W M	
Woodlands (R/C)	Townsend's Warbler	Dendroica townsendi	X						x	Unknown	M	
Riparian Trees	Tree Swallow	Tachycineta bicolor	X	X	X	X	x			Fairly Common		
Riparian Trees	Violet-green Swallow	Tachycineta thalassina	X						x	Common		
Wetland / NW	Virginia Rail	Rallus limicola	X	X			x	x	x	Uncommon		
Riparian Trees	Virginia's Warbler	Vermivora virginiae	X				x			Fairly Common	S - oak - M - Riparian	
Riparian Trees	Warbling Vireo	Vireo gilvus	X	X	X	X	x			Common		
Woodlands	Western Bluebird	Sialia mexicana	X						x	Uncommon - FC	M/W - woodlands	
Riparian - open	Western Kingbird	Tyrannus verticalis	X	X		X	X			Common		

			EIS	BBA	Point Counts	Chatfield Census	Chatfield Checklist				Kingery /A&R	Comments
							Summer	Winter	Migrant	Jeffco/Douglas NDIS	Seasonal Use	
Habitat	**Common Name**	**SciName**								**Abundance**		
Riparian Trees	Western Tanager	Piranga ludoviciana	X						x	Fairly Common		
Riparian Trees	Western Wood-Pewee	Contopus sordidulus	X	X	X	X	X			FC - Common	S M	
Riparian Trees	White-breasted Nuthatch	Sitta carolinensis	X		X		x	x	x	Fairly Common		
Woodlands	White-crowned Sparrow	Zonotrichia leucophrys	X					x		Rare - Common		
Wetland / NW	White-faced Ibis	Plegadis chihi	X						x	Unknown		
Riparian Trees	White-throated Sparrow	Zonotrichia albicollis	X						x	Unknown		
Riparian Shrub	Willow Flycatcher	Empidonax traillii	X		X				x	Rare	S	Locally occurs
Riparian Trees	Wilson's Warbler	Wilsonia pusilla	X						x	Fairly Common	M	
Riparian Shrub	Winter Wren	Troglodytes troglodytes	X					x		Unknown		
Riparian Trees	Wood Duck	Aix sponsa	X	X			x			Rare - Uncommon	S	Locally occurs
Riparian Trees	Yellow Warbler	Dendroica petechia	X	X	X	X	X			Fairly Common	S M	
Cottonwood	Yellow-billed Cuckoo	Coccyzus americanus	X	X		X	x			Rare		Locally occurs
Riparian Shrub	Yellow-breasted Chat	Icteria virens	X	X	X	X	x			UC - Fairly Common		
Wetland / NW	Yellow-headed Blackbird	Xanthocephalus xanthocephalus	X	X			x			Common		
Riparian Trees	Yellow-rumped Warbler	Dendroica coronata	X						X	Common	M	
Riparian Trees	Least Flycatcher		X	X	X		x			Not listed	S M	
	Species removed											
	American Avocet	Recurvirostra americana	X	x					x	Rare-Uncommon		
Generalist	Loggerhead Shrike	Lanius ludovicianus	X						x	Rare - UC		
	American Wigeon	Anas americana	X						x	Rare		
	Baird's Sandpiper	Calidris bairdii	X						x	Unknown	M Rare	
	Bonaparte's Gull	Larus philadelphia	X						x	Unknown	Rare M	
Riparian	Brown Thrasher	Toxostoma rufum	X						x	Unk - Very Rare		Riparian
Riparian / water	Green Heron	Butorides virescens	X						x	Unknown	Rare M	
	Northern Goshawk	Accipiter gentilis	X						x	Very Rare - Rare		
Generalist	Northern Mockingbird	Mimus polyglottos	X				x			Rare - UC		

			EIS	BBA	Point Counts	Chatfield Census	Chatfield Checklist			Jeffco/Douglas NDIS	Kingery /A&R	Comments
							Summer	Winter	Migrant		Seasonal Use	
Habitat	**Common Name**	**SciName**								**Abundance**		
Water	Northern Shoveler	Anas clypeata	X						x	Rare		
Riparian Trees	Orange-crowned Warbler	Vermivora celata	X						x	Rare - Unk	M	
Riparian Trees	Rose-breasted Grosbeak	Pheucticus ludovicianus	X						x	Casual/Accidental	M S	
Generalist	Sage Thrasher	Oreoscoptes montanus	X						x	Unknown - Rare	M - Generalist	
Riparian	Swainson's Thrush	Catharus ustulatus	X						x	Rare - UNK		
Shore/water	Wilson's Phalarope	Phalaropus tricolor	X						x	Rare	Rare	
Water	Thayer's Gull		X						x	Not Listed	Rare M	
Riparian Trees	Northern Parula		X						x	Not Listed	Rare M	
	Eastern Wood-pewee			X						Not Listed	Accidental M	
Generalist	American Crow	Corvus brachyrhynchos	X		X		X	x	x	Fairly Common		
Forest Generalist	American Kestrel	Falco sparverius	X	X		X	X	X	X	Fairly Common		
Generalist	American Peregrine Falcon	Falco peregrinus anatum	X						x	Unknown		Prey driven
Generalist	American Robin	Turdus migratorius	X	X	X	X	X	X	X	Common		
Generalist	Bald Eagle	Haliaeetus leucocephalus	X					x	?	Casual/Accidental		Locally occurs
Generalist	Black-billed Magpie	Pica pica	X	X	X	X	X	X	X	Common		
Generalist	Bohemian Waxwing	Bombycilla garrulus	X					x		Unknown		
Generalist	Brewer's Blackbird	Euphagus cyanocephalus	X	X	X		x			Common		
Riparian/Generalist	Brewer's Sparrow	Spizella breweri	X	X					x	Rare	M	S - Upl Shrub
Generalist open	Brown-headed Cowbird	Molothrus ater	X	X	X	X	x			Common		
Generalist (Fruit)	Cedar Waxwing	Bombycilla cedrorum	X	X			x			Uncommon		
Generalist	Chipping Sparrow	Spizella passerina	X						X	Common	M	S - Montane
Generalist	Common Nighthawk	Chordeiles minor	X	X			x			Fairly Common		
Generalist	Common Raven	Corvus corax	X					x		Fairly Common		
Cliffs/Generalist	Golden Eagle	Aquila chrysaetos	X				x	x	x	Uncommon		
Generalist	Great Horned Owl	Bubo virginianus	X	X		X	X	X	X	Fairly Common		
Generalist	House Finch	Carpodacus mexicanus	X	X			X	X	X	Abundant	Y	
Generalist	Lark Sparrow	Chondestes grammacus	X				x			Common - FC	S M	
Generalist	Merlin	Falco columbarius	X					x		Unknown		

Habitat	Common Name	SciName	EIS	BBA	Point Counts	Chatfield Census	Chatfield Checklist Summer	Chatfield Checklist Winter	Chatfield Checklist Migrant	Jeffco/Douglas NDIS Abundance	Kingery /A&R Seasonal Use	Comments
Generalist	Mountain Bluebird	Sialia currucoides	X						x	Common		
Generalist	Mourning Dove	Zenaida macroura	X	X	X	X	X			Abundant		
Generalist	Pine Siskin	Carduelis pinus	X					x		Common	W M	Winter generalist
Generalist	Rock Wren	Salpinctes obsoletus	X	X						Uncommon - FC	M- generalist	
Upland - Generalist	Swainson's Hawk	Buteo swainsoni	X	X			x			Uncommon - FC		
Generalist	Turkey Vulture	Cathartes aura	X				?		x	Uncommon		
Water	American White Pelican	Pelecanus erythrorhynchos	X		X		?		x	Common		
Water	Black Tern	Chlidonias niger	X						x	Unknown		
Water	Blue-winged Teal	Anas discors	X	X			x			U - Fairly Common		
Water	Bufflehead	Bucephala albeola	X						x	Unknown	M W	
Water	California Gull	Larus californicus	X				X			Unknown	Y	
Water	Canada Goose	Branta canadensis	X	X		X	X	X	X	Abundant		
Water	Canvasback	Aythya valisineria	X						x	Unknown		
Water	Cattle Egret	Bubulcus ibis	X							Unknown	M	
Water	Cinnamon Teal	Anas cyanoptera	X	X			x			Uncommon		
Water	Common Goldeneye	Bucephala clangula	X					X		Unknown		
Water	Common Loon	Gavia immer	X						x	Unknown		
Water	Common Tern	Sterna hirundo	X						x	Unknown		
Water	Eared Grebe	Podiceps nigricollis	X						x	Unknown		
Water	Forster's Tern	Sterna forsteri	X						x	Unknown		
Water	Franklin's Gull	Larus pipixcan	X						x	Unknown		
Water	Gadwall	Anas strepera	X						x	Rare		
Water	Green-winged Teal	Anas crecca	X	X				X		Uncommon		
Water	Herring Gull	Larus argentatus	X						x	Unknown		
Water	Hooded Merganser	Lophodytes cucullatus	X						x	Unknown	Y	
Water	Horned Grebe	Podiceps auritus	X						x	Unknown		
Water	Lesser Scaup	Aythya affinis	X						x	Unknown		
Water	Northern Pintail	Anas acuta	X						x	Unknown - UC		
Water	Osprey	Pandion haliaetus	X						x	Unknown		
Water	Pacific Loon	Gavia pacifica	X						x	Unknown	M	
Water	Red-breasted Merganser	Mergus serrator	X						x	Unknown	M	
Water	Redhead	Aythya americana	X						x	Rare - UNK		

			EIS	BBA	Point Counts	Chatfield Census	Chatfield Checklist			Jeffco/Douglas NDIS	Kingery /A&R	Comments
							Summer	Winter	Migrant		Seasonal Use	
Habitat	**Common Name**	**SciName**								**Abundance**		
Water	Ring-billed Gull	Larus delawarensis	X				X	X	X	Unknown		nest on islands
Water	Ring-necked Duck	Aythya collaris	X						x	Unknown		
Water	Ruddy Duck	Oxyura jamaicensis	X						x	Unknown		
Water	Tundra Swan	Cygnus columbianus	X						x	Unknown		
Water	Western Grebe	Aechmophorus occidentalis	X						X	Unknown		
Shore	American Pipit	Anthus rubescens	X						x	Fairly Common	M W	
Shore/Wet mead.	Greater Yellowlegs	Tringa melanoleuca	X						x	Unknown	M	
Shore	Least Sandpiper	Calidris minutilla	X						x	Unknown		
Shore/WM	Lesser Yellowlegs	Tringa flavipes	X						x	Unknown	M	
Shore	Long-billed Dowitcher	Limnodromus scolopaceus	X						x	Unknown		
Shore	Marbled Godwit	Limosa fedoa	X						x	Unknown		
Shore	Pectoral Sandpiper	Calidris melanotos	X						x	Unknown		
Shore/water	Sanderling	Calidris alba	X						x	Unknown	M	
Shore	Semipalmated Plover	Charadrius semipalmatus	X							Unknown	M	
Shore	Semipalmated Sandpiper	Calidris pusilla	X						x	Unknown		
Shore	Solitary Sandpiper	Tringa solitaria	X						x	Unknown	M	
Shore	Western Sandpiper	Calidris mauri	X						x	Unknown		
Shore	Willet	Catoptrophorus semipalmatus	X						x	Unknown	M	
Upland	Ferruginous Hawk	Buteo regalis	X					?	x	Unk - Rare		
Upland	Horned Lark	Eremophila alpestris	X	X			x	x	x	Uncommon - C		
Upland	Lapland Longspur	Calcarius lapponicus	X					x		Unknown		
Upland	Lark Bunting	Calamospiza melanocorys	X						x	Unk - Common		
Upland shrub	Lazuli Bunting	Passerina amoena	X	X		X	x			UC - Fairly Common		
Upland Woodlands	Plumbeous Vireo	Vireo plumbeus	X						x	Fairly Common		
Cliffs / Upland	Prairie Falcon	Falco mexicanus	X					x		Rare - UC		
Conifer	Red-breasted Nuthatch	Sitta canadensis	X						x	Uncommon		
Grass/ Upland shrub	Rough-legged Hawk	Buteo lagopus	X					x		Unknown		

Habitat	Common Name	SciName	EIS	BBA	Point Counts	Chatfield Census	Chatfield Checklist Summer	Winter	Migrant	Jeffco/Douglas NDIS Abundance	Kingery /A&R Seasonal Use	Comments
Upland	Savannah Sparrow	Passerculus sandwichensis	X						x	Uncommon	M S	
Upland - Upland shrub	Say's Phoebe	Sayornis saya	X		X		?		x	Uncommon		
Upland	Vesper Sparrow	Pooecetes gramineus	X				?		X	FC - Common		
Upland	Western Burrowing Owl	Athene cunicularia		X						Rare		Locally occurs
Upland	Western Meadowlark	Sturnella neglecta	X	X		X	X			Common		
Upland Shrub	Western Scrub Jay	Aphelocoma californica	X				x	x	x	Uncommon		
Cliffs	White-throated Swift	Aeronautes saxatalis	X				x			UNK - Common	M S	
Conifer	Broad-tailed Hummingbird	Selasphorus platycercus	X	X	X	X	x			Fairly Common		
Montane	Dusky Flycatcher	Empidonax oberholseri	X						x	Uncommon	Y	
Conifer	Hammond's Flycatcher	Empidonax hammondii	X						x	Uncommon	S	
Conifer	Steller's Jay	Cyanocitta stelleri	X						x	Fairly Common		

Steps

1 Compiled species lists
EIS List - (incorporate Park list/ Joey Kellnor)
Combined Jefferson and Douglas County NDIS lists - listed range where occurrence or abundance differed - eliminate high elevation s
TetraTech Point Count list
Kingery data
BBA 1994 data (Plum Creek)

2 Eliminated Spp not recorded on site-specific lists
3 Eliminated non-natives
4 Eliminated locally rare/casuals/accidentals and species occurance on edge of range (e.g., redstart regionally rare locally common)
5 Eliminated Habitat Generalist (during season present on Chatfield) as not representative of any single habitat structure
6 Eliminated water, shore, and upland species

Chatfield Ecological Functions

Chatfield EIS Mapping Unit	Habitat Ecological Functions Values (EFV)			
	Breeding	Winter	Forage	Cover
Chatfield EIS PMJM Habitat				
High Value Riparian	1	1	1	1
Low Value Riparian	0.5	0.5	0.75	0.75
Upland	0.25	0.25	0.75	0.5
Non-Habitat	0	0	0	0
None*	0	0	0	0

Notes:
* = (area outside range of PMJM)

Mary Powell

From: 'Gary.drendel@tteci.com' [gary.drendel@tteci.com]
Sent: Wednesday, September 10, 2008 3:23 PM
To: Mary Powell; Ron Beane
Cc: Tom Ryon
Subject: RE: Chatfield Reallocation EIS Functions Meeting

Attachments: (bba_byhabitattype.xls) stubbed.htm; (kingerystratifications.xls) stubbed.htm

(bba_byhabitattype.xls) stubbe... (kingerystratifications.xls) s...

Mary, Ron,

Unfortunately I won't be able to make it to the meeting as I will be on travel in California. I have been in touch with Joey Kellner and I am expecting to get some information from him by today or tomorrow, in which I case I will plan to send it to you in time for the meeting. I have also extracted some additional information from data provided to me several years ago by Hugh Kingery and Ann Bonnell. The first table is from Kingery's study of breeding bird in a riparian area at Chatfield, before, during, and after the construction and filling of the reservoir. For this study he grouped or stratified the nesting bird species based on their nesting locations - - primarily canopy nesters, hole nesters, and understory nesters. The attached table shows the stratification that he used, and is probably generally applicable to the birds in the riparian areas at Chatfield. I developed the second table based on Kingery's results for the Breeding Bird Atlas block for Chatfield. It lists all of the species that were observed during the atlasing period of 1988 to 1994 and it groups the birds by their primary habitat according to the atlas data sheet. It also indicates which species are Probable or Confirmed breeding species at Chatfield. Note that I have additional data on Possible breeders and I can provide that if you need it. The American Redstart was listed as a Possible breeder; it is possible that this species has been confirmed as breeding since the time of the atlas study and this could be checked with Ann Bonnell. The habitat types with the most breeding birds are from the emergent wetland and lowland riparian habitat types. I think these tables are good supplements to our understanding of what the main breeding birds are at Chatfield and their habitat associations. I hope this information is helpful for the upcoming discussions. Please let me know if you have any questions on what I have provided.

Gary Drendel | Project Manager | Certified Ecologist
Direct: 303.980.3546
Gary.Drendel@tteci.com

Tetra Tech EC |
143 Union Blvd., Suite 1010 | Lakewood, CO 80228 | www.tteci.com

"Mary Powell" <mpowell@eroresources.com>

09/09/2008 04:06 PM
To
"Peake, Elizabeth B NWO" <Elizabeth.B.Peake@usace.army.mil>, "Laux, Eric A NWO"

<Eric.A.Laux@usace.army.mil>, <tryon@ottertail.us>, "Ron Beane" <rbeane@eroresources.com>, "Brooke Fox" <brookesfox@comcast.net>, "Jana Pedersen" <jpedersen@eroresources.com>, "Steve Dougherty" <sdougherty@eroresources.com>, <Gary.Drendel@tteci.com>, "Peter_Plage (E-mail)" <peter_plage@fws.gov>, <abonnell@juno.com>, <cecilym@sspr.org>, <david.klute@state.co.us>, <mmuller@nilenet.com>, "Sitoski, Karen M NWO" <Karen.M.Sitoski@usace.army.mil> cc
"Franklin, J Scott NWO" <J.Scott.Franklin@usace.army.mil>, "Jackson, Tina" <Tina.Jackson@state.co.us>
Subject
Chatfield Reallocation EIS Functions Meeting

This is to confirm that we will be meeting this Friday, September 12 to continue our work on creating an ecological function-based method to determine impacts and mitigation associated for the conceptual mitigation plan for the Chatfield Reallocation EIS.

The meeting will be held at the Greenway Foundation office at 5299 DTC Blvd., Suite 710 (see attached map). Currently, the office will not be available until 10:00AM. Unless I get adamant responses that 10:00AM will not work, please plan on phoning in or arriving at the meeting at 10:00AM. If there is significant outcry, we can make special arrangements to get in earlier.

To refresh everybody's memories, we wrapped up assigning values for Preble's habitat at our last meeting (see attached chart for final Preble's habitat values).

The upcoming meeting will be focused on birds. Please review the attached spreadsheet that Ron has prepared. The first page of the spreadsheet shows a cumulative species list developed from several sources. The second page shows the proposed reduced list. The third page documents how the reduced list was generated. Ron is continuing to work on placing the species into guilds based on habitat affinities. If the draft guild list is available prior to Friday, I'll send it out.

I've also attached draft meeting minutes from our meetings on July 28th and August 28th. Please let me know if you have any comments on the minutes.

Thanks.
Mary L. Powell

Natural Resource Specialist
Vice President

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[attachment "Greenway Foundation Map.pdf" deleted by Gary Drendel/SCI/CSQ] [attachment "Chatfield bird list - process.xls" deleted by Gary Drendel/SCI/CSQ] [attachment "Draft FA Meetings Minutes.pdf" deleted by Gary Drendel/SCI/CSQ]

Birds Reported from Breeding Bird Atlas By Primary Habitat Type (Littleton Block, Q3910551) (a,b)

AEM	LRD	MSC	OWL	OWS	RRL	SLC	SMM	TMGP	TMXP	TSG
Double-crested Cormorant	Black-crowned Night Heron	Barn Swallow*	American Coot	Killdeer*	House Sparrow*	Black-headed Grosbeak*	Blue-gray gnatcatcher*	Song Sparrow*	Ring-necked Pheasant*	Burrowing Owl*
Great Blue Heron	Wood Duck*	Rock Wren				Lazuli Bunting*	Green-tailed towhee		Brewer's Sparrow*	Horned Lark*
Canada Goose*	Common Merganser*					Indigo Bunting	Spotted Towhee*		Vesper Sparrow	
Mallard*	Sharp-shinned Hawk					Brewer's Blackbird*	Chipping Sparrow		Western Meadowlark*	
Blue-winged Teal*	Cooper's Hawk*									
Cinnamon Teal*	Swainson's Hawk									
Green-winged Teal*	Red-tailed Hawk*									
Virginia Rail*	American Kestrel*									
Sora	Mourning Dove*									
Spotted Sandpiper	Yellow-billed Cuckoo									
Belted Kingfisher*	Barn Owl									
Northern Rough-winged Swallow*	Eastern Screech Owl*									
Bank Swallow	Great-horned Owl*									
Cliff Swallow	Long-eared Owl*									
Marsh Wren	Common Nighthawk									
Common Yellowthroat*	Broad-tailed Hummingbird*									
Red-winged Blackbird*	Lewis's Woodpecker									
Yellow-headed Blackbird	Downy Woodpecker*									
	Hariy Woodpecker									
	Northern Flicker*									
	Western Wood-Pewee*									
	Eastern Wood-Pewee*									
	Least Flycatcher*									
	Western Kingbird*									
	Eastern Kingbird*									
	Warbling Vireo*									
	Red-eyed vireo*									
	Blue Jay									
	Black-billed Magpie*									
	Tree Swallow									
	Black-capped chickadee*									
	House Wren*									
	American Robin*									
	Gray catbird*									
	European Starling*									
	Cedar Waxwing*									
	Yellow Warbler*									
	American Redstart									
	Yellow-breasted Chat*									
	Western Tanager									
	Blue Grosbeak*									
	Common Grackle*									
	Brown-headed Cowbird*									
	Bullock's Oriole*									
	House Finch*									
	Lesser Goldfinch*									
	American Goldfinch*									

(a) Data for 1988 - 2004, from A.Bonnell and H. Kingery
(b) Habitat Codes:
AEM = Emergent wetlands,
LRD = Lowland Riparian
MSC = Other
OWL = Open Water - Lakes
OWS = Open Water - Streams
RRL = Rural
SMM = Mountain shrublands
SLC = Lowland Carr (lowland willow, riparian skunkbush thickets)
TMGP = Midgrass prairie
TMXP - Mixed Grasess of habitat
TSG = Short-grass prairie

* = Confirmed or Probable breeding

Riparian Nesting Birds at Chatfield Stratified by Nesting Location (a)		
HOLE NESTERS		
Group A		
European Starling		
Tree Swallow		
Group B		
House Wren		
Downy Woodpecker		
N. (Red-shafted)Flicker		
American Kestrel		
Black-capped Chickadee		
CANOPY NESTERS		
Group A		
Eastern Kingbird		
Common Grackle		
Great Horned Owl		
Group B		
Yellow Warbler		
American Robin		
Bullick's Oriole		
Mourning Dove		
Warbling Vireo		
American Goldfinch		
Black-billed Magpie		
Western Kingbird		
Group C		
W. Wood-Pewee		
Red-eyed Vireo		
American Redstart		
Lesser Goldfinch		
Red-tailed Hawk		
Yellow-billed Cuckoo		
Broad-tailed Hummingbird		
UNDERSTORY NESTERS		
Group B		
Common Yellowthroat		
Passerina buntings		
Song Sparrow		
Yellow-breated Chat		
Rufous-sided Towhee		
Group D		
Canada Goose		
Mallard		
Belted Kingfisher		
Rough-winged Swallow		
Gray Catbird		
Blue Grosbeak		
Western Meadowlark		
Red-winged Blackbird		
Brown-headed Cowbird		
COLONIAL BIRDS		
Great Blue Heron		
Double-crested Cormorant		

(a) From H.Kingery "A Twelve-Year Breeding Bird Census of A Cottonwood Grove, Chatfield State Park, Jefferson County, Colorado. The study was conducted from 1971 to 1986, before and after construction of Chatfield Reservoir.

Mary Powell

From: Klute, David [david.klute@state.co.us]
Sent: Thursday, September 11, 2008 1:15 PM
To: Mary Powell
Subject: RE: Chatfield Reallocation EIS Functions Meeting

Attachments: (klute - chatfield bird list - process.xls) stubbed.htm

(klute - chatfield bird list ...

Mary:

I had indicated to Ron that I could attend the meeting tomorrow. However, our family's schedule has had to change, and I need to be at home with my son tomorrow. I apologize for not getting to you sooner.

I've made some comments to the bird spreadsheet. Please don't take these to be comprehensive comments. Rather they're just some ideas and concerns that popped up while I was looking over it.

My general understanding:

· Birds are being used as an indicator for ecological impacts to habitat in general.

· There is a desire to measure the level of impact of the proposed actions to the bird community, and to be able to compare this with other ecological indicators

Problems/questions with the spreadsheet:

· I think there should be more of an effort to narrow the list

o This could be done by focusing on high priority species, species with declining populations, etc. This would be true if there is a desire to really focus on those species of conservation concern at broader scales. This may or may not be a desire of the evaluation.

o There could also be an effort to include those species which are most abundant, or characteristic of the habitats.

· Without narrowing the list there is a big problem for evaluating the relative importance of habitats. When there are a lot of rare/uncommon/vagrant/passage species included, it sort of artificially overweight that habitat. For example, in Riparian Trees there aren't nearly as many Lewis's Woodpeckers as there are Northern Flickers. So counting them both as equals doesn't really seem like a good way to evaluate. But looking at my first bullet point, you could make a case for keeping Lewis's Woodpeckers in the mix because they're a priority species. Or you could keep Northern Flickers because they're much more representative of Front Range riparian forests.

· Some species (e.g., a lot of the raptors) may not be very good simply because of their rarity. They're either just passing-through foragers. Or maybe localized nesters for some.

Generally I think the process would really benefit by very explicitly deciding what your trying to measure. Is the real interest on impacts to ecological processes in general, using birds and other elements as surrogates? If so, then what are the avian elements that best represent those processes? Or is there a more direct interest in measuring impacts to birds, per se. If so, then is the interest really focused on priority species, or most abundant, or most valued by the public, or …..? I think if those types of questions can be better articulated and answered then the mechanisms to incorporate birds will become clearer.

Again, I'm sorry I can't make it. Please let me know if I can do anything as follow up. I don't have a ton of time to devote to this but would be happy to continue to review and participate as time allows.

Cheers,

David

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David Klute, Ph.D.

Bird Conservation Coordinator

Colorado Division of Wildlife

6060 Broadway

Denver, CO 80216

Phone: 303-291-7320

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From: Mary Powell [mailto:mpowell@eroresources.com]
Sent: Tuesday, September 09, 2008 4:06 PM
To: Peake, Elizabeth B NWO; Laux, Eric A NWO; tryon@ottertail.us; Ron Beane; Brooke Fox; Jana Pedersen; Steve Dougherty; Gary.Drendel@tteci.com; Peter_Plage (E-mail); abonnell@juno.com; cecilym@sspr.org; Klute, David; mmuller@nilenet.com; Sitoski, Karen M NWO
Cc: Franklin, J Scott NWO; Jackson, Tina
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Habitat	CommonName	SciName	EIS	BBA	Point Counts	Chatfield Census	Chatfield Checklist Summer	Winter	Migrant	Jeffco/Douglas NDIS Abundance
Shore	American Avocet	Recurvirostra americana	X	x					x	Rare-Uncommon
Emergent	American Coot	Fulica americana	X	X			X			Fairly Common
Generalist	American Crow	Corvus brachyrhynchos	X		X		X	x	x	Fairly Common
Water	American Dipper	Cinclus mexicanus	X				X	x	x	Rare-Uncommon
Riparian Forest	American Goldfinch	Carduelis tristis	X	X	X		x	x	x	U - Fairly Common
Ferest Generalis	American Kestrel	Falco sparverius	X	X		X	X	X	X	Fairly Common
	American Peregrine Falcon	Falco peregrinus anatum	X						x	Unknown
Shore	American Pipit	Anthus rubescens	X						x	Fairly Common
Riparian	American Redstart	Setophaga ruticilla	X	X	X	X	x		x	Casual/Accidental
Generalist	American Robin	Turdus migratorius	X	X	X	X	X	X	X	Common
Riparian	American Tree Sparrow	Spizella arborea	X					X		Unknown
Water	American White Pelican	Pelecanus erythrorhynchos	X		X		?		x	Common
Water	American Wigeon	Anas americana	X						x	Rare
Shore	Baird's Sandpiper	Calidris bairdii	X						x	Unknown
Generalist	Bald Eagle	Haliaeetus leucocephalus	X					x	?	Casual/Accidental
Riparian Forest	Bank Swallow	Riparia riparia	X						x	U - Common
Structures	Barn Owl	Tyto alba		X						Rare
Riparian	Barn Swallow	Hirundo rustica	X	X	X		X			Abundant
Riparain	Belted Kingfisher	Ceryle alcyon	X	X	X	X	X			Uncommon
Water	Black Tern	Chlidonias niger	X						x	Unknown
Generalist	Black-billed Magpie	Pica pica	X	X	X	X	X	X	X	Common
Riparian	Black-capped Chickadee	Poecile atricapillus	X	X	X	X	X	X	X	Fairly Common
Riparian Shrub	Black-crowned Night-Heron	Nycticorax nycticorax	X	X					x	Fairly Common
Riparian Forest	Black-headed Grosbeak	Pheucticus melanocephalus	X	X			x			Fairly Common
Riparian Edges	Blue Grosbeak	Guiraca caerulea	X	X		X	x			U - Fairly Common
Riparian	Blue Jay	Cyanocitta cristata	X	X			?	?	x	U - Fairly Common
Rip/Upl Shrub	Blue-gray Gnatcatcher	Polioptila caerulea	X	X	X		x			Rare - UC
Water	Blue-winged Teal	Anas discors	X	X			x			U - Fairly Common
Generalist	Bohemian Waxwing	Bombycilla garrulus	X					x		Unknown
Water	Bonaparte's Gull	Larus philadelphia	X						x	Unknown
Generalist	Brewer's Blackbird	Euphagus cyanocephalus	X	X	X		x			Common
Riparain/Genera	Brewer's Sparrow	Spizella breweri	X	X					x	Rare
Conifer	Broad-tailed Hummingbird	Selasphorus platycercus	X	X	X	X	x			Fairly Common
Riparian	Broad-winged Hawk	Buteo platypterus	X						x	Unknown
Riparian	Brown Creeper	Certhia americana	X					x		Uncommon
Riparian	Brown Thrasher	Toxostoma rufum	X						x	Unk - Very Rare
Generalist open	Brown-headed Cowbird	Molothrus ater	X	X	X	X	x			Common
Water	Bufflehead	Bucephala albeola	X						x	Unknown
Cottonwood	Bullock's Oriole	Icterus bullockii	X	X	X	X	X			Common

Water	California Gull	Larus californicus	X				X			Unknown
Water	Canada Goose	Branta canadensis	X	X		X	X	X	X	Abundant
Water	Canvasback	Aythya valisineria	X						x	Unknown
Cliffs	Canyon Wren	Catherpes mexicanus	X				x	x	x	Uncommon
Water	Cattle Egret	Bubulcus ibis	X							Unknown
Generalist	Cedar Waxwing	Bombycilla cedrorum	X	X			x			Uncommon
Generalist	Chipping Sparrow	Spizella passerina	X						X	Common
Water	Cinnamon Teal	Anas cyanoptera	X	X			x			Uncommon
Riparian Genera	Clay-colored Sparrow	Spizella pallida	X						x	Unknown
Structures	Cliff Swallow	Petrochelidon pyrrhonota	X	X			X			Abundant
Water	Common Goldeneye	Bucephala clangula	X					X		Unknown
Riparian	Common Grackle	Quiscalus quiscula	X	X	X	X	X			C - Abundant
Water	Common Loon	Gavia immer	X						x	Unknown
Water	Common Merganser	Mergus merganser	X	X			X	X	X	Uncommon
Generalist	Common Nighthawk	Chordeiles minor	X	X			x			Fairly Common
Generalist	Common Raven	Corvus corax	X					x		Fairly Common
Emergent/WM	Wilson's (Common) Snipe	Gallinago gallinago	X	X			x	x	x	Uncommon
Water	Common Tern	Sterna hirundo	X						x	Unknown
Emergents	Common Yellowthroat	Geothlypis trichas	X	X	X	X	X			U - Fairly Common
Woodlands	Cooper's Hawk	Accipiter cooperii	X	X				?	x	Uncommon
Woodlands	Cordilleran Flycatcher	Empidonax occidentalis	X						x	Fairly Common
Woodland/shrub	Dark-eyed Junco	Junco hyemalis	X					X		Common
Water / Riparian	Double-crested Cormorant	Phalacrocorax auritus	X			X	X			Common
Riparian	Downy Woodpecker	Picoides pubescens	X	X		X	x	x	x	Uncommon
Montane	Dusky Flycatcher	Empidonax oberholseri	X						x	Uncommon
Water	Eared Grebe	Podiceps nigricollis	X						x	Unknown
Riparian	Eastern Kingbird	Tyrannus tyrannus	X	X		X	x			Uncommon - FC
Riparian	Eastern Phoebe	Sayornis phoebe	X						x	Unknown
Riparian	Eastern Screech-Owl	Otus asio	X	X			x	x	x	Uncommon
Generalist	European Starling	Sturnus vulgaris	X	X	X	X	X	X	X	Abundant
Riparian Forest	Evening Grosbeak	Coccothraustes vespertinus	X						x	Fairly Common
Grassland	Ferruginous Hawk	Buteo regalis	X					?	x	Unk - Rare
Water	Forster's Tern	Sterna forsteri	X						x	Unknown
Water	Franklin's Gull	Larus pipixcan	X						x	Unknown
Water	Gadwall	Anas strepera	X						x	Rare
Cliffs/Generalist	Golden Eagle	Aquila chrysaetos	X				x	x	x	Uncommon
Grassland	Grasshopper Sparrow	Ammodramus savannarum	X				x			Uncommon
Riparian Shrub	Gray Catbird	Dumetella carolinensis	X	X	X	X	x			Uncommon
Riparian/Shore	Great Blue Heron	Ardea herodias	X	X		X	X			Common
Generalist	Great Horned Owl	Bubo virginianus	X	X		X	X	X	X	Fairly Common
Shore/WM	Greater Yellowlegs	Tringa melanoleuca	X						x	Unknown
Riparian / water	Green Heron	Butorides virescens	X						x	Unknown
Riparian Shrub	Green-tailed Towhee	Pipilo chlorurus	X	X					x	Common

Water	Green-winged Teal	Anas crecca	X	X				X		Uncommon
Riparian Trees	Hairy Woodpecker	Picoides villosus	X	X			?		x	Uncommon
Conifer	Hammond's Flycatcher	Empidonax hammondii	X						x	Uncommon
Riparian Genera	Harris' Sparrow	Zonotrichia querula	X					X		Unknown
Woodlands	Hermit Thrush	Catharus guttatus	X						x	Common
Water	Herring Gull	Larus argentatus	X						x	Unknown
Water	Hooded Merganser	Lophodytes cucullatus	X						x	Unknown
Water	Horned Grebe	Podiceps auritus	X						x	Unknown
Grassland	Horned Lark	Eremophila alpestris	X	X			x	x	x	Uncommon - C
Generalist	House Finch	Carpodacus mexicanus	X	X			X	X	X	Abundant
Agri - Urban	House Sparrow	Passer domesticus	X	X			X	X	X	Abundant
Riparian	House Wren	Troglodytes aedon	X	X	X	X	X			Common
Woodland edge	Indigo Bunting	Passerina cyanea	X	X		X	x			R - Uncommon
Sh/WM/GL	Killdeer	Charadrius vociferus	X	X	X		x	x	x	Common
Grassland	Lapland Longspur	Calcarius lapponicus	X					x		Unknown
Grassland	Lark Bunting	Calamospiza melanocorys	X						x	Unk - Common
Generalist	Lark Sparrow	Chondestes grammacus	X				x			Common - FC
Upl shrub	Lazuli Bunting	Passerina amoena	X	X		X	x			UC - Fairly Common
Shore	Least Sandpiper	Calidris minutilla	X						x	Unknown
Riparian Forest	Lesser Goldfinch	Carduelis psaltria	X	X		X	x			Common - FC
Water	Lesser Scaup	Aythya affinis	X						x	Unknown
Shore/WM	Lesser Yellowlegs	Tringa flavipes	X						x	Unknown
Riparian Trees	Lewis' Woodpecker	Melanerpes lewis	X							Uncommon
Riparian	Lincoln's Sparrow	Melospiza lincolnii	X						x	UC - Common
Generalist	Loggerhead Shrike	Lanius ludovicianus	X						x	Rare - UC
Shore	Long-billed Dowitcher	Limnodromus scolopaceus	X						x	Unknown
Riparian	Long-eared Owl	Asio otus	X	X			x	x	x	Rare
Riparian Forest	MacGillivray's Warbler	Oporornis tolmiei	X						x	Uncommon
Water	Mallard	Anas platyrhynchos	X	X	X	X	X	X	X	Abundant
Shore	Marbled Godwit	Limosa fedoa	X						x	Unknown
Emergent	Marsh Wren	Cistothorus palustris	X					x		Fairly Common
Generalist	Merlin	Falco columbarius	X					x		Unknown
Generalist	Mountain Bluebird	Sialia currucoides	X						x	Common
Riparian	Mountain Chickadee	Poecile gambeli	X					x		Common
Generalist	Mourning Dove	Zenaida macroura	X	X	X	X	X			Abundant
Riparian	Northern Flicker	Colaptes auratus	X	X	X	X				Fairly Common
	Northern Goshawk	Accipiter gentilis	X						x	Very Rare - Rare
Emergegnt / Gra	Northern Harrier	Circus cyaneus	X					x		Rare - UNK
Generalist	Northern Mockingbird	Mimus polyglottos	X				x			Rare - UC
Water	Northern Pintail	Anas acuta	X						x	Unknown - UC
Riparian / banks	Northern Rough-winged Swallow	Stelgidopteryx serripennis	X	X		X			x	Uncommon
Water	Northern Shoveler	Anas clypeata	X						x	Rare
Grassland / Ripa	Northern Shrike	Lanius excubitor	X					x		Unknown

Water / Emerger	Northern Waterthrush	Seiurus noveboracensis	X						x	Unknown
Riparian Trees	Olive-sided Flycatcher	Contopus cooperi	X						x	Uncommon
Riparian Forest	Orange-crowned Warbler	Vermivora celata	X						x	Rare - Unk
Water	Osprey	Pandion haliaetus	X						x	Unknown
Water	Pacific Loon	Gavia pacifica	X						x	Unknown
Shore	Pectoral Sandpiper	Calidris melanotos	X						x	Unknown
Water	Pied-billed Grebe	Podilymbus podiceps	X				x			Uncommon - FC
Generalist	Pine Siskin	Carduelis pinus	X					x		Common
Upl Woodlands	Plumbeous Vireo	Vireo plumbeus	X						x	Fairly Common
Cliffs / Grasslanc	Prairie Falcon	Falco mexicanus	X					x		Rare - UC
Water	Red-breasted Merganser	Mergus serrator	X						x	Unknown
Conifer	Red-breasted Nuthatch	Sitta canadensis	X						x	Uncommon
Cottonwood	Red-eyed Vireo	Vireo olivaceus	X	X	X	X	x			Very Rare
Water	Redhead	Aythya americana	X						x	Rare - UNK
Riparian Trees	Red-headed Woodpecker	Melanerpes erythrocephalus	X						x	Rare - UNK
Riparian Edges	Red-tailed Hawk	Buteo jamaicensis	X	X		X	X	X	X	Fairly Common
Emergent	Red-winged Blackbird	Agelaius phoeniceus	X	X	X	X	X	X	X	Abundant
Water	Ring-billed Gull	Larus delawarensis	X				X	X	X	Unknown
Water	Ring-necked Duck	Aythya collaris	X						x	Unknown
Generalist	Rock Dove	Columba livia	X				x	x	x	Abundant
Generalist	Rock Wren	Salpinctes obsoletus	X	X						Uncommon - FC
Riparian Forest	Rose-breasted Grosbeak	Pheucticus ludovicianus	X						x	Casual/Accidental
Grass/ upl shrub	Rough-legged Hawk	Buteo lagopus	X					x		Unknown
Woodlands	Ruby-crowned Kinglet	Regulus calendula	X					x		Common
Water	Ruddy Duck	Oxyura jamaicensis	X						x	Unknown
Generalist	Sage Thrasher	Oreoscoptes montanus	X						x	Unknown - Rare
Shore/water	Sanderling	Calidris alba	X						x	Unknown
Grassland	Savannah Sparrow	Passerculus sandwichensis	X						x	Uncommon
Grassland - upl s	Say's Phoebe	Sayornis saya	X		X		?		x	Uncommon
Shore	Semipalmated Plover	Charadrius semipalmatus	X							Unknown
Shore	Semipalmated Sandpiper	Calidris pusilla	X						x	Unknown
Woodlands	Sharp-shinned Hawk	Accipiter striatus	X	X					x	Rare - UC
Rip / Emerg / Sh	Snowy Egret	Egretta thula	X						x	Unknown
Shore	Solitary Sandpiper	Tringa solitaria	X						x	Unknown
Riparian / Emerg	Song Sparrow	Melospiza melodia	X	X	X	X	X	X	X	Fairly Common
Emergent/wet m	Sora	Porzana carolina	X	X			x			Uncommon
Shore	Spotted Sandpiper	Actitis macularia	X	X	X		x			Uncommon - FC
Riparian Shrub	Spotted Towhee	Pipilo maculatus	X	X	X	X	X	X	X	Fairly Common
Conifer	Steller's Jay	Cyanocitta stelleri	X						x	Fairly Common
Grassland - Gen	Swainson's Hawk	Buteo swainsoni	X	X			x			Uncommon - FC
Riparian	Swainson's Thrush	Catharus ustulatus	X						x	Rare - UNK
Riparain Shrub	Swamp Sparrow	Melospiza georgiana	X						x	Unknown
	Townsend's Solitaire	Myadestes townsendi	X							Uncommon

Woodlands (R/C	Townsend's Warbler	Dendroica townsendi	X						x	Unknown
Riparian	Tree Swallow	Tachycineta bicolor	X	X	X	X	x			Fairly Common
Water	Tundra Swan	Cygnus columbianus	X						x	Unknown
Generalist	Turkey Vulture	Cathartes aura	X				?		x	Uncommon
Grassland	Vesper Sparrow	Pooecetes gramineus	X				?		X	FC - Common
Riparian	Violet-green Swallow	Tachycineta thalassina	X						x	Common
Emergent	Virginia Rail	Rallus limicola	X	X			x	x	x	Uncommon
Riparian Forest	Virginia's Warbler	Vermivora virginiae	X				x			Fairly Common
Riparian	Warbling Vireo	Vireo gilvus	X	X	X	X	x			Common
Woodlands	Western Bluebird	Sialia mexicana	X						x	Uncommon - FC
Grassland	Western Burrowing Owl	Athene cunicularia		X						Rare
Water	Western Grebe	Aechmophorus occidentalis	X						X	Unknown
Riparian - open	Western Kingbird	Tyrannus verticalis	X	X		X	X			Common
Grassland	Western Meadowlark	Sturnella neglecta	X	X		X	X			Common
Shore	Western Sandpiper	Calidris mauri	X						x	Unknown
UPL Shrub	Western Scrub Jay	Aphelocoma californica	X				x	x	x	Uncommon
Riparian	Western Tanager	Piranga ludoviciana	X						x	Fairly Common
Riparian	Western Wood-Pewee	Contopus sordidulus	X	X	X	X	X			FC - Common
Riparian	White-breasted Nuthatch	Sitta carolinensis	X		X		x	x	x	Fairly Common
Woodlands	White-crowned Sparrow	Zonotrichia leucophrys	X					x		Rare - Common
Emergent	White-faced Ibis	Plegadis chihi	X						x	Unknown
Riparian	White-throated Sparrow	Zonotrichia albicollis	X						x	Unknown
Cliffs	White-throated Swift	Aeronautes saxatalis	X				x			UNK - Common
Shore	Willet	Catoptrophorus semipalmatus	X						x	Unknown
Riparian Willow	Willow Flycatcher	Empidonax traillii	X		X				x	Rare
Shore/water	Wilson's Phalarope	Phalaropus tricolor	X						x	Rare
Riparian Forest	Wilson's Warbler	Wilsonia pusilla	X						x	Fairly Common
Riparian Shrub	Winter Wren	Troglodytes troglodytes	X					x		Unknown
Riparian	Wood Duck	Aix sponsa	X	X			x			Rare - Uncommon
Riparian Forest	Yellow Warbler	Dendroica petechia	X	X	X	X	X			Fairly Common
Cottonwood	Yellow-billed Cuckoo	Coccyzus americanus	X	X		X	x			Rare
Riparian Shrub	Yellow-breasted Chat	Icteria virens	X	X	X	X	x			UC - Fairly Common
Emergent	Yellow-headed Blackbird	Xanthocephalus xanthocephalu	X	X			x			Common
Riparian Forest	Yellow-rumped Warbler	Dendroica coronata	X						X	Common
Riparian Trees	Least Flycatcher		X	X	X		x			Not listed
Water	Thayer's Gull		X						x	Not Listed
Riparian Trees	Northeren Parula		X						x	Not Listed
	Eastern Wood-pewee			X						Not Listed

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Wetland / NW	American Coot	Fulica americana	X	X			X			Fairly Common			
Stream	American Dipper	Cinclus mexicanus	X				X	x	x	Rare-Uncommon		Locally occurs	Probably rare locally
Riparian Trees	American Goldfinch	Carduelis tristis	X	X	X		x	x	x	U - Fairly Common	Y		I think of this as more of a habitat generalist - especially for foraging
Riparian Trees	American Redstart	Setophaga ruticilla	X	X	X	X	x		x	Casual/Accidental		Locally occurs	rare
Riparian Trees	American Tree Sparrow	Spizella arborea	X					X		Unknown			
Riparian Trees	Bank Swallow	Riparia riparia	X						x	U - Common	M		
Structures	Barn Owl	Tyto alba		X						Rare		Locally occurs	Are there structures that are used (even potentially) by BAOW? Or are they just periodically heard/seen in the area?
Riparian Trees	Barn Swallow	Hirundo rustica	X	X	X		X			Abundant			Why is habitat Riparian Trees? For Cliff swallow the habitat is Structures, which is probably more accurate for Barn Swallow. I don't think a chance in Riparian Tree habitat will have an impact on Barn Swallows
Riparian Trees	Belted Kingfisher	Ceryle alcyon	X	X	X	X	X			Uncommon			
Riparian Trees	Black-capped Chickadee	Poecile atricapillus	X	X	X	X	X	X	X	Fairly Common			
Riparian Shrub	Black-crowned Night-Heron	Nycticorax nycticorax	X	X					x	Fairly Common	Y		Is there a rookery in the project area? They'll forage in most any type of riparian habitat. Not representative of riparian shrub
Riparian Trees	Black-headed Grosbeak	Pheucticus melanocephalus	X	X			x			Fairly Common	M	S - rare lowland riparian	
Riparian Edges	Blue Grosbeak	Guiraca caerulea	X	X		X	x			U - Fairly Common			
Riparian Trees	Blue Jay	Cyanocitta cristata	X	X			?	?	x	U - Fairly Common			
Rip/Upland Shrub	Blue-gray Gnatcatcher	Polioptila caerulea	X	X	X		x			Rare - UC		Locally common	
Riparian Trees	Broad-winged Hawk	Buteo platypterus	X						x	Unknown			Would be locally rare. Not dependent on the area when present
Riparian Trees	Brown Creeper	Certhia americana	X					x		Uncommon	W - Rip/ S Con		
Cottonwood	Bullock's Oriole	Icterus bullockii	X	X	X	X	X			Common			
Cliffs	Canyon Wren	Catherpes mexicanus	X				x	x	x	Uncommon			Do CAWR really occur at the site? I'm nto familiar enough with the specific habitats to know. Should be easy to figure out
Riparian Trees	Clay-colored Sparrow	Spizella pallida	X						x	Unknown	M		
Structures	Cliff Swallow	Petrochelidon pyrrhonota	X	X			X			Abundant	S - near water		
Riparian Trees	Common Grackle	Quiscalus quiscula	X	X	X	X	X			C - Abundant			

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Water - woodlands	Common Merganser	Mergus merganser	X	X			X	X	X	Uncommon	Y	Need cavity to nest	
Wetland/ NW/WM	Wilson's (Common) Snipe	Gallinago gallinago	X	X			x	x	x	Uncommon			Is there sufficient wet meadow/short emergent habitat for WISN in the project area?
Wetland/ NW	Common Yellowthroat	Geothlypis trichas	X	X	X	X	X			U - Fairly Common			
Woodlands	Cooper's Hawk	Accipiter cooperii	X	X				?	x	Uncommon			
Woodlands	Cordilleran Flycatcher	Empidonax occidentalis	X						x	Fairly Common	M	S - montane	
Woodland/shrub	Dark-eyed Junco	Junco hyemalis	X					X		Common			
Water / Riparian	Double-crested Cormorant	Phalacrocorax auritus	X			X	X			Common			Is there a rookery? Or just open water foraging?
Riparian Trees	Downy Woodpecker	Picoides pubescens	X	X		X	x	x	x	Uncommon	Y		
Riparian Trees	Eastern Kingbird	Tyrannus tyrannus	X	X		X	x			Uncommon - FC			How common are these really?
Riparian Trees	Eastern Phoebe	Sayornis phoebe	X						x	Unknown			How common are these really?
Riparian Trees	Eastern Screech-Owl	Otus asio	X	X			x	x	x	Uncommon			How common are these really?
Riparian Trees	Evening Grosbeak	Coccothraustes vespertinus	X						x	Fairly Common	M W	Montane - Y	
Riparian Shrub	Gray Catbird	Dumetella carolinensis	X	X	X	X	x			Uncommon			
Riparian/Shore	Great Blue Heron	Ardea herodias	X	X		X	X			Common			Is there a rookery? Or just foraging habitat?
Riparian Shrub	Green-tailed Towhee	Pipilo chlorurus	X	X					x	Common			
Riparian Trees	Hairy Woodpecker	Picoides villosus	X	X			?		x	Uncommon	Y		
Riparian shrub Grass	Harris' Sparrow	Zonotrichia querula	X					X		Unknown	Rare M W		Probably very rare in winter
Woodlands	Hermit Thrush	Catharus guttatus	X						x	Common	M		
Riparian Trees	House Wren	Troglodytes aedon	X	X	X	X	X			Common			
Woodland edge	Indigo Bunting	Passerina cyanea	X	X		X	x			R - Uncommon			
Sh/WM/GL	Killdeer	Charadrius vociferus	X	X	X		x	x	x	Common			Process says all shore species were eliminated. Why is this still here?
Riparian Trees	Lesser Goldfinch	Carduelis psaltria	X	X		X	x			Common - FC	S M		
Riparian Trees	Lewis' Woodpecker	Melanerpes lewis	X							Uncommon	Y		
Riparian Trees	Lincoln's Sparrow	Melospiza lincolnii	X						x	UC - Common	M	S - Foothills - west	
Riparian Trees	Long-eared Owl	Asio otus	X	X			x	x	x	Rare		Locally occurs	
Riparian Trees	MacGillivray's Warbler	Oporornis tolmiei	X						x	Uncommon	M		
Wetlands / Water	Mallard	Anas platyrhynchos	X	X	X	X	X	X	X	Abundant			
Wetland/ NW	Marsh Wren	Cistothorus palustris	X					x		Fairly Common			
Riparian Trees	Mountain Chickadee	Poecile gambeli	X					x		Common			
Riparian Trees	Northern Flicker	Colaptes auratus	X	X	X	X				Fairly Common			
Wetland/ NW / Upland	Northern Harrier	Circus cyaneus	X					x		Rare - UNK		Locally occurs	
Riparian / banks	Northern Rough-winged Swallow	Stelgidopteryx serripennis	X	X		X			x	Uncommon			
Upland / Riparian edge	Northern Shrike	Lanius excubitor	X					x		Unknown			

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Water / Wetland/ NW	Northern Waterthrush	Seiurus noveboracensis	X						x	Unknown			
Riparian Trees	Olive-sided Flycatcher	Contopus cooperi	X						x	Uncommon	S M		
Water/ Wetlands	Pied-billed Grebe	Podilymbus podiceps	X				x			Uncommon - FC			
Cottonwood	Red-eyed Vireo	Vireo olivaceus	X	X	X	X	x			Very Rare		Locally occurs	
Riparian Trees	Red-headed Woodpecker	Melanerpes erythrocephalus	X						x	Rare - UNK	S M		How common are these really?
Woodlands	Red-tailed Hawk	Buteo jamaicensis	X	X		X	X	X	X	Fairly Common			
Wetland/ NW	Red-winged Blackbird	Agelaius phoeniceus	X	X	X	X	X	X	X	Abundant			
Woodlands	Ruby-crowned Kinglet	Regulus calendula	X					x		Common	W		
Woodlands	Sharp-shinned Hawk	Accipiter striatus	X	X					x	Rare - UC		Locally breeds	
Rip / Wetlands / Shore	Snowy Egret	Egretta thula	X						x	Unknown			
Riparian / Wetlands	Song Sparrow	Melospiza melodia	X	X	X	X	X	X	X	Fairly Common	Y		
Wetlands/ NW	Sora	Porzana carolina	X	X			x			Uncommon			
Shore/stream	Spotted Sandpiper	Actitis macularia	X	X	X		x			Uncommon - FC	S/M		
Riparian Shrub	Spotted Towhee	Pipilo maculatus	X	X	X	X	X	X	X	Fairly Common			
Riparian Shrub	Swamp Sparrow	Melospiza georgiana	X						x	Unknown	Rare W M		
Woodlands (R/C)	Townsend's Warbler	Dendroica townsendi	X						x	Unknown	M		
Riparian Trees	Tree Swallow	Tachycineta bicolor	X	X	X	X	x			Fairly Common			
Riparian Trees	Violet-green Swallow	Tachycineta thalassina	X						x	Common			
Wetland / NW	Virginia Rail	Rallus limicola	X	X			x	x	x	Uncommon			
Riparian Trees	Virginia's Warbler	Vermivora virginiae	X				x			Fairly Common	S - oak - M - Riparian		
Riparian Trees	Warbling Vireo	Vireo gilvus	X	X	X	X	x			Common			
Woodlands	Western Bluebird	Sialia mexicana	X						x	Uncommon - FC	M/W - woodlands		
Riparian - open	Western Kingbird	Tyrannus verticalis	X	X		X	X			Common			
Riparian Trees	Western Tanager	Piranga ludoviciana	X						x	Fairly Common			
Riparian Trees	Western Wood-Pewee	Contopus sordidulus	X	X	X	X	X			FC - Common	S M		
Riparian Trees	White-breasted Nuthatch	Sitta carolinensis	X		X		x	x	x	Fairly Common			
Woodlands	White-crowned Sparrow	Zonotrichia leucophrys	X					x		Rare - Common			
Wetland / NW	White-faced Ibis	Plegadis chihi	X						x	Unknown			Probably not many of these around there
Riparian Trees	White-throated Sparrow	Zonotrichia albicollis	X						x	Unknown			
Riparian Shrub	Willow Flycatcher	Empidonax traillii	X		X				x	Rare	S	Locally occurs	
Riparian Trees	Wilson's Warbler	Wilsonia pusilla	X						x	Fairly Common	M		
Riparian Shrub	Winter Wren	Troglodytes troglodytes	X					x		Unknown			
Riparian Trees	Wood Duck	Aix sponsa	X	X			x			Rare - Uncommon	S	Locally occurs	

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Riparian Trees	Yellow Warbler	Dendroica petechia	X	X	X	X	X			Fairly Common	S M		
Cottonwood	Yellow-billed Cuckoo	Coccyzus americanus	X	X		X	x			Rare		Locally occurs	very rare
Riparian Shrub	Yellow-breasted Chat	Icteria virens	X	X	X	X	x			UC - Fairly Common			
Wetland / NW	Yellow-headed Blackbird	Xanthocephalus xanthocephalus	X	X			x			Common			
Riparian Trees	Yellow-rumped Warbler	Dendroica coronata	X						X	Common	M		
Riparian Trees	Least Flycatcher		X	X	X		x			Not listed	S M		
	Species removed												
	American Avocet	Recurvirostra americana	X	x					x	Rare-Uncommon			
Generalist	Loggerhead Shrike	Lanius ludovicianus	X						x	Rare - UC			
	American Wigeon	Anas americana	X						x	Rare			
	Baird's Sandpiper	Calidris bairdii	X						x	Unknown	M Rare		
	Bonaparte's Gull	Larus philadelphia	X						x	Unknown	Rare M		
Riparian	Brown Thrasher	Toxostoma rufum	X						x	Unk - Very Rare		Riparian	
Riparian / water	Green Heron	Butorides virescens	X						x	Unknown	Rare M		
	Northern Goshawk	Accipiter gentilis	X						x	Very Rare - Rare			
Generalist	Northern Mockingbird	Mimus polyglottos	X				x			Rare - UC			
Water	Northern Shoveler	Anas clypeata	X						x	Rare			
Riparian Trees	Orange-crowned Warbler	Vermivora celata	X						x	Rare - Unk	M		
Riparian Trees	Rose-breasted Grosbeak	Pheucticus ludovicianus	X						x	Casual/Accidental	M S		
Generalist	Sage Thrasher	Oreoscoptes montanus	X						x	Unknown - Rare	M - Generalist		
Riparian	Swainson's Thrush	Catharus ustulatus	X						x	Rare - UNK			
Shore/water	Wilson's Phalarope	Phalaropus tricolor	X						x	Rare	Rare		
Water	Thayer's Gull		X						x	Not Listed	Rare M		
Riparian Trees	Northern Parula		X						x	Not Listed	Rare M		
	Eastern Wood-pewee			X						Not Listed	Accidental M		
Generalist	American Crow	Corvus brachyrhynchos	X		X		X	x	x	Fairly Common			
Forest Generalist	American Kestrel	Falco sparverius	X	X		X	X	X	X	Fairly Common			
Generalist	American Peregrine Falcon	Falco peregrinus anatum	X						x	Unknown		Prey driven	
Generalist	American Robin	Turdus migratorius	X	X	X	X	X	X	X	Common			
Generalist	Bald Eagle	Haliaeetus leucocephalus	X					x	?	Casual/Accidental		Locally occurs	
Generalist	Black-billed Magpie	Pica pica	X	X	X	X	X	X	X	Common			
Generalist	Bohemian Waxwing	Bombycilla garrulus	X					x		Unknown			
Generalist	Brewer's Blackbird	Euphagus cyanocephalus	X	X	X		x			Common			
Riparian/Generalist	Brewer's Sparrow	Spizella breweri	X	X					x	Rare	M	S - Upl Shrub	
Generalist open	Brown-headed Cowbird	Molothrus ater	X	X	X	X	x			Common			

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Generalist (Fruit)	Cedar Waxwing	Bombycilla cedrorum	X	X			x			Uncommon			
Generalist	Chipping Sparrow	Spizella passerina	X						X	Common	M	S - Montane	
Generalist	Common Nighthawk	Chordeiles minor	X	X			x			Fairly Common			
Generalist	Common Raven	Corvus corax	X					x		Fairly Common			
Cliffs/Generalist	Golden Eagle	Aquila chrysaetos	X				x	x	x	Uncommon			
Generalist	Great Horned Owl	Bubo virginianus	X	X		X	X	X	X	Fairly Common			
Generalist	House Finch	Carpodacus mexicanus	X	X			X	X	X	Abundant	Y		
Generalist	Lark Sparrow	Chondestes grammacus	X				x			Common - FC	S M		
Generalist	Merlin	Falco columbarius	X					x		Unknown			
Generalist	Mountain Bluebird	Sialia currucoides	X						x	Common			
Generalist	Mourning Dove	Zenaida macroura	X	X	X	X	X			Abundant			
Generalist	Pine Siskin	Carduelis pinus	X					x		Common	W M	Winter generalist	
Generalist	Rock Wren	Salpinctes obsoletus	X	X						Uncommon - FC	M- generalist		
Upland - Generalist	Swainson's Hawk	Buteo swainsoni	X	X			x			Uncommon - FC			
Generalist	Turkey Vulture	Cathartes aura	X				?		x	Uncommon			
Water	American White Pelican	Pelecanus erythrorhynchos	X		X		?		x	Common			
Water	Black Tern	Chlidonias niger	X						x	Unknown			
Water	Blue-winged Teal	Anas discors	X	X			x			U - Fairly Common			
Water	Bufflehead	Bucephala albeola	X						x	Unknown	M W		
Water	California Gull	Larus californicus	X				X			Unknown	Y		
Water	Canada Goose	Branta canadensis	X	X		X	X	X	X	Abundant			
Water	Canvasback	Aythya valisineria	X						x	Unknown			
Water	Cattle Egret	Bubulcus ibis	X							Unknown	M		
Water	Cinnamon Teal	Anas cyanoptera	X	X			x			Uncommon			
Water	Common Goldeneye	Bucephala clangula	X					X		Unknown			
Water	Common Loon	Gavia immer	X						x	Unknown			
Water	Common Tern	Sterna hirundo	X						x	Unknown			
Water	Eared Grebe	Podiceps nigricollis	X						x	Unknown			
Water	Forster's Tern	Sterna forsteri	X						x	Unknown			
Water	Franklin's Gull	Larus pipixcan	X						x	Unknown			
Water	Gadwall	Anas strepera	X						x	Rare			
Water	Green-winged Teal	Anas crecca	X	X				X		Uncommon			
Water	Herring Gull	Larus argentatus	X						x	Unknown			
Water	Hooded Merganser	Lophodytes cucullatus	X						x	Unknown	Y		
Water	Horned Grebe	Podiceps auritus	X						x	Unknown			
Water	Lesser Scaup	Aythya affinis	X						x	Unknown			
Water	Northern Pintail	Anas acuta	X						x	Unknown - UC			
Water	Osprey	Pandion haliaetus	X						x	Unknown			
Water	Pacific Loon	Gavia pacifica	X						x	Unknown	M		
Water	Red-breasted Merganser	Mergus serrator	X						x	Unknown	M		
Water	Redhead	Aythya americana	X						x	Rare - UNK			

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Water	Ring-billed Gull	Larus delawarensis	X				X	X	X	Unknown		nest on islands	
Water	Ring-necked Duck	Aythya collaris	X						x	Unknown			
Water	Ruddy Duck	Oxyura jamaicensis	X						x	Unknown			
Water	Tundra Swan	Cygnus columbianus	X						x	Unknown			
Water	Western Grebe	Aechmophorus occidentalis	X						X	Unknown			
Shore	American Pipit	Anthus rubescens	X						x	Fairly Common	M W		
Shore/Wet mead.	Greater Yellowlegs	Tringa melanoleuca	X						x	Unknown	M		
Shore	Least Sandpiper	Calidris minutilla	X						x	Unknown			
Shore/WM	Lesser Yellowlegs	Tringa flavipes	X						x	Unknown	M		
Shore	Long-billed Dowitcher	Limnodromus scolopaceus	X						x	Unknown			
Shore	Marbled Godwit	Limosa fedoa	X						x	Unknown			
Shore	Pectoral Sandpiper	Calidris melanotos	X						x	Unknown			
Shore/water	Sanderling	Calidris alba	X						x	Unknown	M		
Shore	Semipalmated Plover	Charadrius semipalmatus	X							Unknown	M		
Shore	Semipalmated Sandpiper	Calidris pusilla	X						x	Unknown			
Shore	Solitary Sandpiper	Tringa solitaria	X						x	Unknown	M		
Shore	Western Sandpiper	Calidris mauri	X						x	Unknown			
Shore	Willet	Catoptrophorus semipalmatus	X						x	Unknown	M		
Upland	Ferruginous Hawk	Buteo regalis	X					?	x	Unk - Rare			
Upland	Horned Lark	Eremophila alpestris	X	X			x	x	x	Uncommon - C			
Upland	Lapland Longspur	Calcarius lapponicus	X					x		Unknown			
Upland	Lark Bunting	Calamospiza melanocorys	X						x	Unk - Common			
Upland shrub	Lazuli Bunting	Passerina amoena	X	X		X	x			UC - Fairly Common			
Upland Woodlands	Plumbeous Vireo	Vireo plumbeus	X						x	Fairly Common			
Cliffs / Upland	Prairie Falcon	Falco mexicanus	X					x		Rare - UC			
Conifer	Red-breasted Nuthatch	Sitta canadensis	X						x	Uncommon			
Grass/ Upland shrub	Rough-legged Hawk	Buteo lagopus	X					x		Unknown			
Upland	Savannah Sparrow	Passerculus sandwichensis	X						x	Uncommon	M S		
Upland - Upland shrub	Say's Phoebe	Sayornis saya	X		X		?		x	Uncommon			
Upland	Vesper Sparrow	Pooecetes gramineus	X				?		X	FC - Common			
Upland	Western Burrowing Owl	Athene cunicularia		X						Rare		Locally occurs	
Upland	Western Meadowlark	Sturnella neglecta	X	X		X	X			Common			
Upland Shrub	Western Scrub Jay	Aphelocoma californica	X				x	x	x	Uncommon			
Cliffs	White-throated Swift	Aeronautes saxatalis	X				x			UNK - Common	M S		

Habitat	Common Name	SciName	EIS	BBA	Point Counts	Chatfield Census	Chatfield Checklist Summer	Chatfield Checklist Winter	Chatfield Checklist Migrant	Jeffco/Douglas NDIS Abundance	Kingery /A&R Seasonal Use	Comments	Klute comments/questions
Conifer	Broad-tailed Hummingbird	Selasphorus platycercus	X	X	X	X	x			Fairly Common			
Montane	Dusky Flycatcher	Empidonax oberholseri	X						x	Uncommon	Y		
Conifer	Hammond's Flycatcher	Empidonax hammondii	X						x	Uncommon	S		
Conifer	Steller's Jay	Cyanocitta stelleri	X						x	Fairly Common			

Steps

1 Compiled species lists
EIS List - (incorporate Park list/ Joey Kellnor)
Combined Jefferson and Douglas County NDIS lists - listed range where occurrence or abundance differed - eliminate high elevation s
TetraTech Point Count list
Kingery data
BBA 1994 data (Plum Creek)

2 Eliminated Spp not recorded on site-specific lists
3 Eliminated non-natives
4 Eliminated locally rare/casuals/accidentals and species occurance on edge of range (e.g., redstart regionally rare locally common)
5 Eliminated Habitat Generalist (during season present on Chatfield) as not representative of any single habitat structure
6 Eliminated water, shore, and upland species

Mary Powell

From: Ron Beane [/o=ero/ou=eroserver/cn=recipients/cn=rbeane]
Sent: Thursday, September 11, 2008 2:41 PM
To: Mary Powell; Peake, Elizabeth B Nwo; 'Eric.a.laux@usace.army.mil'; Tom Ryon; Brookesfox; Jana Pedersen; Steve Dougherty; 'Gary.drendel@tteci.com'; 'Peter_plage@fws.gov'; Ann Bonnell; Cecily H. Y. Mui; Klute, David; 'Mmuller@nilenet.com'; Sitoski, Karen M Nwo
Cc: Franklin, J Scott Nwo; Jackson, Tina
Subject: RE: Chatfield - Grouping birds by breeding habitat/guilds

Attachments: (grouped by bba habitat.xls) stubbed.htm; (guild explanation.doc) stubbed.htm; (guilds.xls) stubbed.htm; (the guild concept applied to management of bird populations.pdf) stubbed.htm

(grouped by bba habitat.xls) s... (guild planation.doc) stubb (guilds.xls) stubbed.htm (585 .. (the guild concept applied to ...

All,

If we start with the definition of a guild as a "group of species that exploit the same class of environmental resources in a similar way" (root 1967) two ways to group birds are by 1) habitat use, and 2) a breeding/foraging guild. The goal of grouping Chatfield birds is for the technical group (that would be us) to review the guild and the actual species at Chatfield that occupy that guild, and develop a general index of the functional values that each mapped habitat provides to that guild. In essence, we will be developing a habitat suitability index for the selected guilds that we can then apply values such as optimum, good, fair, poor, to habitat units as we did last meeting for Preble's.

I am attaching two spreadsheets that have grouped Chatfield birds by:

1) BBA habitats
2) Guilds following Verner 1984

BBA habitat approach:

Gray Drendel provided table 1 to me yesterday with the following note

"I developed the table based on Kingery's results for the Breeding Bird Atlas block for Chatfield. It lists all of the species that were observed during the atlasing period of 1988 to 1994 and it groups the birds by their primary habitat according to the atlas data sheet. It also indicates which species are Probable or Confirmed breeding species at Chatfield."

In reviewing this table it was very similar in species and comparable habitat grouping to the list ERO sent out earlier this week with two main exceptions; 1) the list does not include winter residents or migrants, and 2) the list is not pared down to focus on the habitats this process is most interested in (i.e., water, shore, uplands, generalists, rare species, and non-natives are included). Several articles on the guild concept suggest delineating guilds only for breeding species because winter residents and migrants use the same zones in similar ways. Thus, my first question for the group is "can we assume that by addressing functional values for breeding birds we are accounting for the functional value of the habitat for migrant and wintering birds?" As for exception 2, I have highlighted the birds eliminated from the previous list and added five species of potential breeders not included on Gary's list.

Guild approach:

The second spreadsheet takes Gary's spreadsheet and eliminates species as previously described to get to our focus habitats. The species are then grouped into a structural breeding/foraging guild modified from Verner 1984 (article attached). Again, assuming that there will be an increase in open water habitats that don't require a functional assessment, I have come up with seven structural guilds that include:

Open water - stream

Ground layer

Tree layer

Tree boles

Riparian shrub layer

Upland shrub layer

Tree canopy layer (e.g., mature cottonwoods).

This approach is very similar to the habitat stratification used by Kingery to monitor pre- and post reservoir impacts on breeding birds. In fact I was able to transfer his habitat stratification directly into the guild concept and Hugh's groupings are highlighted in blue. There can be discussion on where each individual species fits, but the real focus is on the guild not individual species.

We can discuss both approaches tomorrow, but I recommend moving forward on the structural guild approach (no. 2) and developing a guild suitability index for each guild. We can build on existing Habitat Suitability Indexes such as yellow warbler or red-winged blackbird. For example, optimal habitat suitability for the tree canopy guild could be described as moderately tall to tall stands of deciduous trees with a moderate tall hydrophytic deciduous shrub understory; Good habitat could be tall stands of deciduous trees with a closed canopy and open shrub understory, and fair could be moderately tall to tall stands of deciduous trees with no shrub understory, and so on.

I look forward to our discussion,

Ron

From: Mary Powell
Sent: Tuesday, September 09, 2008 4:06 PM
To: Peake, Elizabeth B NWO; Laux, Eric A NWO; tryon@ottertail.us; Ron Beane; Brooke Fox; Jana Pedersen; Steve Dougherty; Gary.Drendel@tteci.com; Peter_Plage (E-mail); abonnell@juno.com; cecilym@sspr.org; david.klute@state.co.us; mmuller@nilenet.com; Sitoski, Karen M NWO
Cc: Franklin, J Scott NWO; Jackson, Tina
Subject: Chatfield Reallocation EIS Functions Meeting

This is to confirm that we will be meeting this Friday, September 12 to continue our work on creating an ecological function-based method to determine impacts and mitigation associated for the conceptual mitigation plan for the Chatfield Reallocation EIS.

The meeting will be held at the Greenway Foundation office at 5299 DTC Blvd., Suite 710 (see attached map). Currently, the office will not be available until 10:00AM. Unless I get adamant responses that 10:00AM will not work, please plan on phoning in or arriving at the meeting at 10:00AM. If there is significant outcry, we can make special arrangements to get in earlier.

To refresh everybody's memories, we wrapped up assigning values for Preble's habitat at our last meeting (see attached chart for final Preble's habitat values).

The upcoming meeting will be focused on birds. Please review the attached spreadsheet that Ron has prepared. The first page of the spreadsheet shows a cumulative species list developed from several sources. The second page shows the proposed reduced list. The third page documents how the reduced list was generated. Ron is continuing to work on placing the species into guilds based on habitat affinities. If the draft guild list is available prior to Friday, I'll send it out.

I've also attached draft meeting minutes from our meetings on July 28th and August 28th. Please let me know if you have any comments on the minutes.

Thanks.

Mary L. Powell

Natural Resource Specialist
Vice President

ERO Resources Corp. . 1842 Clarkson St. . Denver, CO 80218 . 303.830.1188 . Fax: 830.1199 . www.eroresources.com
<blocked::http://www.eroresources.com/>

Birds Reported from Breeding Bird Atlas By Primary Habitat Type (Littleton Block, Q3910551) (a,b)

Emergent Wetlands (AEM)	Lowland Riparian (LRD)	Other (MSC)	Lowland Carr (SLC)	Mtn. Shrub (SMM)	Tallgrass Prairie (TMGP)	Mixed grass (TMXP)	Short-grass (TSG)	Open Water - Lakes (OWL)	Open Water - Streams (OWS)	Rural (RRL)
Double-crested Cormorant	Black-crowned Night Heron	Barn Swallow*	Black-headed Grosbeak*	Blue-gray gnatcatcher*	Song Sparrow*	Ring-necked Pheasant*	Burrowing Owl*	American Coot	Killdeer*	House Sparrow*
Great Blue Heron	Wood Duck*	Rock Wren	Lazuli Bunting*	Green-tailed towhee		Brewer's Sparrow*	Horned Lark*			
Canada Goose*	Common Merganser*		Indigo Bunting	Spotted Towhee*		Vesper Sparrow				
Mallard*	Sharp-shinned Hawk		Brewer's Blackbird*	Chipping Sparrow		Western Meadowlark*				
Blue-winged Teal*	Cooper's Hawk*									
Cinnamon Teal*	Swainson's Hawk									
Green-winged Teal*	Red-tailed Hawk*									
Virginia Rail*	American Kestrel*									
Sora	Mourning Dove*									
Spotted Sandpiper	Yellow-billed Cuckoo									
Belted Kingfisher*	Barn Owl									
Northern Rough-winged Swallow*	Eastern Screech Owl*									
Bank Swallow	Great-horned Owl*									
Cliff Swallow	Long-eared Owl*									
Marsh Wren	Common Nighthawk									
Common Yellowthroat*	Broad-tailed Hummingbird*									
Red-winged Blackbird*	Lewis's Woodpecker									
Yellow-headed Blackbird	Downy Woodpecker*									
	Hairy Woodpecker									
	Northern Flicker*									
	West. Wood-Pewee*									
	Eastern Wood-Pewee*									
	Least Flycatcher*									
	Western Kingbird*									
	Eastern Kingbird*									
	Warbling Vireo*									
	Red-eyed vireo*									
	Blue Jay									

Black-billed Magpie*
Tree Swallow
Black-capped chickadee*
House Wren*
American Robin*
Gray catbird*
European Starling*
Cedar Waxwing*
Yellow Warbler*
American Redstart
Yellow-breasted Chat*
Western Tanager
Blue Grosbeak*
Common Grackle*
Brown-headed Cowbird*
Bullock's Oriole*
House Finch*
Lesser Goldfinch*
American Goldfinch*

ERO List (Breeding)

American Dipper	Virginia's Warbler	Willow Flycatcher
Wilson's Snipe	White-breasted Nuthatch	

(a) Data for 1988 - 2004, from A.Bonnell and H. Kingery
(b) Habitat Codes:
AEM = Emergent wetlands, marshes
LRD = Lowland Riparian
MSC = Other
OWL = Open Water - Lakes
OWS = Open Water - Streams
RRL = Rural
SMM = Mountain shrublands
SLC = Lowland Carr (lowland willow, riparian skunkbush thickets)
TMGP = Midgrass prairie
TMXP - Mixed Grasess of habitat alteration (plains plantings & introduced grasses)
TSG = Short-grass prairie

* = Confirmed or Probable breeding

Eliminated because of Habitat - water
Eliminated because of generalist, rare, or non-native
Eliminated because of Habitat - uplands

All,

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Open water – stream
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I look forward to our discussion,

Ron

Birds Reported from Breeding Bird Atlas By Guild (Littleton Block, Q3910551) (a,b)

Open Water - Streams	Ground Layer	Tree Layer	Tree Boles	Riparian Shrub Layer	Upland Shrub Layer	Tree Canopy Layer
Killdeer*	Double-crested Cormorant	Double-crested Cormorant	Tree Swallow	Black-headed Grosbeak*	Blue-gray gnatcatcher*	Western Kingbird*
	Great Blue Heron	Great Blue Heron	Lewis's Woodpecker	Indigo Bunting	Green-tailed towhee	Eastern Kingbird*
	Black-crowned Night Heron	Black-crowned Night Heron	Downy Woodpecker*	Spotted Towhee*		Warbling Vireo*
Mallard*	Mallard*		Hairy Woodpecker	Song Sparrow*		Common Grackle*
	Common Merganser*	Common Merganser*	Northern Flicker*	Common Yellowthroat*		Bullock's Oriole*
Belted Kingfisher*	Virginia Rail*	Wood Duck*	American Kestrel	Lazuli Bunting		American Goldfinch*
Northern Rough-winged Swallow*	Sora	Sharp-shinned Hawk	Black-capped chickadee*	Yellow-breasted Chat*		Yellow Warbler*
Bank Swallow	Spotted Sandpiper	Cooper's Hawk*	House Wren*	Gray catbird*		Western Wood-Pewee*
Cliff Swallow	Marsh Wren	Red-tailed Hawk*		Blue Grosbeak*		Eastern Wood-Pewee*
	Red-winged Blackbird*	Barn Owl				Red-eyed vireo*
	Yellow-headed Blackbird	Eastern Screech Owl*				American Redstart
		Long-eared Owl*				Yellow-billed Cuckoo
		Least Flycatcher*				Lesser Goldfinch*
		Blue Jay				
		Western Tanager				
ERO List (Breeding)						
American Dipper	Wilson's Snipe	Virginia's Warbler	White-breasted Nuthatch	Willow Flycatcher		

Eliminate other, grasslands, rural
Eliminate generalists, rare, non-natives
Stratify into structural layers and add tree boles and tree canopy layer per Verner 1984
Rearrange guilds based on Kingery Stratification, BBA, BNA accounts

(shaded) = Per Kingery

Habitat Suitability Index

?	RWBL	Heron	BCCH	?	?	YEWA
	Coot	?	HAWO			
	Rail					

'AL
NT

FORUM
The Guild Concept Applied to Management of Bird Populations

JARED VERNER
PSW Forest and Range Experiment Station
Forestry Sciences Laboratory
Fresno, California 93710

ABSTRACT / Alternative ways to apply the guild concept to wildlife management are evaluated here. I reject the idea that indicator species can be selected for each bird guild to reduce costs of environmental assessment and monitoring. Promise is seen, however, in the option of using whole guilds to indicate the capability of habitat zones to support populations of wildlife species. It may be adequate for most management purposes to delineate guilds only for species that use an environment for breeding, because transients and winter residents probably use the same zones of the habitat in the same ways. Potential guilds are identified by cells of a two-dimensional matrix, the axes identifying primary feeding and nesting zones. Some questions may be answered with guilds as delineated by all cells in the matrix. Alternatively, larger guilds can be formed by grouping all species in each column or row of the matrix to identify, for example, all species that depend on tree canopies for foraging, or tree boles for nesting. One can also consider separately the resident breeders, migrant breeders, and winter residents to obtain insights into whether observed changes in numbers of birds in a guild are a result of conditions locally or elsewhere. I conclude that the guild concept probably has a place in wildlife management, but much testing must be done before it is widely applied.

The recent environmental movement generated much public pressure to conserve all renewable natural resources, resulting in laws and regulations that require land-management agencies to monitor such resources. Meeting these mandates will not be easy, because adequate monitoring systems can be extraordinarily expensive. Any system that is both quantitatively adequate and cost-effective will necessarily involve shortcuts, which we must be certain do not result in irreversible errors. As Aldo Leopold (1953:147) so aptly put it. "If the biota, in the course of aeons, has built something we like but do not understand, then who but a fool would discard seemingly useless parts. To keep every cog and wheel is the first precaution of intelligent tinkering."

The guild concept may provide one way to streamline the tasks of environmental assessment and resource monitoring. This idea has apparently been developed independently by several workers. Järvinen and Väisänen (1979:75) pointed out that, "Because many population changes have multiple causes, monitoring specific environmental changes is most rewarding if birds are grouped by . . . habitat, major strategy (e.g. resident vs. migrant species), or feeding guild." Thomas and fellow researchers (1979) clearly had such an idea in mind when they grouped all terrestrial vertebrates of the Blue Mountains of Oregon and Washington into 16 different "life forms." And Verner (1980a), DeGraaf and Wentworth (1981), and Severinghaus (1981) for animals, and Johnson (1981) for plants, expressly proposed application of the guild concept in land and resource management.

The guild was originally proposed and defined by Root (1967:335) as a "group of species that exploit the same class of environmental resources in a similar way." The way in which Root applied the concept in his own work clarifies the importance he gave to functional relationships of the species in a guild. For example, foliage-gleaning insectivores can be grouped into a guild because they use a similar foraging maneuver to obtain similar food resources from similar substrates in a shared environment. Such delineation has considerable potential in helping to unravel questions about interspecific competition in a bird community.

Guilds are investigator-defined units (Root 1967, MacMahon and others 1981, Jaksić 1981), a fact that introduces circularity into their use for examining ecological questions (Landres and MacMahon 1980, Landres in press). Efforts to make the process of guild delineation more objective have used cluster analysis (Crome 1978), principal components analysis (Holmes and others 1979, Landres and MacMahon 1980, Short and Burnham 1982), canonical correlation (Folse 1981), and discriminant function analysis (Dueser and Shugart 1979). Nonetheless, a review of the avian literature in which guilds are given significant attention, back to 1976, shows a disquieting lack of consistency in how various workers assign bird species to guilds. Most define guilds according to foraging behavior of the species, using substrates, strategies, diets, or some combination of these. Among more than 50 papers reviewed, all but four described foraging guilds. One exception described nesting guilds of seabirds (Siegel-Causey and Whittam 1980). Three described nesting and foraging guilds (De Graaf and Wentworth 1981, Short 1982, Short and Burnham 1982). Even different workers studying avian communities in similar habitats sometimes grouped the same sets of species into different sets of guilds. The overall result is that each study using guilds must be examined on its own merits; one must be cautious when comparing guild analyses between studies.

The potential benefits of applying the guild concept to wildlife management appear to be substantial, but the potential

KEY WORDS: Guild concept; Birds; Environmental impact assessment; Monitoring

hazards of using it inappropriately are also great. In the remainder of this article, I examine the feasibility of using the guild concept to streamline environmental assessments and monitoring trends among bird populations. An example is given using recent studies of bird assemblages of pine-oak woodlands in the western foothills of the Sierra Nevada of California.

Guilds and Management

Previous Efforts

At least three previous efforts have been made to assign all species to guilds over a broad geographic area, and to suggest that these could facilitate assessment of environmental impacts. Severinghaus (1981) identified 31 guilds to include all species of predominantly land-dwelling birds inhabiting the contiguous United States, suggesting that management could be streamlined by focusing attention on one or a few species chosen as indicators of each guild. Thomas and fellow researchers (1979) grouped all species of amphibians, reptiles, birds, and mammals of the Blue Mountains of Oregon and Washington into 16 different "life forms" that could also have been called guilds. Short and Burnham (1982) defined a total of 36 "guild blocks" into which they placed 275 species of amphibians, reptiles, birds, and mammals of southeastern Montana and northeastern Wyoming. Each of these examples is briefly evaluated in this section.

Guilds and indicator species. Severinghaus (1981:187) hypothesized that, since all members of a guild use the same resources, all should respond similarly to certain changes in their environment. He related this idea to wildlife management in the following way:

> Once the impact on any one species in a guild is determined, the impact on every other species in that guild is known. Furthermore, this information can be applied to any ecosystem within which that guild is found. If an endangered species is contained in a guild, it is possible to predict the impact on that species without studying it specifically . . . Economically, the potential cost-savings are tremendous, since only a few species per guild need be studied to establish the resulting impacts on all members of the guild."

From this I define a *guild indicator* as a species selected as an indicator of the responses of all members of its guild to changes in the environment, whether of human or natural origin. Similarly, in wildlife management, a "guild-indicator approach" uses a guild indicator (a) to assess the capability of a habitat to support populations of all other species in its guild, and (b) to indicate population trends among all members of the guild.

Severinghaus (1981) advocated a guild-indicator approach to management, so we can evaluate his guilds in terms of common responses to environmental changes by all members of a particular guild. I find a number of cases among his proposed guilds for which this is untrue. For example, the Roadrunner (*Geococcyx californianus*), a ground feeder in arid shrublands of the southwestern United States, is an unlikely guild companion with the Wood Ibis (*Mycteria americana*), a swamp-dwelling species of the southern states that feeds in shallow freshwater ponds and sloughs. In one guild, gleaners of insects in trees and shrubs were combined, but some environmental changes affect the shrub and tree layers differently. Probably the main reason that Severinghaus's guilds do not meet the test of a uniform response to environmental change by all guild members is that his criteria for grouping species into guilds were not based entirely on habitat requirements. Several guilds were defined by bird size, which is unrelated to important habitat needs.

Life forms. Thomas's group (1979), taking their lead from Haapanen (1967), identified habitat associations for breeding and feeding activities by all terrestrial vertebrate species of the Blue Mountains, with an extensive set of tabulations permitting the compilation of lists of species, by life form, for each major habitat type and successional stage. Comparison of such lists can be used to assess the general impact of a change in the environment on each species, as might occur if an advanced successional stage were set back to an earlier stage by tree or shrub removal.

Life forms were defined according to habitat requirements for breeding and feeding. For example, birds in life form 3 nest on the ground near water and feed in the water, on the ground, in shrubs, and in trees; species in life form 7 nest in shrubs and feed in the water, on the ground, or in the air. The variety of habitat elements, or zones, allowed in grouping species into life forms, especially for feeding, give poor consistency in the responses of various species in each life form to changes in their environment. Thus life forms as defined by Thomas's group (1979) have limited applicability in answering questions for wildlife managers. However, defining assemblages of species according to common requirements for nesting and feeding has great merit. I believe that finer distinctions of the habitat zones required for nesting and feeding can result in more realistic groupings of species that will respond similarly to changes in their habitat. This is essentially the approach used by Short and Burnham (1982), and it is the one I have adopted in this paper for the application of the guild concept to the needs of wildlife managers.

Guild blocks. The guild blocks of Short and Burnham (1982) were delineated in a two-step process. First, the major vertical strata found in natural habitats were identified. In a woodland ecosystem, for example, these were subsurface, ground surface, shrub layer, tree boles, tree canopy layer, and air space. Six strata are thus possible for feeding activity, and five (excluding air space) for breeding cover. Second, the diets and feeding substrates and the breeding substrates in each of these strata were identified for all species. Including species that breed elsewhere but feed in a woodland ecosystem, Short and Burnham defined a 6 × 6 matrix of possible feeding and breeding combinations in the various strata. This is a significant improvement over the life-form approach, because Short and Burnham more finely divided habitats into zones required for feeding and breeding functions by each species.

The approach has some important strengths. When guilds are defined more in terms of animals' associations with zones of their habitats than in terms of diets or foraging maneuvers, guild members are more likely to respond alike to changes in habitat. The subdivision of habitats into strata is well suited to aerial photographic applications (Short 1982), which could streamline certain aspects of environmental assessment. It may even provide a means for predicting the number of breeding species to be expected in a large block of a given type of habitat, as Short (1982) observed a significant correlation ($r = 0.93$) between species richness and the numbers of guild blocks at 18 sites in Arizona.

The approach also has some important shortcomings. For example, Short and Burnham (1982) defined the limits of each species' feeding and nesting associations with habitat strata by assigning numeric values to categories of food types and nesting cover in each habitat stratum. The values for each species were then used to compute means and standard deviations, although the values themselves lack validity in terms of any natural series of numbers. I believe this is an invalid procedure, but it probably does not invalidate the general approach of using guild blocks. One would likely reach the same general conclusions by relying solely on descriptive data.

The Next Step—Management Guilds

A *management guild* is defined here as a group of species that respond in a similar way to a variety of changes likely to affect their environment. This is an operational definition that may violate the letter of Root's (1967) functional one. However, it does not violate the spirit or "intent" of that definition, since even management guilds can be delineated in a way that retains some measure of functional association among the members. For example, one could group in a management guild all bird species that depend upon tree canopies for their food supply, whether fruit, buds, leaves, or insects taken from foliage or twigs. Harvesting timber removes tree canopies and negatively affects all species that feed there, regardless of what they eat. Consequently, it is reasonable to place all canopy feeders in a single management guild. The less detailed functional association of some members in such a guild reflects the fact that the investigator has a particular question in mind that can be better answered by this delineation than by one making finer distinctions among food resources.

One could argue that because harvesting timber also removes the tree boles, it is reasonable to place both bark and canopy feeders in the same management guild. However, a fire of moderate intensity might significantly reduce available tree canopy without markedly diminishing the available bark surface. At least over the short term, canopy feeders could be eliminated by a fire when bark feeders were not, so it is better to place species in these feeding categories in different guilds. Similarly, from a management standpoint, grouping all foliage gleaners into a single guild overlooks the important distinction between species that specialize on tree canopies and those that specialize on shrub canopies. Harvesting timber will negatively impact the tree-canopy specialists, but shrub specialists should benefit from the release of their foraging zone from overstory shading. As a final example, a "hawking" guild makes little sense in a management scheme, because management activities do not eliminate the air as a foraging substrate. Species that feed by hawking will be affected by the loss of requisite perches from which they pursue their prey, so many flycatchers will need to be grouped into guilds with species that forage in tree canopies.

Guild-Indicator vs. Whole-Guild Approach to Management

In this section, I compare the guild-indicator approach to management, as proposed by Severinghaus (1981) with the whole-guild approach. Although not explicitly developed as such, the whole-guild approach was the method implied by the life forms of Thomas and fellow workers (1979) and the guild blocks of Short and Burnham (1982). In this approach the entire guild is treated as a unit to assess the environment's capability of supporting the species in the guild and to monitor trends in the collective populations of those species. In operation, an entire guild is used as an indicator of the quality of a particular zone of a specified habitat.

Delineation of guilds. For the guild-indicator approach, we assume that all species in a guild respond to any change in the habitat in the same way, so that one may be selected as an indicator. Examination of the life forms of Thomas and others (1979) and the bird guilds of Severinghaus (1981) indicate that this assumption is not true, at least for these less refined groupings (see sections on "life forms" and "guilds and indicator species"). The question, then, is whether greater detail in delineating guilds would improve the situation. I believe it would, but not enough to justify a guild-indicator approach. The difficulty is one of scale, as we could continue to refine criteria for determining which species should be grouped into a guild until we have just one species per guild. Five major variables contribute to this difficulty, as follows:

1) Species are grouped into management guilds because they share primary use of an identified zone of their habitat for some purpose, such as feeding or nesting. However, as correctly pointed out by Landres (in press), guild members are not necessarily alike in all ways in which they use zones of the habitat. Consequently, members of the same guild may be affected differently by certain habitat changes, some being better able than others to use other zones of the habitat to compensate for the changes in their primary zone of use. The guild-indicator approach is seriously flawed by this fact. The whole-guild approach is not, however, because the goal is different. The goal of the whole-guild approach is to assess the capability of a given zone of a habitat to support an identified use by guild members, regardless of what species they may be. This is not to say that monitoring whole guilds will not provide much useful information about a variety of species. It will, and that information can be used to examine species composition, species richness, and a host of other important aspects of community organization.

2) Thorough studies of niche differentiation among birds typically show that species in a community subdivide the habitat by specializing in diets, foraging substrates, foraging strata, or foraging times. Similar specializations are seen in nesting habits. If specializations of these sorts are the rule in bird communities, then we should not be surprised to find few if any groups of species in a community with patterns of habitat use so alike that one species could be used as an indicator of the others in its group.

Furthermore, studies of interspecific competition among members of the same guild strongly suggest that the presence of one species in a guild may prevent establishment of another with requirements too similar to those of the first. Martin's (1981) study of bird communities in isolated windbreaks in North Dakota is perhaps the best-documented case of such exclusion among members of the same foraging guild. The point is that, rather than one member of a guild being a good predictor of what other species in its guild should be present in a habitat, it could be a good predictor of what other species should *not* be present. This is not a problem with the whole-guild approach, because the important question is whether or not the habitat can support a certain kind of use by birds. This can be measured regardless of what species happen to be present at any given time or place.

3) Seasonal variation is common in the foraging behavior of a wide variety of bird species. For example, Beal (1910) found that the annual diet of the Scrub Jay (*Aphelocoma coerulescens*) in California consists of approximately 27% animal and 73% vegetable matter. But 70% of its diet in April is animal matter, which gradually decreases to less than 5% by January. Furthermore, mast comprises 38% of the diet over the year, but proportions vary from less than 1% per month from May through August to more than 70% per month from November through February. Among Brown Towhees (*Pipilo fuscus*) in California, weed seeds average approximately 51% of the diet, but they vary seasonally from about 20% in June to 84% in December (Beal 1910). Similar patterns are reported for numerous species, so this is probably a common phenomenon. Some of the seasonal differences are striking and often are paralleled by equally striking differences in the habitat zones in which a species finds its food. For example, Plain Titmice in pine-oak woodlands in California forage primarily in tree canopies during late winter and spring, but as summer advances, they spend progressively more time foraging on the ground (personal observation). Finally, Hejl (1981) found marked shifts in foraging zones of some species even from week to week during the breeding season, depending on plant phenology. Such variations may impossibly complicate selection of the right season, or period within a season, to characterize the guilds of a bird community.

4) Geographic variation in species' feeding behavior would require placing the same species in different guilds in different parts of its range. For example, Landres and MacMahon (1980:357), reporting on a study in an oak woodland in Sonora, Mexico, placed the Ash-throated Flycatcher (*Myiarchus cinerascens*) in a ground-sallying guild with the Eastern Bluebird (*Sialia sialia*), pointing out that the flycatcher "is the only species in the community with extensive use of the ground (37.2%) as a perch site. From its ground perch, the bird typically sallies 1–2 m to catch flying or crawling arthropods. This behavior is in contrast to previous foraging records. . . ." Indeed, in pine-oak woodlands in California, the Ash-throated Flycatcher cannot even be considered to be primarily a hawking species (Hejl 1981). None of its foraging maneuvers were made from the ground, although 14% involved capture of food on the ground. Only 12% of its attacks involved flying arthropods, and 63% involved food on shrub or tree canopies or bark. Geographic variation of this sort affects guild delineation for both the guild-indicator approach and the whole-guild approach. It cautions against putting a species into the same guild throughout its range without ample evidence to warrant it.

5) The ways in which species use their environment can vary even over relatively short distances in relation to differing habitat attributes. For example, in foothill woodlands of the western Sierra Nevada during the winter months, Dark-eyed Juncos (*Junco hyemalis*) typically forage on the ground in grasslands having few or no scattered trees or shrubs (personal observation). When they forage in the adjacent woodlands,

however, approximately 70% of their feeding occurs in tree canopies (Hejl personal communication). As with geographic variation, variation related to habitat differences affects both guild approaches, arguing forecefully for guild assemblages defined in terms of the specific habitats of interest.

Monitoring indicator species. Even if it were feasible to identify species that could be used as accurate indicators of an entire guild, we should examine whether the monitoring task is made more or less challenging by concentrating only on indicators. Taking the simplest case, from the manager's viewpoint, we must recognize when a species or a group of species declines in abundance at such a rate as to be of concern. Without defining what that rate is, we can still examine the implications (a) of detecting a real decline, (b) of erroneously concluding that a decline has occurred when it has not (Type I error), and (c) of missing a real decline when one has occurred (Type II error). The number of sample counts needed increases linearly with a decrease in the average number of animals per count, with increasing confidence that a Type I error is not made, and with the power to eliminate Type II errors. When a real decline is detected, and the manager decides that it demands further attention, it can be costly to study the situation further or to implement plans to correct the problem. The cost is presumably justified. When a Type I error is made, unjustified costs may be borne to correct a nonexistent problem, but at least the manager is unlikely to be faced with a serious and uncorrectable population problem. On the other hand, when a Type II error is made, no cost is borne, but one or more populations may decline to seriously low levels before the decline is finally detected. This is the possibility that managers need most to avoid. In this section, I examine some cost implications of reducing Type II errors.

Dawson (1981), as corrected by Dawson and Verner (in preparation), determined the number of counts needed to detect a change in abundance of a population, as a function of the mean number of individuals per count and the magnitude of the change detected. The model is based on standard statistical analyses, assuming that counts of birds approximate a Poisson distribution. Dawson (1981) showed that a large-sample, normal approximation for data fitting a Poisson distribution is equivalent to a chi-square test for the equality of the total counted in two samples, provided each sample has at least 30 birds, and the number of counts in the smaller sample is at least half that of the larger.

The number of counts needed to detect differences in population abundance between years can be prohibitively large, even for relatively common species (Table 1). For example, with an average of one bird per count, one needs 12,300 counts per year to detect a 10% difference in abundance of that species between years. Our studies in pine-oak wood-

Table 1. Counts/year needed to detect yearly changes in population densities. Tabled numbers of counts will result in Type I errors 5% of the time and Type II errors 20% of the time.

Mean no. of birds/count	Percent difference between populations		
	10	25	50
10	1,230	197	50
1	12,300	1,968	492
0.1	123,300	19,680	4,920
0.01	1,230,000	196,800	49,200

lands of California indicate that a 5-min point count is the most efficient counting procedure in that habitat type (Verner in preparation). With reasonable spacing between points, and confining counts to about a 4-h period in the morning, one could expect to complete a maximum of 20 counts per day. In this case, it would require 615 person-days to obtain the required number of counts each year. Assuming that entry-level biological technicians were capable of doing the counts, the salary alone for this work would be about $33,840 per year. The most abundant species in our pine-oak woodland sites is the Plain Titmouse (*Parus inornatus*), with an average of 1.36 individuals per 5-min point count. Similarly, in the Sierra Nevada of California, our studies show that the Dark-eyed Junco is the most abundant species in many habitats, with average counts about the same as those for the Plain Titmouse in the pine-oak woodlands.

Most of the species we consider to be "common" in our study areas yield average counts below 0.5, and most species have average counts below 0.2. The point is that it is extraordinarily expensive to measure changes between years in the abundance even of the most common species. In using the guild-indicator approach for monitoring changes in abundance, the "cheapest" indicator would be the most common species in each guild. But it may not be the best indicator of its guild's responses to a changing habitat.

Alternatives are available. One is to count all species and combine counts by guild, using a whole-guild approach to assess trends in the capability of a zone of the habitat to support an identified use of that zone. This would take no longer than counting just indicator species, since all birds detected during a 5-min count can be tallied as easily as tallying a few selected species. The procedure has the major advantage of increasing the average count, thus reducing the number of counts needed and the cost of monitoring trends.

A second alternative is development of statistical analyses to detect only declining trends in the abundance of species or guilds. Standard statistical tests, such as the chi-square, are designed to deal with a broad range of possibilities and so require much larger sample sizes to establish confidence limits. F. N. David (personal communication) has developed a procedure for detecting declining trends in counts that promises to require approximately 10% of the counts needed for the chi-square test.

Advantages of a total inventory. Unlike the guild-indicator approach, the whole-guild approach requires a count of all species in each guild to evaluate capabilities of all identified zones of a habitat. One advantage is that it provides a complete species list each time the habitat is sampled, reducing the likelihood of the undetected loss of a species from the area. Another advantage is that one may examine separately any trends among permanent residents, winter residents, migrant breeders, and spring or fall migrants. The decline of a guild selected to indicate trends in the suitability of some zone of the habitat during the breeding season might result from a reduction in numbers of permanent residents, or migrant breeders, or both. By first identifying the decline in the guild as a whole, and then separately examining trends among subsets of the guild, one might be able to determine whether the decline resulted from local conditions or from conditions on the wintering grounds of migrant breeders. Of course, this presupposes samples large enough to establish statistical reliability, which may require pooling species from more than one guild. Raphael (1980) and Beedy (1982), for example, both observed marked differences in abundance between resident and migrant breeders in coniferous forests of the Sierra Nevada, which they associated with climatic conditions.

Another option is to examine trends among species grouped according to territory size, since fragmentation of large blocks of uniform habitat is more likely to have a negative impact on species with large territories than on those with small ones.

Conclusions. Arguments against the guild-indicator approach to management include: (a) certain difficulties of objectively delineating guilds that do not affect the whole-guild approach, (b) the fact that niche differentiation within a community reduces the likelihood of groups of species with niches alike enough to satisfy the goals of a guild-indicator approach, and (c) the numeric realities of sampling trends in populations. I believe that the guild-indicator approach is probably unacceptable for most needs of management. The whole-guild approach has promise as a way to monitor trends in habitat capabilities, which can then be translated into trends in wildlife populations. This approach also gives a count of all species detected, which can be used to examine questions not addressed by the guild-indicator approach.

The Whole-Guild Approach: An Example

In this section, I develop an empirical approach to delineation of management guilds, based largely on studies of the bird community in a pine-oak woodland (Hejl 1981, personal communication; Verner and Ritter in preparation).

Table 2. Percent cover at SJER (n = 5500 points on both plots).

Vegetation	Ungrazed plot	Grazed plot
Grasses	76.0	65.8
Forbs	14.1	21.1
Shrubs	21.8	6.6
Trees	25.3	32.3

The Habitat

The study area is on the San Joaquin Experimental Range (hereafter SJER), Madera County, California, where two 20-ha (50-acre) plots were established in 1977, primarily to test methods for estimating densities of terrestrial birds (Verner and Ritter in preparation). One plot is on a site set aside as a natural area in 1934, when SJER was acquired by the Forest Service. It has not been grazed since that time. Comparison of the vegetation in the natural area today with that shown in photos taken in 1938 and 1959 (Woolfolk and Reppert 1963) shows a marked increase in shrub and tree cover. The other plot has been grazed moderately since 1935. Until the Forest Service acquired SJER, both plots were exposed to unknown intensities of livestock grazing from the late 1800s (Duncan and Clawson 1980).

Both plots support mature woodlands of mixed stands of Blue Oak (*Quercus douglasii*), Interior Live Oak (*Quercus wislizenii*), and Digger Pine (*Pinus sabiniana*), with scattered patches of shrubs consisting mainly of Buck Brush (*Ceanothus cuneatus*). Ground cover is predominantly of annual grasses and forbs. The plots differ most in the extent of their shrub cover, the ungrazed plot having about three times the shrub cover of the grazed plot (Table 2). Comparison of the vegetation structure on the two plots (Table 2 and Figure 1), together with the photographic record, indicates that release from livestock grazing favored regeneration of Buck Brush stands on the ungrazed plot and largely eliminated the browse line on shrub and tree canopies.

Guild Delineation

Guild categories. As proposed in the section on management guilds, guild categories are derived from consideration of those zones of the habitat that are likely to respond in similar ways to various sorts of perturbations. I also believe the number of categories should be held to a minimum, to keep the system as simple as possible and to maximize the number of species in each guild. As a first approximation for birds, I suggest that the ground layer, shrub layer, tree boles and large limbs, tree canopy, and snags will suffice to categorize feeding and nesting guilds in most terrestrial communities.

These comprise a set similar to that proposed by Short and Burnham (1982), with two important exceptions. First, they did not recognize snags as a category. A plant community can have a significant tree component and still lack snags. In fact, certain forest management practices (for example, thinning and salvage sales) create such communities. Snags provide a significant resource for nesting and foraging birds of many species that would otherwise be absent (Balda 1975, Raphael 1980, Thomas and others 1979, and others). Recent recognition of this fact resulted in the adoption of specific snag-retention policies by the Forest Service.

Second, I see little value to the delineation of management guilds in recognizing the air as a foraging substrate for birds, as done by Short and Burnham (1982). Regardless of how severely a habitat is modified, air is still available. Only the aerial food source or the perches used by birds to access that food source are likely to be affected by habitat changes (as described in Maurer and others 1981). Consequently, the suitability of an environment for aerial feeders, such as swallows or flycatchers, is a function of the quantity and structure of the vegetation.

Seasons and groups of species. One could separately delineate guilds for every season and for all species of birds that use a habitat. But since a primary goal is to reduce the costs of environmental assessment and monitoring, we need to explore less involved procedures that permit sound management and result in no irreversible errors. The first priority should be maintenance of viable populations of all species that breed in any given habitat type. Earlier (Verner 1980a and b) I proposed the hypothesis that all bird species dependent upon any given environment, at any season, will be adequately provided for if we manage that environment solely to maintain viable populations of its breeding species. This follows from the assumption that spring and fall migrants and winter residents use basically the same sets of resources, and in the same zones of the habitat, as used by breeding residents. This hypothesis needs thorough testing before it is accepted as fact and applied broadly to wildlife management.

Species assignments. Primary zones of the habitat used for nesting cover and foraging substrates by long-term residents on the study plots at SJER during March, April, and May were determined from the literature and personal observations (Table 3). Long-term residents were those that use the plots for periods of at least three months each year. Foraging zones for 19 of the species were based on field observations by Hejl (1981 and personal communication) on the ungrazed plot, with sample sizes ranging from 26 (Western Kingbird) to 742 (Bushtit). Winter residents could be included here because they

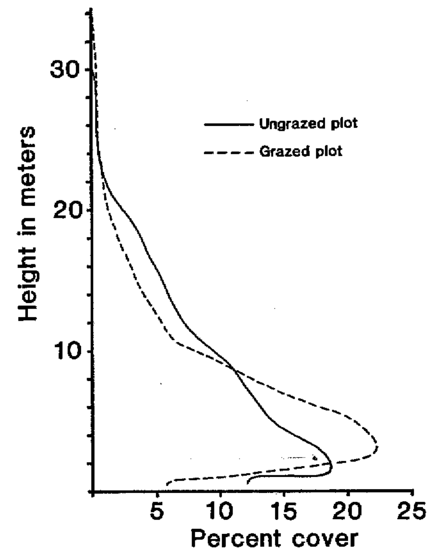

Figure 1. Foliage height profiles of shrubs and trees on the two plots at SJER (n = 1250 in each case).

regularly remain at SJER well into the spring, overlapping the nesting seasons of most breeding species.

Species were next assigned to cells in a matrix with the primary nesting zone on one axis and the primary feeding zone on the other (Table 4), as proposed by Short and Burnham (1982). "Primary" in this case indicates that the highest percentage of its use for nesting or foraging is in that zone. Usually a clear distinction was made because most species used one zone more than 50% of the time. In others, however, the distinction was less clear, with the primary zone being used less than 50% of the time and just a few percentage points more than a secondary zone. For example, White-crowned Sparrows foraged 35.2% of the time under shrubs and 33.3% of the time in shrubs. One could weight each species' assignment to guilds by the proportions of their use of each, but we had insufficient data for most species, and this seemed an unnecessary refinement when our main goal was to assemble a group of species to monitor trends in the capability of some zone of a habitat to support wildlife.

Species that forage primarily on the ground under shrubs have been assumed to depend on shrubs for cover, or for sources of food that require the microhabitat under shrubs, or both. Consequently, they were included in the cell reflecting primary use of shurbs for feeding. Aerial-feeding insectivores were assigned to a primary feeding zone according to their primary perches or watch-posts, as explained above in the section on "guild categories." An alternative would be to assign them to guilds according to the zones in which most of their aerial prey are produced, but this would require much more information than is now available for most ecosystems.

Table 3. Feeding and nesting zones (F, N = primary; f, n = secondary) used by birds at SJER.[1]

		Zones of the habitat						
		Ground				Trees		
Species	Alpha code[2]	In open	Under trees	Under shrubs	Shrubs	Bole	Canopy	Snags
BREEDING SPECIES[3]								
Turkey Vulture (*Cathartes aura*)	TUVU	F	N[4]	N[4]				
Cooper's Hawk (*Accipiter cooperi*)	COHA				f		F, N	
Red-tailed Hawk (*Buteo jamaicensis*)	*RTHA*	F					N	
American Kestrel (*Falco sparverius*)	*AMKE*	F	F			N		
California Quail (*Lophortyx californicus*)	*CAQU*	F, N	F, N					
Mourning Dove (*Zenaida macroura*)	*MODO*	F	F				N	
Roadrunner (*Geococcyx californianus*)	ROAD	F	F	F	N		n	
Screech Owl (*Otus asio*)	SCOW	F	F			N		
Great Horned Owl (*Bubo virginianus*)	*GHOW*	F	F				N	
Long-eared Owl (*Asio otus*)	LEOW	F	F				N	
Anna's Hummingbird[5] (*Calypte anna*)	*ANHU*					f	F, N	
Common Flicker[5] (*Colaptes auratus*)	*COFL*	F	F			f, N		
Acorn Woodpecker (*Melanerpes formicivorous*)	*ACWO*					f, N	F	n
Nuttall's Woodpecker[5] (*Picoides nuttallii*)	*NUWO*					F, N		
Western Kingbird[5] (*Tyrannus verticalis*)	WEKI						F, N	
Ash-throated Flycatcher[5] (*Myiarchus cinerascens*)	*ATFL*					F, N	F	
Violet-green Swallow[5] (*Tachycineta thalassina*)	*VGSW*					N		F
Scrub Jay[5] (*Aphelocoma coerulescens*)	*SCJA*	F	F		n	f	N	
Common Raven (*Corvus corax*)	CORA	F					n[4]	
Plain Titmouse[5] (*Parus inornatus*)	*PLTI*					f, N	F	
Bushtit[5] (*Psaltriparus minimus*)	*BUSH*				F, n		f, N	
White-breasted Nuthatch[5] (*Sitta carolinensis*)	*WBNU*					F, N		
Wrentit (*Chamaea fasciata*)	*WREN*				F, N			
House Wren (*Troglodytes aedon*)	HOWR				F	N		
Bewick's Wren[5] (*Thryomanes bewickii*)	*BEWR*		n[6]	n[6]	F	f, N		
California Thrasher (*Toxostoma redivivum*)	CATH	f	f	F	N			
Western Bluebird[5] (*Sialia mexicana*)	*WEBL*					N	F	
Blue-gray Gnatcatcher (*Polioptila caerulea*)	*BGGN*				n		F, N	
Phainopepla (*Phainopepla nitens*)	PHAI				f, n		F, N	

Table 3. (continued)

Species	Alpha code[2]	Zones of the habitat: Ground: In open	Ground: Under trees	Ground: Under shrubs	Shrubs	Trees: Bole	Trees: Canopy	Snags
Starling (*Sturnus vulgaris*)	STAR	F	F			N		
Hutton's Vireo (*Vireo huttoni*)	*HUVI*				f		F, N	
Western Meadowlark (*Sturnella neglecta*)	WEME	F, N						
Northern Oriole (*Icturus galbula*)	*NOOR*						F, N	
Brown-headed Cowbird (*Molothrus ater*)	*BHCO*	F	F		N		n	
House Finch (*Carpodacus mexicanus*)	HOFI	F	F			n	N[7]	
Lesser Goldfinch (*Carduelis psaltria*)	LEGO	F			N		n	
Brown Towhee[5] (*Pipilo fuscus*)	*BRTO*	F	F	F	N		n	
Rufous-crowned Sparrow (*Aimophila ruficeps*)	*RCSP*	F, N	F, N	F, N				
WINTERING SPECIES								
Sharp-shinned Hawk (*Accipiter striatus*)	SSHA				f		F	
Band-tailed Pigeon (*Columba fasciata*)	BTPI				f		F	
Yellow-bellied Sapsucker (*Sphyrapicus varius*)	YBSA					F		
American Robin (*Turdus migratorius*)	AMRO	F	F				f	
Hermit Thrush (*Catharus guttata*)	HETH		F	F				
Ruby-crowned Kinglet[5] (*Regulus calendula*)	RCKI				F		f	
Yellow-rumped Warbler[5] (*Dendroica coronata*)	YRWA						F	
Rufous-sided Towhee[5] (*Pipilo erythrophthalmus*)	RSTO	F	F	F			f	
Dark-eyed Junco[5] (*Junco hyemalis*)	DEJO						F	
White-crowned Sparrow[5] (*Zonotrichia leucophrys*)	WCSP			F	f			
Golden-crowned Sparrow[5] (*Zonotrichia atricapilla*)	GCSP	F		f				
Fox Sparrow (*Passerella iliaca*)	FOSP			F				
Lincoln's Sparrow (*Melospiza lincolnii*)	LISP			F				

[1]Primary foraging and nesting zones are based on personal observations, Hejl 1981 and personal communication, and on a general review of the relevant literature on avian life histories. Feeding zones of aerial feeders (for example, swallows) are based on perching requirements. Those of aerial searchers that find food elsewhere (such as raptors) are based on where food is found.

[2]Alpha codes are used in Table 4.

[3]Species known to nest on the grids, or near enough to them to use them regularly for foraging. Alpha codes of species whose nests have been found on the grid are shown in italics.

[4]Most often nest in a recess in the face of a cliff or on a steep hillside.

[5]Assignment to primary feeding zone based on at least 25 field observations by Hejl (1981 and personal communication) on the ungrazed plot.

[6]Sometimes nest in subsurface cavities, such as rodent burrows.

[7]Often nest in man-made structures.

Table 4. Guild matrix, with primary feeding zones and primary nesting zones forming the two axes of the matrix. (Four-letter codes used to designate species are identified in Table 3.) The feeding zone of the VGSW reflects its primary perching zone when not feeding aerially. The feeding zones of the CATH, HETH, WCSP, FOSP, and LISP were assigned to shrubs because they feed primarily under shrubs.

PRIMARY FEEDING ZONE \ PRIMARY NESTING ZONE	Ground	Shrubs	Tree boles and limbs	Tree canopies	Snags	Breeds elsewhere
Snags			VGSW			
Tree canopies			ACWO ATFL PLTI WEBL	COHA ANHU WEKI BGGN PHAI HUVI NOOR		SSHA BTPI YRWA DEJU
Tree boles and limbs			NUWO WBNU			YBSA
Shrubs		WREN CATH	HOWR BEWR	BUSH		HETH RCKI WCSP FOSP LISP
Ground	TUVU CAQU CORA WEME RCSP	ROAD BHCO LEGO BRTO	AMKE SCOW COFL STAR	RTHA MODO GHOW LEOW SCJA HOFI		AMRO RSTO GCSP

This matrix approach to guild delineation permits considerable flexibility. Potentially, 30 guilds could be represented at SJER, if each cell of the matrix is used to delineate a guild (Table 4). We could use this fine subdivision to seek answers to some questions (for instance, do nesting specialists exhibit similar feeding specialties, or is nesting zone independent of feeding zone?). On the other hand, we can combine into larger guilds all species in any row or column of the matrix. In this way we can identify five potential guilds defined by feeding zone or six defined by nesting zone.

Numbers shown in each cell of the matrix in Table 5 are the summed average counts for all species in the cell, using 8-min point counts. Although 5-min point counts are more efficient, I have no 5-min counts in this habitat when migrant breeders were present. Comparisons of 5-min and 8-min counts done in late winter show no significant differences in mean counts per species or in species richness between the two count durations. Total counts for guilds in each cell of the matrix tend to be so small as to require very large numbers of counts to detect trends in the collective abundance of the species in guilds. Seventeen (63%) of these guilds have average counts of less than 0.50 individuals. It is clear that forming larger feeding or nesting guilds by combining species in rows or columns usually results in substantial increases in the total number of individuals in a count, making this a more cost-effective method of monitoring. The tabulation below compares count totals for "nesting" guilds and "feeding" guilds, obtained by combining species in columns and rows for each of the zones of the habitat and averaging counts for the grazed and ungrazed plots:

	Nesting	*Feeding*
Snags	—	0.08
Tree canopies	2.43	4.04
Tree boles and limbs	4.47	0.39
Shrubs	0.45	1.56
Ground	0.28	2.16
Breeds elsewhere	0.59	
Totals	8.22	8.23

I believe the guilds formed by combining along the rows and columns of Table 5 are better for many purposes than the smaller guilds defined by each cell of the matrix, because all zones of the habitat are still accounted for, and the higher counts obtained make the challenge of monitoring more feasible. Determination of whether the feeding axis (combining by rows) or the nesting axis (combining by columns) is better could be considered on a case-by-case basis. As a practical matter, it is probably best to examine trends in both groups of guilds.

In the bird community of the pine-oak woodlands considered here, snags are obviously not well represented by either

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Table 5. Mean counts of birds on grazed (g) and ungrazed (u) plots, by cell of the guild matrix (Table 4), with the number of species recorded shown in parentheses for each guild. Rows and columns were totaled to give the aggregate count along each axis of the matrix; each total represents either a feeding (rows) or nesting (columns) guild for one habitat zone.

PRIMARY FEEDING ZONE		PRIMARY NESTING ZONE: Ground	Shrubs	Tree boles and limbs	Tree canopies	Snags	Breeds elsewhere	Totals
Snags	g			0.11 (1)				0.11 (1)
	u			0.06 (1)				0.06 (1)
Tree canopies	g			3.31 (4)	0.70 (4)		0.49 (2)	4.50 (10)
	u			3.04 (4)	0.24 (6)		0.29 (1)	3.57 (11)
Tree boles and limbs	g			0.48 (2)				0.48 (2)
	u			0.29 (2)				0.29 (2)
Shrubs	g			0.78 (2)	0.81 (1)		0.01 (1)	1.60 (4)
	u		0.04 (2)	0.75 (1)	0.54 (1)		0.18 (3)	1.51 (7)
Ground	g	0.15 (1)	0.30 (3)	0.03 (1)	1.08 (3)		0.03 (1)	1.59 (9)
	u	0.42 (2)	0.55 (3)	0.08 (2)	1.48 (4)		0.19 (3)	2.72 (14)
Totals	g	0.15 (1)	0.30 (3)	4.71 (10)	2.59 (8)		0.53 (4)	8.28 (26)
	u	0.42 (2)	0.59 (5)	4.22 (10)	2.26 (11)		0.66 (7)	8.15 (35)

the feeding or the nesting axis, but snags are not essential for birds in this habitat. Most cavity nesters use living trees, especially Blue Oaks. Even Violet-green Swallows, which commonly perch on snags between bouts of aerial feeding, will perch in tree canopies when snags are not available. Acorn Woodpeckers often use snags as granaries, but they also use boles of living trees (MacRoberts and MacRoberts 1976), which eventually die as a result of the development of the granary. The Common Flicker may typically nest in snags, as the literature suggests, but two of the three nests we have located at SJER were in live trees.

Tree canopies are used more frequently for feeding, and boles and limbs are used more for nesting. However, tree canopies cannot occur without boles and large limbs, so it might be reasonable to combine the species in those guilds into a single "tree guild" to indicate the availability of live trees. Suitability of shrub and ground zones can be better monitored by feeding guilds than by nesting guilds, because many more species feed in those zones than nest in them, and count totals are at least three times higher for the feeding guilds.

Comparison of Plots at SJER

Some of the potential for using management guilds, as defined here, can be examined with the bird communities on the grazed and ungrazed plots at SJER. Species richness and total counts are compared on the two plots, based on 80 8-min point counts on each plot from 14 April to 6 May 1980 (Verner and Ritter in preparation). Fourteen cells of the matrix are occupied by at least one species in the composite results (Table 5). Species richness was higher on the grazed plot in two cells, on the ungrazed plot in seven, and tied in five. This difference is significant at the 0.05 level (Wilcoxon signed-ranks test) or the 0.06 level (randomization test—Siegel 1956). Total counts were higher on the grazed plot in seven cells and on the ungrazed plot in seven, and the combined total counts on the two plots were nearly identical.

Table 6. Percentages of foraging observations, by substrate, for breeding residents (30 species), winter residents (10 species), and transients (33 species) at SJER, March through May 1979 and 1980 (Hejl personal communication).

	Ground				Trees			Aerial	
	Open	Under trees	Under shrubs	Shrubs	Canopy	Bark	Snags	Insects	Vertebrates
Breeding residents	6.1 (0.5)[1]	2.8	2.6	21.4 (1.9)	23.5 (6.1)	19.6 (0.2)	2.8 (9.6)	7.5	13.7
Winter residents	8.0 (1.2)	12.3	3.9	22.7 (5.3)	43.6 (8.0)	7.3	0.3 (33.3)	0.6	0.8
Transients	2.1	2.8	0.6	32.1 (12.4)	41.9 (25.6)	10.7	5.8 (89.5)	2.1	1.8

[1] Values in parentheses are percentages of observations involving use of those substrates as perches from which to hawk for insects in the air, or to pounce on insects on the ground.

Both shrub-nesting and shrub-feeding species were more common on the ungrazed plot (Table 5), which had more than three times the shrub cover of the grazed plot (Table 2). Additionally, we have never detected California Thrashers or Wrentits on the grazed plot, but they regularly occur in small numbers on the ungrazed one. Both species are known to be common only in areas with substantial shrub cover.

Ground feeders were apparently more abundant on the ungrazed plot, as total counts were greater there in all five cells of the guild matrix ($P = 0.03$, sign test). This may reflect the fact that the ungrazed plot would produce more seeds, since grasses and forbs there are not grazed down before seed set and drop. However, it is impossible to be certain in a comparison such as this, with only one grazed and one ungrazed plot.

Comparison of Seasonal Residents

An assumption made in this analysis is that if we manage environments adequately for the assemblage of *breeding* birds, we probably will provide for transients and winter residents as well. Although far from proven in a general sense, the assumption is supported by this analysis. The number of zones of any given habitat that must be defined for a scheme such as this is reasonably small (for example, see Short and Burnham 1982). Transients and winter residents foraged in the same zones of the pine-oak woodlands as the breeders, although not in the same proportions (Table 6). Tree canopies were used more extensively by the transients and winter residents than by the breeders. Winter residents fed on the ground more than either of the other groups (this reflects a significant addition of granivores to the bird community during the winter). And aerial searching for insects or ground prey was much more common among the breeders. These were differences only in percentages of use of the various zones of the habitat already identified as important to breeders. Consideration of the needs of transients or winter residents did not introduce any new zone or pattern of habitat use. Adequate maintenance of these zones for the existing breeding species should, therefore, assure continued provision for the transients and winter residents that use the same area.

Acknowledgments

I thank P. B. Landres, K. E. Mayer, C. J. Ralph, M. G. Raphael, H. Salwasser, and W. D. Severinghaus, who provided constructive reviews of this paper. I am particularly indebted to W. D. Severinghaus and the US Army Corps of Engineers for providing the stimulus to examine the applicability of the guild concept to management of bird populations.

Literature Cited

Balda, R. P. 1975. The relationship of secondary cavity nesters to snag densities in western coniferous forests. USDA Forest Service, SW Region, Albuquerque, NM. *Wildlife Habitat Technical Bull.* 1:1–37.

Beal, F. E. L. 1910. Birds of California in relation to the fruit industry. Part II. *USDA Biol. Survey Bull.* 34:1–96.

Beedy, E. R. 1982. Bird community structure in coniferous forests of Yosemite National Park, California. Ph.D. dissertation, University of California, Davis, CA. 167 pp.

Crome, F. H. J. 1978. Foraging ecology of an assemblage of birds in lowland rainforest in northern Queensland. *Australian Journal of Ecology* 3:195–212.

Dawson, D. G. 1981. Experimental design when counting birds. Pages 392–398 *in* C. J. Ralph and J. M. Scott (eds.), Estimating numbers of terrestrial birds. Studies in Avian Biology 6.

DeGraaf, R. M., and J. M. Wentworth. 1981. Urban bird communities and habitats in New England. *Trans. N. Amer. Wildl. and Natur. Resourc. Conf.* 46:396–413.

Dueser, R. D., and H. H. Shugart, Jr. 1979. Niche pattern in a forest-floor small-mammal fauna. *Ecology* 60:108–118.

Duncan, D. A., and W. J. Clawson. 1980. Livestock utilization of

California's oak woodlands. Pages 306–313 *in* T. R. Plumb (tech. coord.), Proceedings of Symposium on the Ecology, Management, and Utilization of California Oaks. USDA Forest Service, Gen. Tech. Report PSW-44. PSW Forest and Range Exp. Stn., Berkeley, CA.

Folse, L. J., Jr. 1981. Ecological relationships of grassland birds to habitat and food supply in east Africa. Pages 160–166 *in* D. E. Capen (ed.), The use of multivariate statistics in studies of wildlife habitat. USDA Forest Service, Gen. Tech. Report RM-87. Rocky Mountain Forest and Range Exp. Stn., Fort Collins, CO.

Haapenen, A. 1965. Bird fauna of the Finnish forests in relation to forest succession. I. *Annales Zoologici Fennici* 2:153–196.

Hejl, S. J. 1981. Foraging ecology of birds in relation to plant phenology in California pine-oak woodlands. M.S. thesis, University of California, Davis, CA. 73 pp.

Holmes, R. T., R. E. Bonney, Jr., and S. W. Pacala. 1979. Guild structure of the Hubbard Brook bird community: a multivariate approach. *Ecology* 60:512–520.

Jaksić, F. M. 1981. Abuse and misuse of the term "guild" in ecological studies. *Oikos* 37:397–400.

Järvinen, O., and R. A. Väisänen. 1979. Changes in bird populations as criteria of environmental changes. *Holarctic Ecol.* 2:75–80.

Johnson, R. A. 1981. Application of the guild concept to environmental impact analysis of terrestrial vegetation. *J. Environ. Manage.* 13:205–222.

Landres, P. B. 1983. Use of the guild concept in environmental impact assessment. *Environ. Manage.* (in press).

Landres, P. B., and J. A. MacMahon. 1980. Guilds and community organization: analysis of an oak woodland avifauna in Sonora, Mexico. *Auk* 97:351–365.

Leopold, A. 1953. Round River. Oxford University Press, New York, NY. 173 pp.

MacMahon, J. A., D. J. Schimpf, D. C. Andersen, K. G. Smith, and R. L. Bayn, Jr. 1981. An organism-centered approach to some community and ecosystem concepts. *J. Theor. Biol.* 88:287–307.

MacRoberts, M. H., and B. R. MacRoberts. 1976. Social organization and behavior of the Acorn Woodpecker in central coastal California. *Ornithol. Monogr.* 21:1–115.

Martin, T. E. 1981. Limitation in small habitat islands: chance or competition? *Auk* 98:715–734.

Maurer, B. A., L. B. McArthur, and R. C. Whitmore. 1981. Effects of logging on guild structure of a forest bird community in West Virginia. *American Birds* 35:11–13.

Raphael, M. G. 1980. Utilization of standing dead trees by breeding birds at Sagehen Creek, California. Ph.D. dissertation, University of California, Berkeley, CA. 195 pp.

Root, R. B. 1967. The niche exploitation pattern of the Blue-gray Gnatcatcher. *Ecol. Monogr.* 37:317–350.

Severinghaus, W. D. 1981. Guild theory development as a mechanism for assessing environmental impact. *Environ. Manage.* 5:187–190.

Short, H. L. 1982. Development and use of a species richness model to evaluate wildlife habitat. *Trans. N. Amer. Wildl. and Natur. Resourc. Conf.* 47:57–72.

Short, H. L., and K. P. Burnham. 1982. Technique for structuring wildlife guilds to evaluate impacts on wildlife communities. USDI Fish and Wildlife Service, Special Sci. Report—Wildlife 244. 33 pp.

Siegel, S. 1956. Nonparametric statistics for the behavioral sciences. McGraw-Hill, New York, NY. 312 pp.

Siegel-Causey, D., and T. S. Whittam. 1980. Species associations and community structure in Alaskan seabird colonies. *Amer. Zool.* 20:883 (abstract).

Thomas, J. W., R. J. Miller, C. Maser, R. G. Anderson, and B. E. Carter. 1979. Plant communities and successional stages. Pages 22–39 *in* J. W. Thomas (tech. ed.), Wildlife habitats in managed forests: the Blue Mountains of Oregon and Washington. USDA Forest Service, Agric. Handbook No. 553.

Verner, J. 1980a. Birds of California oak habitats—management implications. Pages 246–264 *in* T. R. Plumb (tech. coord.), Proc. of Symposium on the Ecology, Management, and Utilization of California Oaks. USDA Forest Service, Gen. Tech. Report PSW-44. PSW Forest and Range Exp. Stn., Berkeley, CA.

Verner, J. 1980b. Bird communities of mixed-conifer forests of the Sierra Nevada. Pages 198–223 *in* R. M. DeGraff (tech. coord.), Workshop Proceedings: Management of Western Forests and Grasslands for Nongame Birds. USDA Forest Service, Gen. Tech. Rep. INT-86. Intermountain Forest and Range Exp. Stn., Ogden, UT.

Woolfolk, E. J., and J. N. Reppert. 1963. Then and now: changes in California annual-type range vegetation. USDA Forest Service, Research Note PSW-N24, PSW Forest and Range Exp. Stn., Berkeley, CA. 9 pp.

Mary Powell

From: Klute, David [david.klute@state.co.us]
Sent: Thursday, September 11, 2008 3:08 PM
To: Ron Beane; Mary Powell; Peake, Elizabeth B Nwo; 'Eric.a.laux@usace.army.mil'; Tom Ryon; Brookesfox; Jana Pedersen; Steve Dougherty; 'Gary.drendel@tteci.com'; 'Peter_plage@fws.gov'; Ann Bonnell; Cecily H. Y. Mui; 'Mmuller@nilenet.com'; Sitoski, Karen M Nwo
Cc: Franklin, J Scott Nwo; Jackson, Tina
Subject: RE: Chatfield - Grouping birds by breeding habitat/guilds

Ron:

I'm still perplexed by the complexity of doing this for such a large group of species. I think this quote from your email gets to the crux of my confusion:

"…. we can then apply values such as optimum, good, fair, poor, to habitat units as we did last meeting for Preble's."

I could make a good classification of habitats into those categories without even considering any birds (or anything else) by asking questions like, "is it extensive?", "is it degraded?", "is it connected?", etc. The problem with considering guilds is that there is so much internal variability in terms of microhabitat use within the guild that it is nearly impossible to make a blanket categorization. Forest birds all associate with trees, but vary greatly in terms of stem density, tree species composition, age structure, etc. Those issues often become sufficiently diluted when using a guild approach for a broad-scale evaluation (e.g., a national forest unit). But for this application it is really site specific and there isn't sufficient variability to assume that the entire guild is benefitted uniformly by the habitat. For a single-species issue (e.g.., Preble's) it is easier to make a categorization for that species.

With or without a guild approach, the number of species being considered is still problematic. There is no inherent consideration of abundance. Eastern Wood Peewees and Yellow Warblers are vastly different in their abundance at that site. Maybe Yellow Warblers should be considered 'more important' because they're more representative simply because of abundance. Or – devil's advocate – Eastern Wood Peewees should be considered more important because of their relative rarity? I don't think taking a guild approach gets past those issues.

You've already made some decisions about what is important for this EIS. There isn't (I don't think) any analysis being done to consider impacts to insects, or mollusks, etc. Is there? Why not then take those decisions a step further and make some decisions that narrow the role that birds are playing in the evaluation. It could be that you consider the impacts to high-priority species with declining populations. Or you consider locally abundant species as representative indicators of the habitat quality. You could even use a guild approach within these narrowed categories. But I'm just not sure that evaluating impacts to birds is going to work because it is such a broad consideration for such a site-specific issue.

My 2 cents – hope it helps,

David

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David Klute, Ph.D.

Bird Conservation Coordinator

Colorado Division of Wildlife

6060 Broadway

Denver, CO 80216

Phone: 303-291-7320

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From: Ron Beane [mailto:rbeane@eroresources.com]
Sent: Thursday, September 11, 2008 2:41 PM
To: Mary Powell; Peake, Elizabeth B NWO; Laux, Eric A NWO; tryon@ottertail.us; Brooke Fox; Jana Pedersen; Steve Dougherty; Gary.Drendel@tteci.com; Peter_Plage (E-mail); abonnell@juno.com; cecilym@sspr.org; Klute, David; mmuller@nilenet.com; Sitoski, Karen M NWO
Cc: Franklin, J Scott NWO; Jackson, Tina
Subject: RE: Chatfield - Grouping birds by breeding habitat/guilds

All,

If we start with the definition of a guild as a "group of species that exploit the same class of environmental resources in a similar way" (root 1967) two ways to group birds are by 1) habitat use, and 2) a breeding/foraging guild. The goal of grouping Chatfield birds is for the technical group (that would be us) to review the guild and the actual species at Chatfield that occupy that guild, and develop a general index of the functional values that each mapped habitat provides to that guild. In essence, we will be developing a habitat suitability index for the selected guilds that we can then apply values such as optimum, good, fair, poor, to habitat units as we did last meeting for Preble's.

I am attaching two spreadsheets that have grouped Chatfield birds by:

1) BBA habitats

2) Guilds following Verner 1984

BBA habitat approach:

Gray Drendel provided table 1 to me yesterday with the following note

"I developed the table based on Kingery's results for the Breeding Bird Atlas block for Chatfield. It lists all of the species that were observed during the atlasing period of 1988 to 1994 and it groups the birds by their primary habitat according to the atlas data sheet. It also indicates which species are Probable or Confirmed breeding species at Chatfield."

In reviewing this table it was very similar in species and comparable habitat grouping to the list ERO sent out earlier this week with two main exceptions; 1) the list does not include winter residents or migrants, and 2) the list is not pared down to focus on the habitats this process is most interested in (i.e., water, shore, uplands, generalists, rare species, and non-natives are included). Several articles on the guild concept suggest delineating guilds only for breeding species because winter residents and migrants use the same zones in similar ways. Thus, my first question for the group is "can we assume that by addressing functional values for breeding birds we are accounting for the functional value of the habitat for migrant and wintering birds?" As for exception 2, I have highlighted the birds eliminated from the previous list and added five species of potential breeders not included on Gary's list.

Guild approach:

The second spreadsheet takes Gary's spreadsheet and eliminates species as previously described to get to our focus habitats. The species are then grouped into a structural breeding/foraging guild modified from Verner 1984 (article attached). Again, assuming that there will be an increase in open water habitats that don't require a functional assessment, I have come up with seven structural guilds that include:

Open water – stream

Ground layer

Tree layer

Tree boles

Riparian shrub layer

Upland shrub layer

Tree canopy layer (e.g., mature cottonwoods).

This approach is very similar to the habitat stratification used by Kingery to monitor pre- and post reservoir impacts on breeding birds. In fact I was able to transfer his habitat stratification directly into the guild concept and Hugh's groupings are highlighted in blue. There can be discussion on where each individual species fits, but the real focus is on the guild not individual species.

We can discuss both approaches tomorrow, but I recommend moving forward on the structural guild approach (no. 2) and developing a guild suitability index for each guild. We can build on existing Habitat Suitability Indexes such as yellow warbler or red-winged blackbird. For example, optimal habitat suitability for the tree canopy guild could be described as moderately tall to tall stands of deciduous trees with a moderate tall hydrophytic deciduous shrub understory; Good habitat could be tall stands of deciduous trees with a closed canopy and open shrub understory, and fair could be moderately tall to tall stands of deciduous trees with no shrub understory, and so on.

I look forward to our discussion,

Ron

From: Mary Powell
Sent: Tuesday, September 09, 2008 4:06 PM
To: Peake, Elizabeth B NWO; Laux, Eric A NWO; tryon@ottertail.us; Ron Beane; Brooke Fox; Jana Pedersen; Steve

Dougherty; Gary.Drendel@tteci.com; Peter_Plage (E-mail); abonnell@juno.com; cecilym@sspr.org; david.klute@state.co.us; mmuller@nilenet.com; Sitoski, Karen M NWO
Cc: Franklin, J Scott NWO; Jackson, Tina
Subject: Chatfield Reallocation EIS Functions Meeting

This is to confirm that we will be meeting this Friday, September 12 to continue our work on creating an ecological function-based method to determine impacts and mitigation associated for the conceptual mitigation plan for the Chatfield Reallocation EIS.

The meeting will be held at the Greenway Foundation office at 5299 DTC Blvd., Suite 710 (see attached map). Currently, the office will not be available until 10:00AM. Unless I get adamant responses that 10:00AM will not work, please plan on phoning in or arriving at the meeting at 10:00AM. If there is significant outcry, we can make special arrangements to get in earlier.

To refresh everybody's memories, we wrapped up assigning values for Preble's habitat at our last meeting (see attached chart for final Preble's habitat values).

The upcoming meeting will be focused on birds. Please review the attached spreadsheet that Ron has prepared. The first page of the spreadsheet shows a cumulative species list developed from several sources. The second page shows the proposed reduced list. The third page documents how the reduced list was generated. Ron is continuing to work on placing the species into guilds based on habitat affinities. If the draft guild list is available prior to Friday, I'll send it out.

I've also attached draft meeting minutes from our meetings on July 28th and August 28th. Please let me know if you have any comments on the minutes.

Thanks.

Mary L. Powell

Natural Resource Specialist
Vice President

ERO Resources Corp. • 1842 Clarkson St. • Denver, CO 80218 • 303.830.1188 • Fax: 830.1199 •
www.eroresources.com <blocked::http://www.eroresources.com/>

Mary Powell

From: 'Gary.drendel@tteci.com' [gary.drendel@tteci.com]
Sent: Friday, September 12, 2008 6:00 AM
To: Ron Beane; Mary Powell
Subject: Chatfield - Bird Data

Attachments: (chatfield eis.xls) stubbed.htm

(chatfield eis.xls) stubbed.ht...

Ron, Mary,

I just received this response from Joey Kellner and wanted to pass it on to you before I head to the airport. I haven't had a chance to do anything with it, but I think it is pretty self-explanatory. I had asked Joey to use his professional judgment/years of experience birding at Chatfield to identify the most common and important birds in each of the habitat types on our map. In addition, for his Point Count locations, I asked him to best match their habitats with the habitat types we are using. This information could be used to query his database to identify the birds most frequently found in each habitat type, etc. His response are in the attached spreadsheet. I hope this will be of additional help at this morning's meeting.

Well I've got to run, have a good meeting,

Gary

Point Count #	Vegetation/habitat categories used by Tetra Tech EC[3]	My description of the habitat	Specific location of Poin
Point Count 01	Mature Cottonwood	Cottonwood grove	Cottonwood Grove parking lot (NE corner)
Point Count 02	Upland	Grassland; scattered trees	.55 miles from last stop; Intersection with "Chatfield Planting Base" road
Point Count 03	Upland	Grassland	.4 miles from last stop; closest part of road to dam outlet canal
Point Count 04	Upland	grassland; bare ground	In parking lot at top of spillway; next to "Chatfield Overlook" sign
Point Count 05	Upland	grassland; intermittent stream	<.5 miles from last stop; past guard rail on right at gas pipe warning sign on right
Point Count 06	Upland / Water	grassland	.5 miles from last stop (visitor's center); thin gas warning sign on right
Point Count 07	Mature Cottonwood / Shrub[1]	riparian; cottonwood; willow	.45 miles from last stop; Deer Creek end of guard rail on right
Point Count 08	Trees	grassland; cottonwood	.5+ miles from last stop; stop at Livery turn off
Point Count 09	Upland / Trees	grassland; scattered trees	.4 miles from last stop; orange poles on right (by tree)
Point Count 10	Trees	grassland; pine; cottonwood	<.4 miles from last stop; end of livery loop near restroom; stop at west end of circle
Point Count 11	Upland	grassland; bushes	.3 miles from Fox Run turnout; Bushes on right side of road
Point Count 12	Mature Cottonwood / Shrub[1]	riparian; cottonwood; willow	.5+ miles from last stop; pull off just before dirt road on right.
Point Count 13	Upland / Trees	grassland; scattered trees	<.5 miles from last stop; just past tree on right
Point Count 14	Upland / Water	grassland	.45 miles from last stop; at road curves sign
Point Count 15	Upland / Trees	grassland; pine; juniper	.5 miles from last stop; 1/2 way between model plane road and speed limit sign-where turnout on le
Point Count 16	Trees	grassland; many spaced elm; juniper	.5 miles from last stop; just past campground entrance road on right (by the "Do Not Enter" sign)
Point Count 17	Upland	grassland	>.4 miles from last stop; at top of hill on road to Plum Creek Nature Area
Point Count 18	Upland / Shrub[2]	grassland; bushes	.5 miles from last stop; between ravine and bushes on right
Point Count 19	Trees / Shrub[1]	riparian; cottonwood; willow	End of Plum Creek Nature Area road; NW corner of parking lot
Point Count 20	Trees / Shrub[2]	grassland; rabbitbush; scattered trees	Riverside Picnic area; End of parking lot before Marina Point sign
Point Count 21	Upland	grassland	South Entrance; At Chatfield State Park sign; between Entrance Station and park boundry
Point Count 22	Upland	grassland	Southwest corner of the Lakeview parking lot. Parking lot overlooks the lake and is amongst the ca
Point Count 23	Mature Cottonwood & Shrub[1] & Wetland/Non-Woody	grassland	Chatfield Wetlands gazebo. Wetlands built in early 1990's by the Colorado Department of Transpor

Shrub is used in two contexts here and is denoted as follows:

[1] Dense stands of willows in the riparian corridor

[2] Dry shrub habitat such as contains Rabbitbrush and small and large bushes

[3] Habitat categories are pretty vague and were not well defined. The category "Trees" doesn't, to me, convey the importance of a woodland with layers: forbs, shrubs, box elders, willows, and cottonwoods. For example "Trees", I assumed this to be any species of tree less than 20-25 years old. Another example is "Mature Cottonwood", I assumed this to be Cottonwoods 30 years old or older. This definition of "Mature Cottonwoods" does not match the habitat map as there are numerous "Mature Cottonwoods" in areas not denoted on the attached map.

I was asked what "...the most common or important bird species would be in each of these habitat categories". This question depends upon the time of year as the birds can be quite different at Chatfield depending upon the season (breeding birds vs wintering birds from the north, migrant birds resting and feeding during spring and fall, etc.). I have listed both the common and important species as they can be quite different. For example, Yellow Warblers and House Wrens are some of the most common bird species during the summer, each in more than one habitat you list, but they are ubiquitous and would not be a valid indicator species for the quality of a particular habitat since they will use marginal habitat outside of the habitats you list. That is why I list BOTH some of the most common species as well as some of the "most important" bird species below.

1) Mature Cottonwood (primarily along the upper South Platte above the bridge at the Kingfisher parking area)

Most Comon Bird Species:	Yellow Warbler (summer), House Wren (summer)
Most Important Bird Species:	Black-capped Chickadee (resident), Western Wood Pewee (summer), Red-shafted Flicker (resident), Downy Woodpecker (resident), Cooper's Hawk (summer), Bald Eagle (winter)

2) Shrub (primarily in the riparian areas along the upper South Platte and Plum Creek)

Most Comon Bird Species:	Yellow Warbler (summer)
Most Important Bird Species:	Song Sparrow (resident), Gray Catbird (summer), Yellow-breasted Chat (summer), American Tree Sparrow (winter)

3) Trees

Most Comon Bird Species:	Yellow Warbler (summer), American Robin (summer)
Most Important Bird Species:	Bullock's Oriole (summer), Warbling Vireo (summer), Western Kingbird (summer), Dark-eyed Junco (winter)

4) Upland

Most Comon Bird Species:	Western Meadowlark (summer)
Most Important Bird Species:	Vesper Sparrow (summer), Grasshopper Sparrow (summer), Horned Lark (resident), Loggerhead Shrike (migration)

5) Wetland/Non-Woody

Most Comon Bird Species:	Red-winged Blackbird (spring, summer, fall)
Most Important Bird Species:	Common Yellowthroat (summer),Virginia Rail (resident), Sora (summer), Wilson's Snipe (summer), White-faced Ibis (migration)

6) Shoreline

Most Comon Bird Species:	Killdeer (spring, summer, fall)
Most Important Bird Species:	Killdeer (spring, summer, fall), American White Pelican (More in water, but relies on shore for day and nighttime roosts)

7) Water (primarily open water in the reservoir; AND South Platte River)

Most Comon Bird Species:	Canada Goose (resident), Mallard (resident)
Most Important Bird Species:	Western Grebe (spring, fall), Double-crested Cormorant (spring, summer, fall), Common Merganser (breed along the river and use the reservoir in late summer and winter), American Dipper (winter), Bald Eagle (winter)

Other sources of information about Chatfield birds:

Breeding Bird Atlas (1987,2007)

Breeding Bird Census (Hugh Kingery did this for the old heron grove (1960-1982))

ERO Resources Corp.
1842 Clarkson Street
Denver, CO 80218
(303) 830-1188
Fax: 830-1199
www.eroresources.com
ero@eroresources.com

Chatfield Reallocation Functional Assessment Methods

Meeting Minutes for

September 12, 2008

10:00 am to 12:00 pm

Greenway Foundation Office

Greenway Foundation office at 5299 DTC Blvd., Suite 710

Attendees:

Eric Laux (via teleconference) – U.S. Army Corp of Engineers (Corps)
Betty Peake (via teleconference) – Corps
Karen Sitoski – Corps
Pete Plage – U.S. Fish and Wildlife Service (Service)
Cecily Mui – South Suburban Park and Recreation District/South Platte Park
Mike Mueller – Sierra Club
Ray Sperger - Chatfield Basin Conservation Network
Brooke Fox – Chatfield Basin Conservation Network
Steve Dougherty – ERO Resources Corp. (ERO)
Ron Beane – ERO
Jana Pedersen – ERO
Mary L. Powell – ERO

Meeting Summary:

1. Introductions
2. Review of draft meeting minutes – no objections to drafts.
3. Preble's questions
    a. How does the approach relate to impacts to Critical Habitat?
    b. How do numbers relate to 50 year horizon? Projected functional units?
        i. Not yet discussed

ii. Mitigation may be different in Critical Habitat and functional units may not apply. EFUs may not be applicable to Forest Service lands.

c. Implementation – discuss at later date. Current work is focused on Plum Creek basin.

d. Preble's High Quality versus Low Quality – On hold for now, but need to clarify descriptions and definitions.

4. Discussion on Eliminating Habitats (water, shore, uplands)

a. Are there habitats that can be eliminated from consideration because they would not be adversely affected or the effects would not be significant locally or regionally?

b. Uplands – do they need to be mitigated? They provide important habitat for birds and buffering functions for wetlands and Preble's.

c. From FR/EIS perspective for other wildlife, alternatives would not have a great adverse effect on other mammals. CDOW has commented and said it's not an issue.

d. "Birds" includes more than just migratory birds and uplands are important in that regard.

e. Consensus is to eliminate water from FA.

f. Shoreline

i. There will be no shoreline mitigation because it will increase under the action alternatives. There may be associated water quality issues, but those are not being addressed by the FA approach.

ii. Shoreline would increase, but what about quality? Shoreline mitigation would take place on-site, if needed.

iii. Consensus that shoreline should be assessed, but not under the FA method being developed for the target resources.

g. Uplands – Consensus is to leave uplands in FA approach.

5. Discuss Dave Klute's email

a. Dave has problems with guild approach

i. Diluted because of quantity of species

ii. More birds using trees puts trees too high

iii. Instead, consider quality of the habitat

b. Other options

i. Guilds were based on habitat structure, so maybe structure could be used. Problem is that the matrix ends up being auto-correlated.

ii. Use EIS and other data on point counts and sensitive species. Look at species richness/abundance and number of sensitive species in each habitat.

6. Item for next meeting

i. Work on bird scale.

ii. Bring maps and tables with resource overlaps to get better idea of what is being impacted.

Mary Powell

From: Ron Beane [/o=ero/ou=eroserver/cn=recipients/cn=rbeane]
Sent: Wednesday, September 24, 2008 4:28 PM
To: 'Peter_plage@fws.gov'
Cc: Mary Powell
Subject: Chatfield bird functions

Attachments: (chatfield bird functions sep 24.xls) stubbed.htm; (convert bba_ habitattype.xls) stubbed.htm

(chatfield bird functions sep ...   (convert bba_ habitattype.xls)...

Pete,

I have attached 2 spreadsheets:

1) The first is our functions matrix with just PMJM and birds - I have been mulling over two approaches

a. Option 1 (preferred) - considers 4 main functions (values) of Chatfield bird habitat.

b. Option 2 - the original matrix evaluating the seasonal value of the habitat - I suggest dropping this because each habitat provides optimal seasonal functions for those bird communities inhabiting the habitat. I also put together a rough sample of scoring these functions as good, fair, poor, etc. per PMJM.

2) Tetra-tech's bird list from the EIS (compiled from BBA data, Joey Kellnor, etc.) with spp placed in habitats categories mapped for EIS.

a. Blue highlights indicate where I moved some species to fit EIS construct - i.e., all Mtn. shrub species moved to shrubs, and some lowland riparian species were moved that are dependant or strongly associated with mature cottonwoods. I also list the species I eliminated from the Tetra tech list on page 2. USGS riparian indicator species are in boxes and CNHP species are marked with a comment. BCC species - seems Chatfield falls at transition from southern Rockies and shortgrass prairie and few BCC species for either region breed on/near Chatfield.

b. Page 2 also lists my questions and suggested solutions for evaluating this list by the approach listed in #1

Any thoughts or questions will be very helpful. I would like to send a revised version to the full group after you have a chance to provide suggestions and input.

Call me with any questions.

Thanks,

Chatfield Bird Functions

Chatfield EIS Mapping Unit	PMJM EFV				Functions			
	Breeding	Winter	Forage	Cover	Diversity / Richness	Supports BCC/ Sens/ Declining spp.	Supports Rare Species	Limited Habitat (local or regional)
Wildlife Habitat (Community)								
Chatfield EIS Wildlife Habitat								
Shoreline								
Shrub (riparian)								
Trees								
Upland								
Wetland/Non-Woody								
Mature Cottonwood								
Non-Habitat								
Chatfield EIS PMJM Habitat								
High Value Riparian	1	1	1	1				
Low Value Riparian	0.5	0.5	0.75	0.75				
Upland	0.25	0.25	0.75	0.5				
Non-Habitat	0	0	0	0				
None*	0	0	0	0				
Chatfield EIS Wetland Habitat								
Lacustrine Emergent								
Palustrine Aquatic Bed								
Palustrine Emergent								
Palustrine Scrub-Shrub								
Palustrine Forested								
None								

Notes:
* = (area outside range of PMJM)
= Functions not applicable

BCC = Birds of Conservation Concern - Shortgrass Prairie

Rating		Function				Eliminated from consideration
		Divers. (# spp)	**SENS. spp.**	**Rare**	**Limited Habitat (local or regional)**	**# of Rip. Indic.**
1.00	Optimal/High	>15	>3	>3	Very limited	
0.75	GoodMod High	10-14	3	3	Limited	
0.50	Fair/Moderate	5-9	2	2	Common	
0.25	Poor/Low	< 5	1	1	Abundant	
0.00	None	0	0	0	- -	

Chatfield Bird Functions

Chatfield EIS Mapping Unit	PMJM EFV				Functions		
	Breeding	Winter	Forage	Cover	Nesting Habitat	Winter Habitat	Migration Habitat
Wildlife Habitat (Community)							
Chatfield EIS Wildlife Habitat							
Shoreline							
Shrub (riparian) (SLC)							
Trees (LRD)							
Upland							
Wetland/Non-Woody (AEM)							
Mature Cottonwood (LRD)							
Non-Habitat							
Chatfield EIS PMJM Habitat							
High Value Riparian	1	1	1	1			
Low Value Riparian	0.5	0.5	0.75	0.75			
Upland	0.25	0.25	0.75	0.5			
Non-Habitat	0	0	0	0			
None*	0	0	0	0			
Chatfield EIS Wetland Habitat							
Lacustrine Emergent							
Palustrine Aquatic Bed							
Palustrine Emergent							
Palustrine Scrub-Shrub							
Palustrine Forested							
None							

Notes:
* = (area outside range of PMJM)
= Functions not applicable

Birds Reported from Breeding Bird Atlas By Primary Habitat Type (Littleton Block, Q3910551) (a,b)

EIS Habitats	**Shoreline**	**Wetlands**	**Riparian trees**	**Shrubs**		**Uplands**	**Mature Cottonwood**	**Species needing Special Mngt.or outside area of reallocation impacts (BUOW)**
BBA Equivalent Habitats		**Emergent Wetlands (AEM)**	**Lowland Riparian (LRD)**	**Lowland Carr (SLC)**	**Mtn. Shrub (SMM)**	**Grassland**		
	Spotted Sandpiper	Canada Goose*		Blue-gray gnatcatcher*		Horned Lark*	**Yellow-billed Cuckoo**	Double-crested Cormorant
	Belted Kingfisher*	Mallard*	**Wood Duck***	Green-tailed towhee		Brewer's Sparrow*	**Lewis's Woodpecker**	Great Blue Heron
		Blue-winged Teal*	Common Merganser*	Spotted Towhee*		Vesper Sparrow	Downy Woodpecker*	Barn Owl
		Cinnamon Teal*	Sharp-shinned Hawk	Chipping Sparrow		Western Meadowlark*	Hariy Woodpecker	Black-crowned Night Heron
		Green-winged Teal*	Cooper's Hawk*	Black-headed Grosbeak*			**Least Flycatcher***	Bald Eagle
		Virginia Rail*		Lazuli Bunting*			**Red-eyed vireo***	**Burrowing Owl***
		Sora	Eastern Screech Owl*	Indigo Bunting				
		Marsh Wren	Long-eared Owl*	Brewer's Blackbird*			**Ovenbird**	
		Common Yellowthroat*	Northern Flicker*	Song Sparrow*				
		Red-winged Blackbird*	Western Wood-Pewee*	Yellow-breasted Chat*				
		Yellow-headed Blackbird	Eastern Wood-Pewee*	Western Tanager				
			Western Kingbird*					
			Eastern Kingbird*					
			Warbling Vireo*					
			Blue Jay					
			Tree Swallow					
			Black-capped chickadee*					
			House Wren*					
			Gray catbird*					
			Cedar Waxwing*					
			Yellow Warbler*					
			American Redstart					
			Blue Grosbeak*					
			Common Grackle*					
			Bullock's Oriole*					
Joey Kellnor's Important Species								
							Black-capped chickadee	
	Killdeer	Red-winged blackbird	Bullock's oriole	Song sparrow		Vesper sparrow	N. flicker	
			Warbling vireo	Gray catbird		Grasshopper sparrow	Western wood pewee	
			Western Kingbird	Yellow-breasted chat		Horned lark	Downy woodpecker	
							Cooper's hawk	

Ovenbird - no recent records, but historically occurred - CNHP spp.

Species from BBA moved to different habitat category to correspond to EIS habitat mapping

Bold Type = CNHP or birds of conservation concern species

* = Confirmed or Probable breeding

ERO evaluated Species listed by USGS as indicators of riparian conditionas a selection criteria and found that each riparain habitat had a single listed indicator and was not usefull in our analysis

Species Removed from list

Emergent Wetlands (AEM)	Lowland Riparian (LRD)
Water dependant - foraging	**Generalists/non-native**
Northern Rough-winged Swallow* Bank Swallow Cliff Swallow	Great-horned Owl* Swainson's Hawk Red-tailed Hawk* American Kestrel* Mourning Dove* Common Nighthawk Broad-tailed Hummingbird* Black-billed Magpie* American Robin* European Starling* Brown-headed Cowbird* House Finch* Lesser Goldfinch* American Goldfinch* Ring-necked Pheasant*

(a) Data for 1988 - 2004, from A.Bonnell and H. Kingery
(b) BBA Habitat Codes:
AEM =
LRD = Lowland Riparian
MSC = Other
OWL = Open Water - Lakes
OWS = Open Water - Streams
RRL = Rural
SMM = Mountain shrublands
SLC = Lowland Carr (lowland willow, riparian skunkbush thickets)
TMGP = Midgrass prairie
TMXP -
TSG = Short-grass prairie

Mary Powell

From: Mary Powell [/o=ero/ou=eroserver/cn=recipients/cn=mpowell]
Sent: Thursday, October 02, 2008 3:25 PM
To: Ann Bonnell; Peake, Elizabeth B Nwo; Brookesfox; Cecily H. Y. Mui; Klute, David; 'Eric.a.laux@usace.army.mil'; Jana Pedersen; Sitoski, Karen M Nwo; Sk Wiley; Mueller, Michael J.; 'Peter_plage@fws.gov'; Ray And Erin Sperger; Rick Mcloud; Ron Beane; Steve Dougherty; Tom Ryon
Subject: Next Chat. FA Meeting

Attachments: (bird fhu questions.doc) stubbed.htm; (chatfield bird functions oct 2.xls) stubbed.htm; (convert bba_ habitattype.xls) stubbed.htm; (greenway foundation map.pdf) stubbed.htm

(bird fhu uestions.doc) stubb. (chatfield bird functions oct ... (convert bba_ habitattype.xls)... (greenway undation map.pdf)

This email is to confirm that we are meeting on October 6th at 1:00 PM at the Greenway Foundation's conference room (same place as last time).

For those who may not remember how to get there, I've attached a map again and have included directions below.

Also, I have attached two spreadsheets from Ron and text with his discussion of the spreadsheets. Please note that each spreadsheet has two sheets.

Directions:

The Greenway Foundation's Office

5299 DTC Blvd., Suite 710

Take Belleview East to DTC Blvd (not DTC Parkway). Turn right onto DTC Blvd. Building on NW corner of Prentice and DTC Blvd.

Mary L. Powell

Natural Resource Specialist
Vice President

All,

Below are a list of questions we need to address to move forward with the Chatfield Ecological Functions approach. ERO has provided the list of questions and our Suggested solution for discussion.

We have also included two excel workbooks:

1) Tetra-tech's bird list from the EIS (compiled from BBA data, Joey Kellnor, etc.) with spp placed in habitats categories mapped for EIS.
    a. Blue highlights indicate where ERO moved some species to fit EIS construct – i.e., all Mtn. shrub species moved to shrubs, and some lowland riparian species were moved that are dependant or strongly associated with mature cottonwoods. Species eliminated from the Tetra tech list (generalists) are listed on page 2.
2) The functions matrix with just PMJM and birds – Two options
    a. Option 1 (preferred) – considers 3 to 4 main functions (values) of Chatfield bird habitat.
    b. Option 2 – the original matrix evaluating the seasonal value of the habitat - I suggest dropping this because each habitat provides optimal seasonal functions for those bird communities inhabiting the habitat. ERO also put together a rough sample of scoring these functions as good, fair, poor, etc. per PMJM.

Questions	**ERO Suggestion**
What list do we use?	BBA list from Tetra Tec (attached)
Where do we group species?	Group consensus - Combination of BBA and Kellnor (Rectify BCCH, NOFL, WEWP, COHA)
What values do we evaluate?	1) Relative Abundance (richness) 2) No. sensitive/declining spp., 3) No of locally rare spp. 4) Regionally limited habitat
Is there too much overlap between sens spp, locally rare spp and limited habitat??	Probably - combine sens. Spp and locally rare into single function.
Mature cottonwood is a subset of riparian trees - many species overlap - do we designate species to primary habitat or do we place in both categories for estimating relative abundance?	??? - Place in several categories for richness - keep in primary habitat for locally rare and sens. Spp?
What is definition of Sensitive Species?	Spp of cons. Concern, CNHP, State T&E - all of above, others?
Consider Season of Use?	Assume values for breeding birds similar across seasons
Other Questions?	

Chatfield Bird Functions

Chatfield EIS Mapping Unit	PMJM EFV				Functions			
	Breeding	**Winter**	**Forage**	**Cover**	**Diversity / Richness**	**Supports BCC/ Sens/ Declining spp.**	**Supports Local Rare Species**	**Limited Habitat (local or regional)**
Wildlife Habitat (Community)								
Chatfield EIS Wildlife Habitat								
Shoreline								
Shrub (riparian)								
Trees								
Upland								
Wetland/Non-Woody							Suggest delete this column	
Mature Cottonwood								
Non-Habitat								
Chatfield EIS PMJM Habitat								
High Value Riparian	1	1	1	1				
Low Value Riparian	0.5	0.5	0.75	0.75				
Upland	0.25	0.25	0.75	0.5				
Non-Habitat	0	0	0	0				
None*	0	0	0	0				
Chatfield EIS Wetland Habitat								
Lacustrine Emergent								
Palustrine Aquatic Bed								
Palustrine Emergent								
Palustrine Scrub-Shrub								
Palustrine Forested								
None								

Notes:

* = (area outside range of PMJM)

= Functions not applicable

BCC = Birds of Conservation Concern

Suggested rating approach

Rating		Function (Combined snesitive and rare species)		
		Species Richness (# spp)	**Sensitive /rare spp.**	**Limited Habitat (local or regional)**
1.00	Optimal/High	>15	>3	Very limited
0.75	GoodMod High	10-14	3	Limited
0.50	Fair/Moderate	5-9	2	Common
0.25	Poor/Low	< 5	1	Abundant
0.00	None	0	0	- -

Chatfield Bird Functions

Chatfield EIS Mapping Unit	PMJM EFV				Functions		
	Breeding	Winter	Forage	Cover	Nesting Habitat	Winter Habitat	Migration Habitat
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Chatfield EIS Wildlife Habitat							
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Non-Habitat	0	0	0	0			
None*	0	0	0	0			
Chatfield EIS Wetland Habitat							
Lacustrine Emergent							
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Palustrine Emergent							
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Palustrine Forested							
None							

Notes:
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	Belted Kingfisher*	Mallard*	**Wood Duck***	Green-tailed towhee		Brewer's Sparrow*	**Lewis's Woodpecker**	Great Blue Heron
		Blue-winged Teal*	Common Merganser*	Spotted Towhee*		Vesper Sparrow	Downy Woodpecker*	Barn Owl
		Cinnamon Teal*	Sharp-shinned Hawk	Chipping Sparrow		Western Meadowlark*	Hariy Woodpecker	Black-crowned Night Heron
		Green-winged Teal*	Cooper's Hawk*	Black-headed Grosbeak*			**Least Flycatcher***	Bald Eagle
		Virginia Rail*		Lazuli Bunting*			**Red-eyed vireo***	**Burrowing Owl***
		Sora	Eastern Screech Owl*	Indigo Bunting				
		Marsh Wren	Long-eared Owl*	Brewer's Blackbird*			**Ovenbird**	
		Common Yellowthroat*	Northern Flicker*	Song Sparrow*				
		Red-winged Blackbird*	Western Wood-Pewee*	Yellow-breasted Chat*				
		Yellow-headed Blackbird	Eastern Wood-Pewee*	Western Tanager				
			Western Kingbird*					
			Eastern Kingbird*					
			Warbling Vireo*					
			Blue Jay					
			Tree Swallow					
			Black-capped chickadee*					
			House Wren*					
			Gray catbird*					
			Cedar Waxwing*					
			Yellow Warbler*					
			American Redstart					
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			Common Grackle*					
			Bullock's Oriole*					
Joey Kellnor's Important Species								
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			Western Kingbird	Yellow-breasted chat		Horned lark	Downy woodpecker	
							Cooper's hawk	

Ovenbird - no recent records, but historically occurred - CNHP spp.

Species from BBA moved to different habitat category to correspond to EIS habitat mapping

Bold Type = CNHP or birds of conservation concern species

* = Confirmed or Probable breeding

ERO evaluated Species listed by USGS as indicators of riparian conditionas a selection criteria and found that each riparain habitat had a single listed indicator and was not usefull in our analysis

Species Removed from list

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Bank Swallow	Swainson's Hawk
Cliff Swallow	Red-tailed Hawk*
	American Kestrel*
	Mourning Dove*
	Common Nighthawk
	Broad-tailed Hummingbird*
	Black-billed Magpie*
	American Robin*
	European Starling*
	Brown-headed Cowbird*
	House Finch*
	Lesser Goldfinch*
	American Goldfinch*
	Ring-necked Pheasant*

(a) Data for 1988 - 2004, from A.Bonnell and H. Kingery
(b) BBA Habitat Codes:
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LRD = Lowland Riparian
MSC = Other
OWL = Open Water - Lakes
OWS = Open Water - Streams
RRL = Rural
SMM = Mountain shrublands
SLC = Lowland Carr (lowland willow, riparian skunkbush thickets)
TMGP = Midgrass prairie
TMXP -
TSG = Short-grass prairie

ERO Resources Corp.
1842 Clarkson Street
Denver, CO 80218
(303) 830-1188
Fax: 830-1199
www.eroresources.com
ero@eroresources.com

Chatfield Reallocation Functional Assessment Methods

Meeting Minutes for

October 6, 2008

1:00 pm to 4:00 pm

Greenway Foundation Office

5299 DTC Blvd., Suite 710

Attendees:

Eric Laux (via teleconference) – U.S. Army Corp of Engineers (Corps)
Betty Peake (via teleconference) – Corps
Karen Sitoski – Corps
Cecily Mui – South Suburban Park and Recreation District/South Platte Park
Mike Mueller – Sierra Club
Ray Sperger - Chatfield Basin Conservation Network
Brooke Fox – Chatfield Basin Conservation Network
Steve Dougherty – ERO Resources Corp. (ERO)
Ron Beane – ERO
Jana Pedersen – ERO
Mary L. Powell – ERO

Meeting Summary:

1. Introductions
2. Discussion on birds
   a. Review information Ron developed
   b. Discussion of birds taken off the list. What is the utility of adding them back in? They are only important if they aid in discerning between the habitats.
   c. There were shorebirds that aren't on the list. Shoreline was removed from FA approach.
   d. Should any birds be added that aren't on all three lists? Probably some.

3. Discussion of how the functional units will be used in the CE/ICA
4. Discussion of habitat types
    a. Karen thinks out loud about adding back in the removed emergent wetland. Probably should.
    b. Discussion of keeping mature cottonwood separate. Is it functionally different than other types of riparian forest types? Decided to keep it separate.
5. Discussion of habitat functions
    a. Ron summarizes his thinking behind choosing the functions he chose.
    b. An outstanding question is whether it makes sense to combine sensitive and locally rare? Are they similar enough to do that>
    c. What functions should be use?
    d. How much can we rely on the work done for the EIS?
    e. Group decided to let Ron crunch numbers on the EIS point count data, etc. He will email results around along with his proposed breakdown of points.

Mary Powell

From: Mary Powell [/o=ero/ou=eroserver/cn=recipients/cn=mpowell]
Sent: Monday, October 27, 2008 12:17 PM
To: Ann Bonnell; Peake, Elizabeth B Nwo; Brookesfox; Cecily H. Y. Mui; Klute, David; 'Eric.a.laux@usace.army.mil'; Jana Pedersen; Sitoski, Karen M Nwo; Sk Wiley; Mueller, Michael J.; 'Peter_plage@fws.gov'; Ray And Erin Sperger; Rick Mcloud; Ron Beane; Steve Dougherty; Tom Ryon
Subject: Proposed Bird Functional Index Numbers

Attachments: (chatfield bird functions oct 21.xls) stubbed.htm; (chatfield sensitive bird list 10-21-08.xls) stubbed.htm; (efu - bird point counts and abundance 10-21-08 (rdb).xls) stubbed.htm; (efu point count data and ranking (3).doc) stubbed.htm; (proposed efu ranking and bird data.pdf) stubbed.htm

(chatfield bird functions oct ... | (chatfield sensitive bird list... | (efu - bird point counts and ... | (efu point count data and rank... | (proposed efu ranking and bird...

Please find attached one Word document, three Excel tables, and one PDF. The Word and Excel files outline the proposed functional index values for birds and include the original bird count data provided by TetraTech. The PDF a compilation of the 4 native files for those folks who have trouble printing out our Excel spreadsheets.

Please review the attachments in the next day or so. I'd suggest focusing on the Word document and the EFU - Chatfield Birds Functions Oct 21 spreadsheet. The other spreadsheets are back up data. We are soliciting comments/suggestions from the group on the acceptability of the numbers Ron has proposed.

If at all possible, I would like to get everyone's comments this week. Please send your comments back to me and I'll compile them. If you have specific questions for Ron, the answers to which will inform your comments, please address those directly to him (or call him).

Thanks!!

Mary L. Powell

Natural Resource Specialist
Vice President

ERO Resources Corp. . 1842 Clarkson St. . Denver, CO 80218 . 303.830.1188 . Fax: 830.1199 . www.eroresources.com <blocked::http://www.eroresources.com/>

Chatfield Bird Functions

Chatfield EIS Mapping Unit	PMJM EFV				Bird EFV				EFI
	Breeding	Winter	Forage	Cover	Species Richness	Species Abund-ance	Supports Sensitive spp.	Limited Habitat (local or regional)	(scaled to 1)
Wildlife Habitat (Community)									
Chatfield EIS Bird Habitat									
Shoreline									
Shrub (riparian)					0.75	1	0	0.75	0.63
Trees					0.75	0.75	0.5	0.75	0.69
Upland					0.75	0.75	1	0.5	0.75
Wetland/Non-Woody					1	0.75	0.25	1	0.75
Mature Cottonwood					0.75	0.75	0.75	1	0.81
Non-Habitat					0	0	0	0	0.00
Chatfield EIS PMJM Habitat									
High Value Riparian	1	1	1	1					1.00
Low Value Riparian	0.5	0.5	0.75	0.75					0.63
Upland	0.25	0.25	0.75	0.5					0.44
Non-Habitat	0	0	0	0					0.00
None*	0	0	0	0					0.00
Chatfield EIS Wetland Habitat									
Lacustrine Emergent									
Palustrine Aquatic Bed									
Palustrine Emergent									
Palustrine Scrub-Shrub									
Palustrine Forested									
None									

Notes:
* = (area outside range of PMJM)
= Functions not applicable

Rating Criteria **Bird Functions**

Rating	Description	Species Richness* (# spp)	Species Abund.* (# Indiv./ha)	Sensitive spp.	Limited Habitat (Region)
1.00	Optimal/High	> 25	>16	>6	Very limited
0.75	Good/Mod High	17-24	11-15	4-5	Limited
0.50	Fair/Moderate	9-16	6-10	2-3	Common
0.25	Poor/Low	1-8	1-5	1	Abundant
0.00	None	0	0	0	- -

* = Data from Point Counts (TetraTech 2007)

Sensitive Species

	Shoreline	Wetlands	Riparian trees	Shrubs	Uplands	Mature Cottonwood
Year Round			Bald Eagle (ST, CNHP)		Bald Eagle (ST, CNHP) Golden Eagle (BCC)	
Summer			Yellow-billed Cuckoo (SC?, BCC) Lewis's Woodpecker (CNHP, BCC)		Burrowing Owl (ST, CNHP, BCC)) Swainson's Hawk (BCC)	Yellow-billed Cuckoo (SC?, BCC) Ovenbird (CNHP) Red-eyed vireo (CNHP) Lewis's Woodpecker (CNHP, BCC)
Winter		Northern Harrier (BCC)			Northern Harrier (BCC) Ferruginous hawk (SC, CNHP, BCC)	

CNHP = Colorado Natural Heritage Program; ST = State Threatened, SC = State Species of Special Concern, BCC = Birds of Conservation Concern

Sensitive Species by Season of Occurrence

Year Round			1	0	2	0
Summer			2	0	2	4
Winter		1	0	0	2	0
Total #		**1**	**3**	**0**	**6**	**4**

(a) Data for 1988 - 2004, from A.Bonnell and H. Kingery
(b) BBA Habitat Codes:
AEM =
LRD = Lowland Riparian
MSC = Other
OWL = Open Water - Lakes
OWS = Open Water - Streams
RRL = Rural
SMM = Mountain shrublands
SLC = Lowland Carr (lowland willow, riparian skunkbush thickets)
TMGP = Midgrass prairie
TMXP -
TSG = Short-grass prairie

Chatfield Migratory Bird Point Counts - 2006

		AMCR	AMGO	AMRE	AMRO	BASW	BBMA	BCCH	BEKI	BHCO	BGGN	BRBB	BTHU	BUOR	CAGO	CLSW	COFL	COSN	COYT	DCCO	DOWO	GBHE	GHOW	GRAC	GRCA	HOWR	KILL
Site: CHATB01 Habitat: Wetland	<25 meters:																										
Start Time: 06:55 End Time: 07:10	>25 meters:				1				1																	1	1
	Total (n)	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Date: 6/20/06 Visit No: 1	n-1	-1	-1	-1	0	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0
Notes: NOFL and HOWR are calling only	n(n-1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site: CHATB02 Habitat: Wetland	<25 meters:																										2
Start Time: 07:27 End Time: 07:42	>25 meters:	1					3																				
	Total (n)	1	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	n-1	0	-1	-1	-1	-1	2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1
Date: 6/20/06 Visit No: 1	n(n-1)	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Site: CHATB03 Habitat: Shrub	<25 meters:									1			2													2	
Start Time: 08:10 End Time: 08:25	>25 meters:		1																								
	Total (n)	0	1	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0
	n-1	-1	0	-1	-1	-1	-1	-1	-1	0	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-1
Date: 6/20/06 Visit No: 1	n(n-1)	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0
Notes: BTHU are females; YBCH - heard near bridge																											
Site: CHATB04 Habitat: Tree	<25 meters:												1													2	
Start Time: 08:40 End Time: 08:55	>25 meters:		1																								
	Total (n)	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0
	n-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-1
Date: 6/20/06 Visit No: 1	n(n-1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
Notes: NOFL, MODO, AMGO, REVI are calling; ?'s next to BTHU and REVI																											
Site: CHATB05 Habitat: Tree	<25 meters:												2	1												4	
Start Time: 09:08 End Time: 09:23	>25 meters:							1						1												4	
	Total (n)	0	0	0	0	0	0	1	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	8	0
	n-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	7	-1
Date: 6/20/06 Visit No: 1	n(n-1)	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	56	0
Site: CHATB06 Habitat: Shrub	<25 meters:				1								2														
Start Time: 09:34 End Time: 09:49	>25 meters:		1		2		1						1														
	Total (n)	0	1	0	3	0	1	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n-1	-1	0	-1	2	-1	0	-1	-1	-1	-1	-1	2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Date: 6/20/06 Visit No: 1	n(n-1)	0	0	0	6	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes: ? Next to >25 meters for BTHU																											
Site: CHATB07 Habitat: Tree	<25 meters:																				1						
Start Time: 09:45 End Time: 10:00	>25 meters:																								1		
	Total (n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0
	n-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	0	-1	-1
Date: 6/20/06 Visit No: 1	n(n-1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes: Reed Canary Grass, Canada Thistle																											
Site: CHATB08 Habitat: Tree	<25 meters:												1													1	
Start Time: 09:15 End Time: 9:30	>25 meters:																										
	Total (n)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	n-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1
Date: 6/20/06 Visit No: 1	n(n-1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: Cottonwood

Site: CHATB09 Habitat: Shrub
Start Time: 08:35 End Time: 8:50
Date: 6/20/06 Visit No: 1
Notes: dry willows along old channel;
weedy species

<25 meters:				1																					1	
>25 meters:				1			1				1										1				1	
Total (n)	0	0	0	2	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0
n-1	-1	-1	-1	1	-1	-1	0	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	1	-1
n(n-1)	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0

Site: CHATB10 Habitat: Willow Shrub
Start Time: 08:10 End Time: 8:25
Date: 6/20/06 Visit No: 1
Notes: willow shrubs along old channel;
grasses - rush surrounded by trees

<25 meters:		1		1																						
>25 meters:				1																					2	
Total (n)	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
n-1	-1	0	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-1
n(n-1)	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0

Site: CHATB11 Habitat: Wetland
Start Time: 07:30 End Time: 7:45
Date: 6/20/06 Visit No: 1
Notes: Reed canary grass and some shrubs/
sm. Trees, opening in forest, canada
thistle and stinging needle.
Uak Hammer(?) gathering cattail fluff

<25 meters:																								1		
>25 meters:											1															
Total (n)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
n-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1
n(n-1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Site: CHATB12 Habitat: Wetland
Start Time: 07:05 End Time: 7:20
Date: 6/20/06 Visit No: 1
Notes: Reed canary grass and few shrubs

<25 meters:																		1								
>25 meters:		1		1	1					1		1												2	1	
Total (n)	0	1	0	1	1	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	2	1	0
n-1	-1	0	-1	0	0	-1	-1	-1	-1	0	-1	0	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	1	0	-1
n(n-1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0

Species N	1	5	0	9	1	4	2	1	1	1	2	10	2	0	0	0	0	1	0	1	1	0	0	4	19	3
Observed in Tree	0	1	0	0	0	0	1	0	0	0	0	4	2	0	0	0	0	0	0	1	0	0	0	1	11	0
Observed in Shrub	0	3	0	7	0	1	1	0	1	0	1	5	0	0	0	0	0	0	0	0	1	0	0	0	6	0
Observed in Wet	1	1	0	2	1	3	0	1	0	1	1	1	0	0	0	0	0	1	0	0	0	0	0	3	2	3

LEFL	MALL	MODO	NOFL	REVI	RWBL	SAPH	SOSP	SPSA	SPTO	STAR	TRSW	Uak Hammer	Un Sparrow	Warbling Vireo WAVE	White-breasted Nuthatch WBNU	White Pelican WHPE	Willow Flycatcher WIFL	Western Wood Peewee WWPE	Yellow Breasted Chat YBCH	Yellow Warbler YEWA	SubTotal	Total N		Spp Rich	Sumn(n-1)	Simpson's
																	1			1	2					
			1		1														1		7		9			
0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1		9		9		
-1	-1	-1	0	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0	0						
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					0	0
					1			1													4					
			2		5						1									2	14		18			
0	0	0	2	0	6	0	0	1	0	0	1	0	0	0	0	0	0	0	0	2		18		8		
-1	-1	-1	1	-1	5	-1	-1	0	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	1						
0	0	0	2	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2					42	0.137255
																				3	8					
	l		1																1		3		11			
0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3		11		7		
-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	2						
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6					10	0.090909
1				1														1	2	1	9					
		1	1																		3		12			
1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1		12		10		
0	-1	0	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	1	0						
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0					4	0.030303
			1																	1	9					
			1															1	1		9		18			
0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1		18		8		
-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0						
0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					62	0.202614
1			1						1						2				1	2	11					
		1	1																		7		18			
1	0	1	2	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	1	2		18		11		
0	-1	0	1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	1	-1	-1	-1	0	1						
0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2					18	0.058824
																				1	2					
							1												1	2	5		7			
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	3		7		5		
-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	2						
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6					6	0.142857
							1													1	4					
		2																		2	4		8			
0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3		8		5		
-1	-1	1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	2						
0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6					8	0.142857

																				2	4				
		1	1																1	1	9	13			
0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3		13	9		
-1	-1	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	2					
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6				10	0.064103

																				2	4				
																				1	4	8			
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3		8	4		
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	2					
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6				10	0.178571

												1								2	4				
																		1	1	1	4	8			
0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	3		8	6		
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	0	0	2					
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6				6	0.107143

																			1		2				
						1			1										1	3	14	16			
0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	2	3		16	12		
-1	-1	-1	-1	-1	-1	0	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	2					
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6				10	0.041667

2	0	5	10	1	7	1	2	1	2	0	1	1	0	0	2	0	1	3	11	28	0	146
1	0	3	3	1	0	0	2	0	0	0	0	0	0	0	0	0	0	2	4	8		
1	0	2	4	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	3	11		
0	0	0	3	0	7	1	0	1	1	0	1	1	0	0	0	0	1	1	4	9		

Chatfield Migratory Bird Point Counts - 2006

		AMCR	AMGO	AMRE	AMRO	BASW	BBMA	BCCH	BEKI	BHCO	BGGN	BRBB	BTHU	BUOR	CAGO	CLSW	COFL	COSN	COYT	DCCO	DOWO	GBHE	GHOW	GRAC	GRCA
		AMCR	AMGO		AMRO	BASW	BBMA	BCCH	BEKI	BHCO	BGGN	BRBB	BTHU	BUOR		CLSW			COYT	DCCO	DOWO	GBHE			
Site: CHATB01 Habitat: Wetland	<25 meters:																								
Start Time: 09:45 End Time: 10:00	>25 meters:		1																			1			
	Total (n)	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	n-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1
Date: 6/26/06 Visit No: 2	n(n-1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes: Site totally inundated																									
reservoir water level rose																									
Site: CHATB02 Habitat: wetland	<25 meters:																								
Start Time: 09:20 End Time: 09:35	>25 meters:									2						2									
	Total (n)	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
	n-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-1	-1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Date: 6/27/06 Visit No: 2	n(n-1)	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
Notes: mudflat at beaver pond with bull rush																									
cattils, rush, carex, swamp milkweed,																									
some open water, many frogs - leopard																									
Site: CHATB03 Habitat: Shrub	<25 meters:		1										1												
Start Time: 08:35 End Time: 08:50	>25 meters:																								
	Total (n)	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	n-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Date: 6/27/06 Visit No: 2	n(n-1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes: plants: thick willow w/ site surrounded by																									
NL and Plains cottonwoods but not																									
mature trees, understory includes hemlock,																									
canada thistle, cyncafil, virgninia creeper,																									
and roa (?)																									
Site: CHATB04 Habitat: Tree	<25 meters:										1														
Start Time: 08:00 End Time: 08:15	>25 meters:		1		1																				
	Total (n)	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n-1	-1	0	-1	0	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Date: 6/27/06 Visit No: 2	n(n-1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes: many lg cottonwoods; box elder and NL																									
cottonwoods - understory, wheat grass,																									
canada thistle, snowberry, hemlock																									
*BGGN had ?'s by it																									
Site: CHATB05 Habitat: Tree	<25 meters:																								
Start Time: 07:20 End Time: 07:35	>25 meters:				1																		1		
	Total (n)	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	n-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1
Date: 6/27/06 Visit No: 2	n(n-1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes: KIFI and WAVE btwn transects																									
Plants: many lg mature cottonwoods,																									
wheat grass, leafy spurge, snowberry,																									
sm cottonwood saplings																									
Site: CHATB06 Habitat: Shrub	<25 meters:		1																						
Start Time: 06:55 End Time: 07:10	>25 meters:				1																				1
	Total (n)	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	n-1	-1	0	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
Date: 6/27/06 Visit No: 2	n(n-1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes: Plants: Hops, Plum, NL-Cottonwood,																									
J Browne (?), Willows, Snowberry, p. ivy,																									
L. spurge																									
Un Sparrow-white fringe on tail feathers																									
Site: CHATB07 Habitat: Tree	<25 meters:																								
Start Time: 06:51 End Time:	>25 meters:		1												1										
	Total (n)	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	n-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Date: 6/27/06 Visit No: 2	n(n-1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site: CHATB08 Habitat: Tree	<25 meters:												2												
Start Time: 07:20 End Time: 07:35	>25 meters:		1												2										
	Total (n)	0	1	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0
	n-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Date: 6/27/06 Visit No: 2	n(n-1)	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0
Notes: CAGO and MALL are calling only																									
Site: CHATB09 Habitat: Willow Shrub	<25 meters:				1					8															
Start Time: 07:50 End Time: 08:05	>25 meters:									2															
	Total (n)	0	0	0	1	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n-1	-1	-1	-1	0	-1	-1	-1	-1	9	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Date: 6/27/06 Visit No: 2	n(n-1)	0	0	0	0	0	0	0	0	90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: NOWR in tree cavity; SOSP probable

Site: CHATB10 Habitat: Shrub
Start Time: 08:21 End Time: 08:36
Date: 6/27/06 Visit No: 2
Notes: BHCO is female

<25 meters:		4							1															
>25 meters:				1																			1	
Total (n)	0	4	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
n-1	-1	3	-1	0	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1
n(n-1)	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Site: CHATB11 Habitat: Wetland
Start Time: 09:08 End Time: 09:23
Date: 6/27/06 Visit No: 2

<25 meters:				1																				1
>25 meters:				1					2															
Total (n)	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
n-1	-1	-1	-1	1	-1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
n(n-1)	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Site: CHATB12 Habitat: Wetland
Start Time: 07:05 End Time: 7:20
Date: 6/26/06 Visit No: 2
Notes: AMRE ? Check song - calling only; COYE is yellow throat. Blue Grosbeak pair en route to site - near enclosure, Lark Sparrow pair en route from site near parking lot

<25 meters:				1								2						2						2
>25 meters:																								
Total (n)	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	2
n-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	1	-1	-1	-1	-1	-1	1	-1	-1	-1	-1	-1	1
n(n-1)	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	2

Species N	0	10	0	8	0	0	0	0	15	1	0	5	0	3	2	0	0	2	0	0	1	1	1	4
Observed in Tree	0	3	0	2	0	0	0	0	0	1	0	2	0	3	0	0	0	0	0	0	0	1	0	0
Observed in Shrub	0	6	0	3	0	0	0	0	11	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1
Observed in Wet	0	1	0	3	0	0	0	0	4	0	0	2	0	0	2	0	0	2	0	0	1	0	0	3

HOWR	KILL	LEFL	MALL	MODO	NOFL	REVI	RWBL	SAPH	SOSP	SPSA	SPTO	STAR	TRSW	Uak Hammer	Un Sparrow	WAVE	WBNU	WHPE	WIFL	WWPE	YBCH	YEWA					
HOWR	KILL	LEFL	MALL	MODO	NOFL	REVI	RWBL	SAPH	SOSP	SPSA	SPTO		TRSW	Uak Hammer			WBNU		WIFL	WWPE	YBCH	YEWA	SubTotal	Total N	Spp Rich	Sumn(n-1)	
																							0				
																		1					3	3			
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0		3	3		
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1					
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				0	0
	3						1			1													5				
	3						1		1	1											1		11	16			
0	6	0	0	0	0	0	2	0	1	2	0	0	0	0	0	0	0	0	0	0	1	0		16	7		
-1	5	-1	-1	-1	-1	-1	1	-1	0	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1					
0	30	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0				38	0.158333
4																	1					3	10				
1				2	1												1			1	1	1	8	18			
5	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	1	4		18	9		
4	-1	-1	-1	1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-1	-1	0	0	3					
20	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	12				36	0.117647
3																1					1	2	8				
1				2																	1	2	8	16			
4	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	4		16	8		
3	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	1	3					
12	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	12				28	0.116667
3																						2	5				
3				1																		2	8	13			
6	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4		13	5		
5	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	3					
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12				42	0.269231
2															2					1		2	8				
2																					1	4	9	17			
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	1	6		17	8		
3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-1	-1	-1	-1	0	0	5					
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	30				44	0.161765
																							0				
							1				1										2	1	7	7			
0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	2	1		7	6		
-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	0					
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0				2	0.047619
2																						2	6				
			1																		1		5	11			
2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2		11	7		
1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	1					
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2				8	0.072727
1																							10				
									1												1		4	14			
1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0		14	5		
0	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1					
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				90	0.494505

2									1											1		2	11					
				1	1															1			5		16			
2	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	2		16		10		
1	-1	-1	-1	0	0	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-1	1						
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2					18	0.075
												1									2	1	6					
				1																			4		10			
0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	1		10		7		
-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	1	0						
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0					6	0.066667
																							7					
																						2	2		9			
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2		9		5		
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1						
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2					8	0.111111
24	6	0	1	7	2	0	3	0	3	2	1	1	0	0	2	1	2	1	0	4	11	26	0		150			
12	0	0	1	3	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	5	11						
12	0	0	0	3	2	0	0	0	2	0	0	0	0	0	2	0	2	0	0	4	3	12						
0	6	0	0	1	0	0	2	0	1	2	0	1	0	0	0	0	0	1	0	0	3	3						

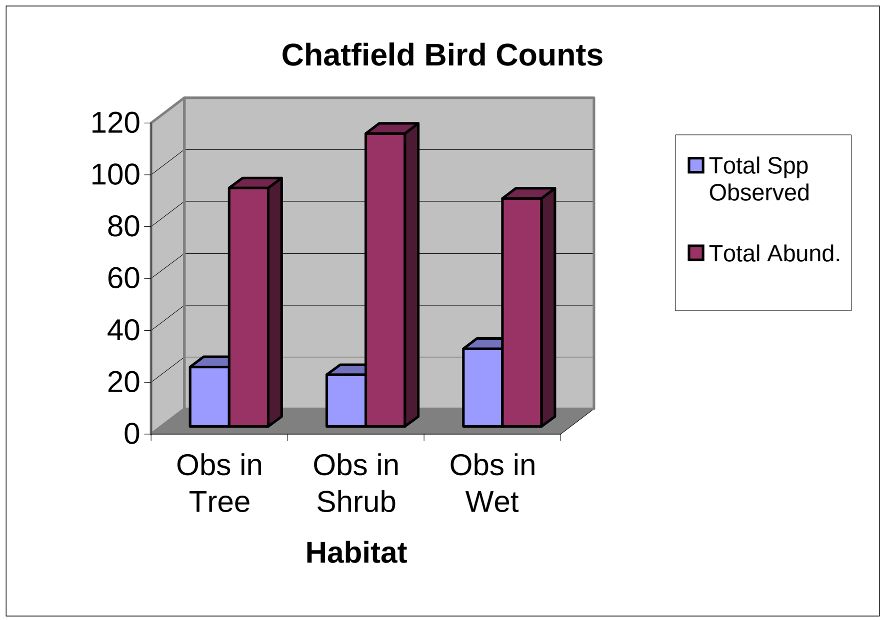
Table 1. Raw Data

Species	AMCR	AMGO	AMRE	AMRO	BASW	BBMA	BCCH	BEKI	BHCO	BGGN	BRBB	BTHU	BUOR	CAGO	CLSW	COSN
Session 1 N	1	5		9	1	4	2	1	1	1	2	10	2			
Session 2 N		10		8					15	1		5		3	2	
Total	1	15		17	1	4	2	1	16	2	2	15	2	3	2	
Obs in Tree		4		2			1			1		6	2	3		
Obs in Shrub		9		10		1	1		12		1	6				
Obs in Wet	1	2		5	1	3		1	4	1	1	3			2	

	Total Spp Observed	**Total Abund.**	**# Species observed in single habitat**
Obs in Tree	23	92	7
Obs in Shrub	20	113	2
Obs in Wet	30	88	12

	Abundance / (per ha)[1]
Obs in Tree	14.6
Obs in Shrub	18.3
Obs in Wet	14.2

[1] = Abundance per ha from TetraTech Table 3.3



Species in Single Habitat		
Tree	**Shrub**	**Wet**
BUOR		BASW
DOWO		BEKI
GHOW		CLSW
REVI		COYT
WAVE		KILL
		SAPH
		SPSA
		TRSW
		WIFL
CAGO	GRAC	STAR
MALL	WBNU	WHPE
		AMCR

COYT	DCCO	DOWO	GBHE	GHOW	GRAC	GRCA	HOWR	KILL	LEFL	MALL	MODO	NOFL	REVI	RWBL	SAPH	SOSP	SPSA	SPTO
1		1	1			4	19	3	2		5	10	1	7	1	2	1	2
2			1	1	1	4	24	6		1	7	2		3		3	2	1
3		1	2	1	1	8	43	9	2	1	12	12	1	10	1	5	3	3
		1		1		1	23		1	1	6	3	1	1		2		1
			1		1	1	18		1		5	6				2		1
3			1			6	2	9			1	3		9	1	1	3	1

STAR	TRSW	WAVE	WBNU	WHPE	WIFL	WWPE	YBCH	YEWA	Total Spp Observed	Total Abundance
	1		2		1	3	11	28	33	145
1		1	2	1		4	11	26	28	148
1	1	1	4	1	1	7	22	54	41	293
		1				2	9	19	23	92
			4			4	6	23	20	113
1	1			1	1	1	7	12	30	88

ERO
ERO Resources Corp.
1842 Clarkson Street
Denver, CO 80218
(303) 830-1188
Fax: 830-1199
www.eroresources.com
ero@eroresources.com

October 22, 2008

To: Chatfield Reallocation Biological Technical Committee

From: Ronald Beane, Mary L. Powell

Re: ERO summary of Chatfield bird point count data and abundance/richness ranking

Please find attached three spreadsheets relating to Chatfield Ecological Functions:

1. **Chatfield Bird Functions Oct 21.xls** contains the Ecological Function Values (EFV) calculated for Preble's and bird habitats. Page 2 provides the rating criteria for bird functions. The breakouts for the criteria are primarily mathematical. The highest number in the data divided by 4 – the number of rating categories, excluding zero. For example, for species richness, the highest number of birds observed in the habitat types was 30 in wetlands. Dividing 30 by 4 results in increments of about 7 (1-8, 9-16, 17-24, >25).
2. **EFU – Bird Point Counts and abundance 10-21-08.xls** has three worksheets. The first two contain the raw data from TetraTech point counts site visits 1 and 2. The **Abundance** worksheet contains the two point counts combined and summarized by total species observed (species richness) and total abundance. ERO has included both richness and abundance as functions because the data indicated that species-rich habitats may be low in abundance (e.g., wetlands) and vise-versa. This worksheet also contains the species abundance per hectare previously provided by TetraTech in Appendix Q of the Draft EIS. This table also provides the number of species observed only with a single habitat for each respective habitat. Note that the point count data does not include counts within upland or mature cottonwood habitats. Mature cottonwood was assigned the same value calculated for riparian tree habitat and upland was conservatively assigned the same value as the lowest EFV calculated for the three measures habitats.
3. **Chatfield Sensitive Bird List 11-20-08.xls** provides the compiled list of sensitive species by season of occurrence. Sensitive species include State listed species, species tracked by CNHP, and Birds of Conservation Concern (USFWS 2002) for Regions 16 (Southern Rockies) and 18 (Shortgrass Prairie).

Mary Powell

From: Klute, David [david.klute@state.co.us]
Sent: Thursday, October 30, 2008 1:41 PM
To: Mary Powell
Cc: Ron Beane
Subject: RE: Proposed Bird Functional Index Numbers

Mary, Ron:

I think this looks pretty good. There is really so much subjectivity that it is hard to say that it is 'right' or 'wrong', but I think it is justifiable. I might suggest that you remove Yellow-billed Cuckoo as a sensitive species though. I assume that any list that it is showing up on refers only the Western Yellow-billed Cuckoo, which would not be occurring at Chatfield.

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

David Klute, Ph.D.

Bird Conservation Coordinator

Colorado Division of Wildlife

6060 Broadway

Denver, CO 80216

Phone: 303-291-7320

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From: Mary Powell [mailto:mpowell@eroresources.com]
Sent: Monday, October 27, 2008 12:17 PM
To: Ann Bonnell; Betty Peake; Brooke Fox; Cecily Mui; Klute, David; Eric Laux; Jana Pedersen; Karen Sitoski; Kent Wiley; Mike Mueller; Pete Plage; Ray Sperger; Rick McLoud; Ron Beane; Steve Dougherty; Tom Ryon
Subject: Proposed Bird Functional Index Numbers

Please find attached one Word document, three Excel tables, and one PDF. The Word and Excel files outline the proposed functional index values for birds and include the original bird count data provided by TetraTech. The PDF a compilation of the 4 native files for those folks who have trouble printing out our Excel spreadsheets.

Please review the attachments in the next day or so. I'd suggest focusing on the Word document and the EFU – Chatfield Birds Functions Oct 21 spreadsheet. The other spreadsheets are back up data. We are soliciting comments/suggestions from the group on the acceptability of the numbers Ron has proposed.

If at all possible, I would like to get everyone's comments this week. Please send your comments back to me and I'll compile them. If you have specific questions for Ron, the answers to which will inform your comments, please address those directly to him (or call him).

Mary Powell

From: Ron Beane [/o=ero/ou=eroserver/cn=recipients/cn=rbeane]
Sent: Thursday, October 30, 2008 2:00 PM
To: Klute, David; Mary Powell
Subject: RE: Proposed Bird Functional Index Numbers

Thanks David,

I had the same thoughts about the Cuckoo, but several of the lists are unclear about the subspecies.

Ron

From: Klute, David [mailto:David.Klute@state.co.us]
Sent: Thursday, October 30, 2008 1:41 PM
To: Mary Powell
Cc: Ron Beane
Subject: RE: Proposed Bird Functional Index Numbers

Mary, Ron:

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Bird Conservation Coordinator

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Phone: 303-291-7320

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Thanks!!

Mary L. Powell

Natural Resource Specialist
Vice President

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<blocked::http://www.eroresources.com/>

Mary Powell

From: Sitoski, Karen M Nwo [karen.m.sitoski@usace.army.mil]
Sent: Friday, October 31, 2008 11:25 AM
To: Mary Powell
Subject: RE: Proposed Bird Functional Index Numbers

Mary,

The numbers are acceptable with sufficient data and rational.

Thanks!!

Karen

-----Original Message-----
From: Mary Powell [mailto:mpowell@eroresources.com]
Sent: Monday, October 27, 2008 12:17 PM
To: Ann Bonnell; Peake, Elizabeth B NWO; Brooke Fox; Cecily Mui; David Klute; Laux, Eric A NWO; Jana Pedersen; Sitoski, Karen M NWO; Kent Wiley; Mike Mueller; Pete Plage; Ray Sperger; Rick McLoud; Ron Beane; Steve Dougherty; Tom Ryon
Subject: Proposed Bird Functional Index Numbers

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Please send your comments back to me and I'll compile them. If you have specific questions for Ron, the answers to which will inform your comments, please address those directly to him (or call him).

Thanks!!

Mary L. Powell

Natural Resource Specialist
Vice President

ERO Resources Corp. * 1842 Clarkson St. * Denver, CO 80218 * 303.830.1188 *
Fax: 830.1199 * www.eroresources.com <blocked::http://www.eroresources.com/>

Mary Powell

From: Cecily Mui [cecilym@ssprd.org]
Sent: Saturday, November 01, 2008 3:19 PM
To: Mary Powell; Ann Bonnell; Peake, Elizabeth B Nwo; Brookesfox; Klute, David; 'Eric.a.laux@usace.army.mil'; Jana Pedersen; Sitoski, Karen M Nwo; Sk Wiley; Mueller, Michael J.; 'Peter_plage@fws.gov'; Ray And Erin Sperger; Rick Mcloud; Ron Beane; Tom Ryon; Steve Dougherty
Subject: Bird EFV joint comment from ABonnell and CMui

Ann and I have jointly worked on reviewing the latest bird EFV. In general, we thought that this process of evaluation was good and will be acceptable to peer review because it demonstrates an objective link to science especially if grasslands/uplands weren't originally surveyed. We do have some comments on the presentation of the raw data and analysis, as well as, sensitive species considered.

Comments on raw data presentation and analysis:

* In the summary, there are a few bird codes that are non-existent in the accepted AOU and BBL code system. Can you please clarify GRAC, STAR, and WAVE?
* The presentation of "Species in Single Habitat" gives a misleading image that the species are using just the one habitat or have a greater dependency on that one habitat. Columns and tables in the raw data analysis related to species in single habitat should be eliminated.
* The bar graph presenting an analysis of Chatfield bird counts should either be eliminated or be presented with confidence intervals showing if there is significant difference between habitat types. Given the low number of surveys used for the analysis, the difference is probably not statistically significant.

Comments on sensitive species:

* Below the tables, there should be a reference for all the lists that were used for determine the sensitive species that are being considered.
* Ann and I have additional species that we would like considered and listed in the tables. They are:

Wetland: Rufous Hummingbird (BCC)

Riparian Trees: Rufous Hummingbird (BCC), Virginia's Warbler (BCC)

Shrub: Rufous Hummingbird (BCC), Virginia's Warbler (BCC)

Uplands: Prairie Falcon (BCC), Peregrine Falcon (SC, BCC), Rufous Hummingbird (BCC), Loggerhead Shrike (BCC)

Mature Cottonwood: Virginia's Warbler (BCC)

Habitat assignments were given based on Colorado Breeding Bird Atlas and Colorado Birds (Andrews and Righter)

* Should these additional species be accepted for the EFV analysis, the values in the Functions table will need to be adjusted.

Ann & Cecily

Cecily H.Y. Mui

Resource Specialist

South Platte Park

3000 W. Carson Dr.

Littleton, Colorado 80120

cecilym@sspr.org

303-730-1022 ext. 12

Visit us here at the South Platte Park and the Carson Nature Center! http://www.sspr.org/nature/ <http://www.sspr.org/nature/>

From: Mary Powell [mailto:mpowell@eroresources.com]
Sent: Monday, October 27, 2008 12:17 PM
To: Ann Bonnell; Betty Peake; Brooke Fox; Cecily Mui; David Klute; Eric Laux; Jana Pedersen; Karen Sitoski; Kent Wiley; Mike Mueller; Pete Plage; Ray Sperger; Rick McLoud; Ron Beane; Steve Dougherty; Tom Ryon
Subject: Proposed Bird Functional Index Numbers

Please find attached one Word document, three Excel tables, and one PDF. The Word and Excel files outline the proposed functional index values for birds and include the original bird count data provided by TetraTech. The PDF a compilation of the 4 native files for those folks who have trouble printing out our Excel spreadsheets.

Please review the attachments in the next day or so. I'd suggest focusing on the Word document and the EFU – Chatfield Birds Functions Oct 21 spreadsheet. The other spreadsheets are back up data. We are soliciting comments/suggestions from the group on the acceptability of the numbers Ron has proposed.

If at all possible, I would like to get everyone's comments this week. Please send your comments back to me and I'll compile them. If you have specific questions for Ron, the answers to which will inform your comments, please address those directly to him (or call him).

Thanks!!

Mary L. Powell

Natural Resource Specialist
Vice President

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Mary Powell

From: 'Eric.a.laux@usace.army.mil' [eric.a.laux@usace.army.mil]
Sent: Friday, November 07, 2008 2:48 PM
To: Mary Powell; Ron Beane
Cc: Peake, Elizabeth B Nwo
Subject: RE: Proposed Bird Functional Index Numbers

Mary, Ron
I am told that the review of the models should be reviewed on their own merit... i.e. birds, prebles, and wetlands seperately looked at. Theoretical soundness, compliance with Corps Policy, and computational accuracy will be the job of the model approver. Overlap of the outputs to provide higher scores, addition of weighting factors, and other application of the model will be the responsibility of the ITR reviewer. While I am trying to make these reviewers the same person, I do not know if I will be successful. I may have to find an independent prebles expert to review that piece. Can you think of anyone specifically that would be considered an expert on Prebles that isn't involved in this exercise?

Good scientific and process documentation, and spreadsheeds that make the equasions and computations obvious will be important for successful review.
We will have documentaion for each of the parameters in order to describe the group concensus and scientific reasoning for each (documentation similar to HSI), correct?. E.g. why does using diversity, abundance, sensitivity of species, and locally limited habitat provide a good basis upon which to base mitigation? Is is supported in the literature that such metrics are good indicators of habitat importance?

This will be very important in our documentation of the modeling, and very important to provide to the reviewer so that the process is totally transparent, defensible, and easy to comment on. The birds and prebles will require this type of documetnation.

We will also need documetation of how we are modifying an already documented wetland model to suit our purposes.

Do we have a good start on any of the documentation?

It would probably be good to also have meeting notes that document each of the meetings so one could look at that for an understanding of our process.
-----Original Message-----
From: Mary Powell [mailto:mpowell@eroresources.com]
Sent: Monday, October 27, 2008 1:17 PM
To: Ann Bonnell; Peake, Elizabeth B NWO; Brooke Fox; Cecily Mui; David Klute; Laux, Eric A NWO; Jana Pedersen; Sitoski, Karen M NWO; Kent Wiley; Mike Mueller; Pete Plage; Ray Sperger; Rick McLoud; Ron Beane; Steve Dougherty; Tom Ryon
Subject: Proposed Bird Functional Index Numbers

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If at all possible, I would like to get everyone's comments this week.
Please send your comments back to me and I'll compile them. If you have specific questions for Ron, the answers to which will inform your comments, please address those directly to him (or call him).

Mary Powell

From: Mary Powell [/o=ero/ou=eroserver/cn=recipients/cn=mpowell]
Sent: Friday, November 21, 2008 2:36 PM
To: Ann Bonnell; Peake, Elizabeth B Nwo; Brookesfox; Cecily H. Y. Mui; Klute, David; 'Eric.a.laux@usace.army.mil'; Jana Pedersen; Sitoski, Karen M Nwo; Sk Wiley; Mueller, Michael J.; 'Peter_plage@fws.gov'; Ray And Erin Sperger; Rick Mcloud; Ron Beane; Steve Dougherty; Tom Ryon
Subject: Draft Functional Assessment Methods

Attachments: (draft ecological functions rpt 11-20-08.doc) stubbed.htm

(draft ecological functions rp...

Please find attached a draft write up of the work we have done to-date as a group and a summary of how the work will be used from this point on. The table with bird ecological functional values reflects changes to values to response to comments Ron received from the group. The functional values for wetlands will be provided next week. Please review the attachment and return comments and suggestions to me or Ron.

Also, we had discussed getting together one more time to go over the final ratings and functional impacts and to talk about next steps beyond the FA group. For those interested in meeting, I have set up a Doodle schedule page to see what the best meeting date and time is. To participate please do the following:

1. Go to http://www.doodle.com/f8sgwixfcpxbyrwe
2. Click on "Your Name" and add your name.
3. Go through the proposed dates (lots) and times (10 AM or 1 PM in most, but not all, cases) and mark "Yes", "No", "If-need-be".
4. Click "Participate" to have your information added to the poll.

Please let me know if you have any questions about the meeting or have suggestions on agenda items.

Thanks!

Mary L. Powell

Natural Resource Specialist
Vice President

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Draft Chatfield Ecological Functions Approach (EFA) (Terrestrial)

Introduction

Background

The terrestrial habitat at Chatfield Reservoir (Chatfield) provides shared ecological functions for the three primary ecological resources identified during the Chatfield Reallocation Feasibility Study/EIS process: Preble's meadow jumping mouse (Preble's), overall wildlife habitat represented by a diverse avian community, and wetlands. Very little site-specific data exist on the relationships and interaction between the habitats available at Chatfield and the wildlife communities that use those habitats. Thus, we must rely on the scientific and technical literature and the professional opinions of local experts to evaluate the terrestrial ecological functions that would be impacted by reallocation. The model being developed should be viewed as hypotheses of species-habitat and habitat-function relationships rather than statements of proven cause and effect relationships. The value of the model is to serve as a foundation for improved decision making based on actual habitat function.

Goals and Objectives

1. Develop a standard unit for evaluating three diverse ecological attributes (referred to as "target resources") that can be used in the U.S. Army Corps of Engineers (Corps) Cost Effectiveness/Incremental Cost Analysis (CE/ICA).
2. Provide a process for evaluating impacts and identifying mitigation that incorporates the complementary habitat requirements of three target resources—Preble's, avian community, and wetlands functions.
3. Incorporate this Ecological Functions Approach (EFA) into the conceptual mitigation plan being prepared concurrently with the EFA development.

Model Development

ERO researched and evaluated several existing models, including Habitat Equivalency Analysis (HEA), Habitat Evaluation Procedures (HEP), and Habitat Suitability Indices (HSI) and adapted a modeling process using the following criteria:

1. Captures overlap of resources
2. Is applicable to potential off-site mitigation areas
3. Uses existing EIS and off-site mapping
4. Provides outputs that are appropriate for economic analysis

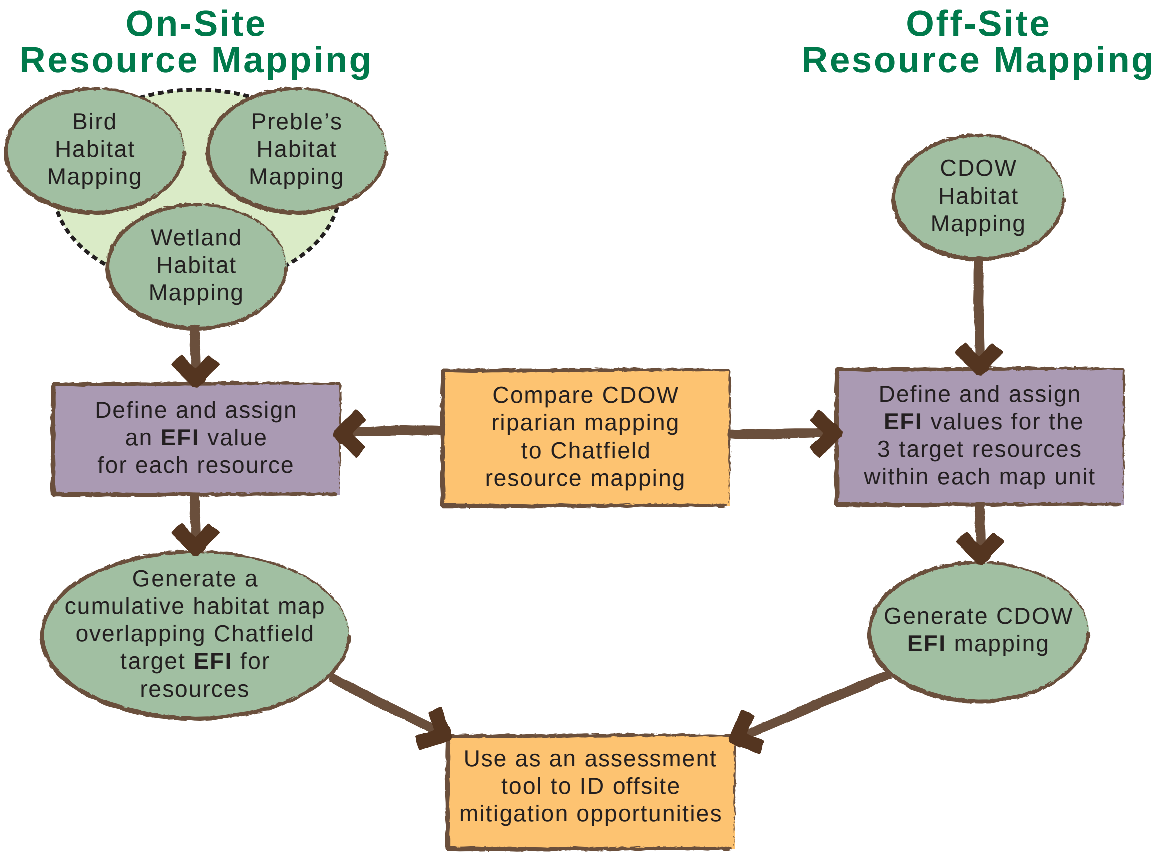
Approach Overview

The overall approach is to convene an Ecological Functions Technical Committee (committee) of locally recognized experts with expertise in the three target resources; a) Preble's, b) Colorado Front Range bird communities, and c) wetlands. This committee has met on several occasions to discuss and reach consensus on a process for evaluating and assigning values to the Chatfield ecological functions model including the following steps (Figure 1):

1. Standardizing vegetation/habitat mapping within the Chatfield study area and off-site riparian areas.
2. Defining the ecological functions of mapped habitat units used in the Chatfield Reallocation Feasibility Study/EIS (Preble's habitat, bird habitat, and wetlands).
3. Assigning Ecological Function Values (EFV) to each mapped unit by consensus of the committee.
4. Calculating impacts as Ecological Functional Units (EFU).
5. Incorporating the EFA into conceptual mitigation plan:
    a. **Assign Weighting Factors –** Additional ecological services such as habitat connectivity and proximity to Chatfield would be applied to individual mitigation parcels and projects as appropriate. Weighting factors would be driven by regulatory requirements associated with the Endangered Species Act (ESA) as it relates to Preble's habitat. Weighting factors and values would be determined during ESA consultation with the U.S. Fish and Wildlife Service (Service).
    b. **Establish a process for tracking actual impacts (debits) and mitigation (credits) –** Debits are the number of EFUs impacted by reallocation and credits are the number of EFUs secured through on- and off-site mitigation.
6. Implementation

This Draft EFA addresses Steps 1 through 3. Step 4 will be done on a provisional basis using the preferred alternative (Alternative 3) described in the PDEIS. Final impacts will be calculated based on the alternative eventually selected. Step 5 will be developed concurrently with ESA consultation. Step 6 will begin once agreement has been reached between the project proponents, Corps, and Service on the conceptual mitigation plan.

Figure 1. Ecological Functions Approach.



Methods

Standardizing Vegetation/Habitat Mapping

The first task of the EFA was to develop standardized habitat mapping for both on-site and off-site areas. Initial habitat mapping for the three target resources (Preble's habitat, bird habitat, and wetlands) was based on resource-specific mapping used in the Chatfield Reallocation Feasibility Study/EIS. The upper limit of wetland mapping was the maximum proposed pool elevation of 5,444 feet. Preble's and bird habitat mapping extended slightly above 5,444 feet, but do not include all areas within Chatfield State Park (CSP) or any off-site areas.

Mitigating impacts to the target resources from the proposed reallocation will involve a combination of on-site habitat enhancement and restoration, and off-site habitat preservation, enhancement, and restoration. Effective mitigation will require standardized habitat mapping both within the new storage pool zone (between 5,432 – 5,444 feet) and within on-site and off-site mitigation sites. Extensive riparian mapping, based on satellite imagery, has been conducted in the entire South Platte River/Plum Creek watersheds by the Colorado Division of Wildlife (CDOW). Comparison of the Chatfield Reallocation habitat mapping and CDOW riparian mapping revealed considerable similarities between the two efforts. Standardizing CDOW riparian with Chatfield habitat mapping involved several steps:

1. Establish equivalencies between CDOW vegetation mapping categories and Chatfield vegetation and habitat mapping categories (Table 1).
2. Generate GIS overlay of expected overlap between site-specific Chatfield mapping categories and CDOW mapping categories for each of the target resources.
3. Correct inconsistencies.

Table 1. Mapping category equivalencies between CDOW Riparian Mapping and Chatfield Reallocation Study target resource mapping.

CDOW Riparian Mapping Category (CDOW Map Code)	Chatfield Equivalent Habitat (Preble's)	Chatfield Equivalent Habitat (Wetlands)	Chatfield Equivalent Habitat (Birds)
RIPARIAN DECIDUOUS TREES			
Riparian Deciduous Tree – Cottonwood (RT2)	High Value Riparian	Palustrine Forested, Palustrine Scrub-Shrub	Mature Cottonwood
RIPARIAN SHRUBS			
Riparian Shrub – General (RS)	High Value Riparian	Palustrine Scrub-Shrub	Wetland/Non-Woody
Riparian Shrub – Willow (RS1)	High Value Riparian	Palustrine Scrub-Shrub, Palustrine Forested, Palustrine Emergent	Shrub
RIPARIAN HERBACEOUS			
Riparian Herbaceous - Cattails/Sedges/Rushes (with permanent standing water) (RH1)	Non-Habitat	Lacustrine Emergent	Wetland/Non-Woody
Riparian Herbaceous - Sedges/Rushes/Mesic Grasses (Waterlogged or Moist Soils) (RH2)	High Value Riparian	Palustrine Emergent	Wetland/Non-Woody
OTHER RIPARIAN			
Unvegetated (NV)	Non-Habitat	Non-Habitat	Palustrine Aquatic Bed
Sandbar (SB)	Non-Habitat		Shoreline
NON-RIPARIAN			
Upland Grass (UG)	Upland		Upland
Upland Grass (Subirrigated Fields) (UG1)			
Irrigated Agriculture (AI, IA, IR)	Low Value Riparian		Upland

Data tables and GIS layers were created that correlated the similarities between habitat mapping of the target resources and CDOW riparian data. The data table and GIS mapping were verified with aerial photos to identify inconsistencies in the two mapping efforts and possible reasons for the inconsistencies. Most inconsistencies were related to the different dates of aerial photo/satellite imagery used for the two mapping efforts. Many areas identified as wetlands in the earlier CDOW mapping had developed into riparian shrublands at the time of the Chatfield Reallocation mapping. Once inconsistencies were reconciled as much as possible, the CDOW mapping and Chatfield Preble's habitat mapping overlapped as expected 96% of the time, CDOW and bird habitat overlapped as expected 78% of the time, and CDOW and Chatfield wetland mapping overlapped as expected 74% of the time.

These correlations will be used later during first-level screening to assess the mitigation potential, in terms of EFUs, and on-site and off-site areas.

Defining Ecological Functions

With regard to habitat variables used in the EFA, the focus of habitat variables related to birds and Preble's revolved around support to life requisites such as breeding, over wintering and migration, forage, and cover. Wetlands were evaluated using the Colorado Department of Transportation's Functional Assessment of Colorado Wetlands (FACWet) Method. TheCorps Denver Regulatory Office was involved in developing the FACWet method and recommended its use in assessing wetland functional impacts and mitigation for the Chatfield Reallocation project. More detailed definitions of the ecological functions for the target resources were discussed and defined in the committee and are briefly described below.

Preble's Habitat

Preble's habitat functions are defined in terms of quality and habitat type (riparian or upland) as described in the DEIS. Three habitat types were used to map Preble's habitat within the EIS study area. They are:

1. High Quality Riparian Habitat
2. Low Quality Riparian Habitat
3. Upland Habitat

High Quality Riparian Habitat – those habitat areas that support multi-strata woody riparian vegetation including willow shrubs, and contain relatively high plant diversity, especially in the understory. Preble's habitat that is of high quality ranks as optimal for all ecological services and all functions are met.

Low Quality Riparian Habitat – habitat areas that support multi-strata woody riparian vegetation that do not support relatively high plant diversity or that are lacking in woody riparian vegetation (i.e., missing multi-strata), but still contain herbaceous plants of adequate diversity. Low quality Preble's habitat provides varying levels of ecological services ranking between fair to good.

Uplands – areas outside the normal riparian zone that provide upland grasses and shrubs of substantial cover, and provide forage for Preble's. Nearly all uplands adjacent to high or low quality riparian habitat meet this definition. Preble's upland habitat provides ecological services ranking between fair to good. Upland sites adequately provide some functions but are limited in many functions.

Non-Habitat – areas that do not support vegetation including paved and dirt roads, parking lots (paved and unpaved), buildings, open water on ponds and the main reservoir, and the dam face east of Plum Creek. These areas do not provide any ecological functions for Preble's.

None – Areas outside the occupied range of Preble's habitat at Chatfield.

Ecological services of Preble's habitat generally are described by the Service (63 FR 26517, 1998) and CDOW (Shenk and Eussen 1998, Shenk unpublished). The draft recovery plan for Preble's (Service 2003) states that delineation of Preble's habitat "needs to include all the necessary resources for Preble's to nest/breed, find cover, travel, feed and hibernate." Based on this information, ecological services provided at CSP for Preble's generally consist of:

1. Breeding
2. Hibernating
3. Foraging
4. Protection from predators (cover) (Table 2)

Ecological Function Values (EFV) were assigned to each Preble's habitat mapping unit by consensus of the committee, based on habitat affinities described in the literature (Trainor et al. 2005; Bakeman and Deans 1997; Meaney et al. 1997; Schoor 2001; Clippinger 2002), the Preble's Draft Recovery Plan, and the final designation of critical habitat (68 FR 37276). The general criteria used in assigning Preble's values include:

- General quality of the habitat unit (e.g., general cover including multi-strata vegetation and plant diversity (Trainor et al. 2005) as an indicator of cover value;
- Importance of habitat to provide general cover and forage including thick understory vegetation and down woody debris as an indication of forage and breeding value;
- Juxtaposition of riparian habitat to uplands (e.g., adjacent or isolated) and active stream channel (e.g., river, stream, or pond in terms of relative ability to maintain or create new habitat) as an indicator of foraging value;
- Preble's presence as indicator of breeding/foraging value; and
- Vegetation structure and habitat unit juxtaposition as an indicator of hibernation potential.

Table 2. Preble's Ecological Functions Rating Definitions.

Rating	Description	Breeding	Winter	Forage	Cover
1.00	Optimal	Provides superior sites	Provides superior sites	Meets all needs	Meets all needs
0.75	Good	Provides adequate to optimal sites	Provides adequate to optimal sites	Meets most needs	Meets most needs
0.50	Fair	Provides sub-optimal sites	Provides sub-optimal sites	Meets many needs	Meets many needs

Rating	Description	Breeding	Winter	Forage	Cover
0.25	Poor	Provides sites operating at functional minimum	Provides sites operating at functional minimum	Meets some needs	Meets some needs
0.00	None	Not provided	Not provided	Not provided	Not provided

Avian Community

Biologists created a habitat map of six bird habitats that would be within the maximum inundation area. The bird habitats that were mapped included wetlands, woodlands (including mature cottonwood forest), shrublands, open water, shorelines, and upland habitats. This area of inundation represents the EIS ecological study area (study area). Biologists used high-resolution aerial photography to map habitats in the field. The field maps were digitized into a Geographic Information System (GIS) where they could be further summarized and impacts by alternative analyzed.

The mapped bird habitat types are described below.

Mature Cottonwood – this habitat type consists of areas along the South Platte River that have old, large Plains cottonwoods (*Populus deltoides* ssp. *monilifera*), but there are also narrowleaf cottonwood (*Populus angustifolia*), peachleaf willow (*Salix amygdaloides*), and other deciduous species. The understory is relatively open and is comprised of riparian grasses and forbs, as well as some shrubs including coyote willow (*Salix exigua*).

Other Trees – this habitat type consists of the remaining forested areas within the study area. This habitat comprises the riparian areas dominated by plains and narrowleaf cottonwoods, peachleaf willows, and box elder (*Negundo aceroides*). They include the even-aged stands of cottonwoods along the reservoir edges, as well as the multi-aged stands at the mouths of Deer Creek, Plum Creek, and the South Platte River that are in various successional stages. These forests do not have substantial areas of mature cottonwood. Understory can be bare (along shorelines) to thick with grasses, forbs, and shrubs.

Shrubs – this habitat type is comprised of riparian shrubs, mostly coyote willow, and other associated shrubs adjacent to streams and floodplains within the study area. This may include crack willow (*Salix fragilis*), chokecherry (*Padus virginiana* ssp. *melanocarpa*), snowberry (*Symphoricarpos occidentalis*), and skunk bush sumac (*Rhus aromatica* ssp. *trilobata*).

Uplands – this habitat type includes areas dominated by grasslands including smooth brome (*Bromopsis inermis),* crested wheatgrass (*Agropyron cristatum*), western wheatgrass (*Pascopyron smithii),* blue grama (*Chondrosum gracile*), and sand dropseed (*Sporobolus cryptandrus*). These can also include weedy areas on upper creek terraces that include Canada thistle (*Breea arvensis*), mullein (*Verbascum thapsis*), cheatgrass (*Anisantha tectorum*), and knapweed (*Acosta* sp.).

Wetland/Non-woody – this habitat type includes riparian and shoreline areas that do not contain trees or shrubs and are mostly comprised of wetland associated plants. This includes cattails (*Typha* sp.), rushes, sedges (*Carex* spp.), reed canarygrass (*Phalaroides arundinacea)*, great cane (*Phragmites australis*), and quackgrass (*Elytrigia repens*). Typically, these areas are inundated due to spring flooding, summer rainstorms, or reservoir levels.

Shoreline – this habitat type includes unvegetated areas around the reservoir and inlets. They can be gravelly, sandy, or silty.

Non-habitat – this habitat type includes parking areas, roadways, and other areas devoid of any habitat value for birds.

Water – this habitat type includes open water bodies, including Chatfield and various ponds and former gravel pits along the South Platte River. This habitat does not include the South Platte River, Plum Creek, or Deer Creek, which were mapped as wetlands or riparian habitat. It is assumed that open water and the terrestrial ecological functions associated with water (primarily for water birds) would not be adversely affected by the proposed reallocation, and water as a terrestrial habitat is not included in this analysis.

The bird habitats described above provide the ecological functions necessary to support breeding, wintering, and migrating avian communities. The committee determined that, for the purposes of this study, the assessment of bird ecological functions would focus on four specific functions of avian habitats within the South Platte River/Plum Creek watershed:

1. Supports a diverse avian community (species richness)
2. Supports large numbers of birds (abundance)
3. Provides seasonal habitats for sensitive species
4. Provides habitats that are limited or rare on a local or regional scale (Table 3)

The values of these functions (EFV) on Chatfield were determined from several data sources, including point counts conducted by TetraTech as part of the Chatfield Reallocation DEIS baseline inventory, surveys and bird counts conducted by the Audubon Society of Greater Denver, the Colorado Breeding Bird Atlas (Kingery 1998), and the National Audubon Society Christmas Bird Count (CBC) data summarized by USGS (http://www.mbr-pwrc.usgs.gov/cbc/cbcnew.html). Specific methods for determining EFVs are described below.

Table 3. EFV Rating Criteria.

Rating	**Description**	**Species Richness* (# spp)**	**Species Abundance* (# Indiv./ha)**	**# of Sensitive spp.**	**Limited Habitat (Region)**
1.00	Optimal/High	> 25	>16	>10	Very limited
0.75	Good/Mod High	17-24	11-15	7-9	Limited
0.50	Fair/Moderate	9-16	6-10	4-6	Common
0.25	Poor/Low	1-8	1-5	1-3	Abundant
0.00	None	0	0	0	- -

* Data from Point Counts (TetraTech 2007).

Species Richness and Abundance

Species richness and abundance was determined from point count data conducted in three types of riparian habitats in June 2006 (DEIS, Appendix Q). The two point counts were combined and summarized by total species observed in each habitat (species richness) and total number of birds observed in each habitat (abundance). Both species richness and abundance were included as functions because the data indicated that species-rich habitats may be low in abundance (e.g., wetlands) and vice-versa. The point count data did not include counts within upland or mature cottonwood habitats. The committee assigned mature cottonwoods the same value calculated for riparian tree habitat and, based on the site-specific knowledge and general quality of uplands within the region, upland habitat was assigned a value one step below the lowest EFV calculated for the three measured habitats.

Sensitive Species

Sensitive species are defined as federally or state-listed species, species tracked by Colorado Natural Heritage Program, and Birds of Conservation Concern (Service 2002) for Regions 16 (Southern Rockies) and 18 (Shortgrass Prairie). A list of sensitive species was compiled and reviewed by the committee (List to be added). Each species was placed into appropriate habitat(s) by season of occurrence based on professional opinion and the consensus expertise of the committee.

Limited Habitat

Limited habitat was based on the spatial extent (total acres) of each habitat, as mapped by CDOW riparian mapping, both within CSP boundaries (local) and over a larger region that encompassed both the South Platte River and Plum Creek drainages from C-470 south to the Waterton Bridge and Sedalia. This area was selected because habitat markedly changes from a prairie to a more montane system west of the Waterton Bridge, and riparian habitat changes from a system with a tree overstory north of Sedalia to a system with a dominant willow shrub overstory with few trees south of Sedalia.

Wetlands

Within the study area, biologists mapped areas that had indicators of the three characteristics that the Corps considers necessary for an area to be determined a wetland (hydrophytic vegetation, adequate hydrology, and wetland soils). The mapping was limited to areas below 5,444 feet, the maximum proposed pool elevation.

Wetland areas were grouped into five main categories: emergent, submergent, scrub/shrub, forested, and seasonal wetlands. These categories were developed with input from the Corps and include natural or man-made wetlands.

Functions provided by the wetlands were assessed using the FACWet method. FACWet is a qualitative rapid assessment method that relies on professional judgment to assess the functional conditions of wetlands and riparian areas. FACWet assesses the status of seven wetland functions relative to those expected in the habitat's natural or reference-standard condition. The functions assessed by FACWet are wildlife habitat, fish/aquatic habitat, flood attenuation, short- and long-term water storage, nutrient/toxicant removal, sediment retention/shoreline stabilization, and production export/food chain support.

Results and Discussion

Assigning EFVs

The committee held a series of workshops and email exchanges to reach consensus on assigning EFV for Preble's and bird habitat (Table 2 and Table 3). As in HSI, a numerical value of EFV was assigned for each function on a 0.0 to 1.0 scale. Wetland values were also assigned function values on a 0.0 to 1.0 scale following the FACWet method (Table 4).

EFV were then summed across all habitat units and scaled to 1 to obtain an Ecological Functional Index (EFI) for each habitat type (Table 4). The resulting EFI were entered spatially into habitat polygons for the three target resource files using GIS and combined by overlapping resource layers to create a map showing the cumulative EFI for each habitat polygon.

Rating Criteria for EFVs

Ratings for habitat functions were assigned based on a combination of qualitative and quantitative rating criteria (Table 4). Preble's EFV were based on a general quality scale ranging from non-habitat (EFV = 0.0) to High Quality or Optimal habitat for Chatfield (EFV = 1.0). Ratings for limited bird habitat was based on a general abundance scale ranging from abundant (EFV = 0.25 to very limited (EFV = 1.0). The increments used to determine the EFV rating for bird richness, abundance, and sensitive species habitat were primarily mathematical. The highest number in the data was divided by the number of rating categories (4), excluding zero. For example, for species richness, the highest number of species observed among all habitat types was 30 in wetlands. Dividing 30 by 4 results in increments of about 7 (1-8, 9-16, 17-24, >25). When compared back to the data tables, these increments closely matched natural breaks in the data.

Table 4. Rating Criteria for EFVs.

Chatfield EIS Mapping Unit	Preble's EFV				Bird EFV				Wetlands EFV							EFI
	Breeding	**Winter**	**Forage**	**Cover**	**Species Richness**	**Species Abundance**	**Supports Sensitive spp.**	**Limited Habitat (local or regional)**	**Wildlife Habitat**	**Fish/ Aquatic Habitat**	**Flood Atten-uation**	**Short- and Long-Term Water Storage**	**Nutrient Tox. Removal**	**Sediment Retention Shoreline Stab.**	**Prod. Export Food Chain Support**	**scaled to 1**
Chatfield EIS Bird Habitat																
Shoreline																
Shrub (riparian)					0.75	1	0.25	0.75								0.69
Trees					0.75	0.75	0.5	0.75								0.69
Upland					0.5	0.5	1	0.5								0.63
Wetland/Non-Woody					1	0.75	0.25	1								0.75
Mature Cottonwood					0.75	0.75	0.5	1								0.75
Non-Habitat					0	0	0	0								0.00
Chatfield EIS Preble's Habitat																
High Value Riparian	1	1	1	1												1.00
Low Value Riparian	0.5	0.5	0.75	0.75												0.63
Upland	0.25	0.25	0.75	0.5												0.44
Non-Habitat	0	0	0	0												0.00
None*	0	0	0	0												0.00
Chatfield EIS Wetland Habitat																
Palustrine Aquatic Bed									**TBD**							0.00
Palustrine Emergent																0.00
Palustrine Scrub-Shrub																0.00
Palustrine Forested																0.00

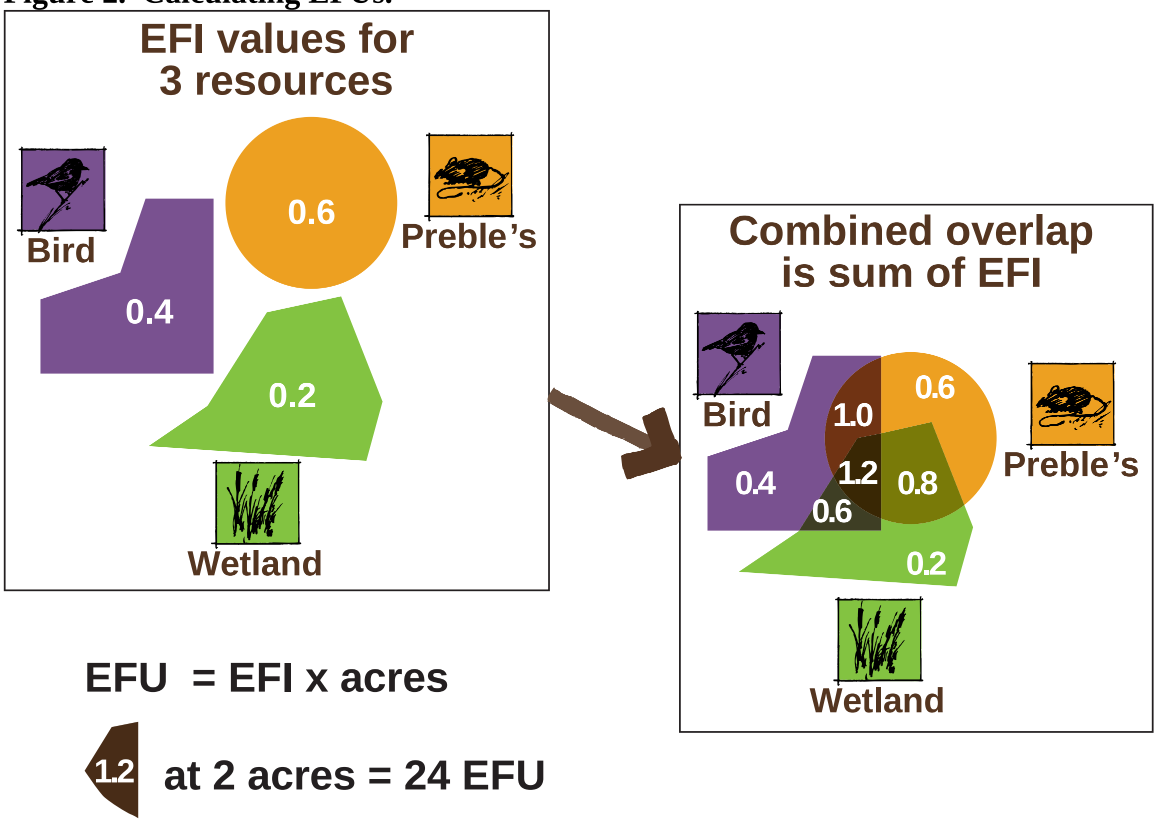
Notes:
[*] area outside range of Preble's
(grey) = Functions not applicable
(yellow) = Numbers changed based on committee suggestions

Calculate Impacts as Functional Units

The number of EFUs in a particular area is the product of the EFI of a polygon times the acreage of the area in question. For instance, if a particular Preble's habitat polygon has an EFI of 0.75 and the polygon is 10 acres, the polygon provides 7.5 EFUs for Preble's. If four of those 10 acres are inundated, three EFUs would no longer be available.

The total number of functional units impacted by the selected alternative will be calculated based on the sum of impacted EFUs provided for each target resource (Figure 2). For example if 100 acres are inundated and those 100 acres provide 200 EFUs for Preble's, 150 EFUs for birds, and 75 EFUs for wetlands, a total of 425 EFUs would be impacted.

Figure 2. Calculating EFUs.



Implementation

Once the number of EFUs that would be impacted by the selected alternative is known, measures described in the Conceptual Mitigation Plan would be implemented. Those measures include on-site mitigation via habitat creation and enhancement and off-site mitigation via habitat conservation, creation, and enhancement.

First-level screening of on- and off-site mitigation opportunities could be done using the CDOW riparian mapping equivalencies. If two areas become available for use as mitigation sites, an approximation of the number of EFUs that could be expected for each parcel could be calculated. For example, if one parcel is larger and has a lower cost per acre, but is mapped as having a preponderance of upland grassland habitat; and the other parcel is smaller and has a higher cost per acre, but has a greater proportion of riparian habitat, the smaller, more expensive parcel may be preferred because it results in a lower cost per EFU.

First-level screening would be followed by site-specific assessments of priority mitigation opportunities. Habitats would be mapped using methods applied during mapping for the Chatfield Reallocation Study and an accurate baseline number of EFUs would be calculated. Once the baseline EFUs are known, increases in EFUs that result from creation and enhancement activities would be monitored over time and counted toward mitigation.

Weighting factors for additional ecological services such as habitat connectivity, proximity to Chatfield, buffering, and contribution to Preble's recovery would be applied to individual mitigation parcels and projects as appropriate. Identification of weighting factors and values would be determined during consultation with the Service.

A "ledger sheet" of debits (impacted EFUs) and credits (mitigation EFUs) would be established and updated annually based on site-specific monitoring. As part of this process, minimum EFU mitigation thresholds for regulated species (Preble's) and other sensitive habitats (i.e., mature cottonwood) would be established in consultation with the Service to ensure complete regulatory compliance.

As described in the Conceptual Mitigation Plan, in order to implement mitigation, an organization would be formed or identified that would manage funds contributed by the participants. The organization would coordinate its efforts with other planning entities, identify priority parcels and potentially negotiate with landowners, and direct monitoring and management. The organization's primary tasks would be habitat acquisition, monitoring, and adaptive management.

Integration with Conceptual Mitigation Plan

The Chatfield Conceptual Mitigation Plan has several guiding principles that would be followed throughout the mitigation planning and decision-making process. These guiding principles apply to Preble's habitat, bird habitat, and wetlands that are potentially impacted. Table 5 summarizes the Guiding Principles for Mitigation.

Table 5. Guiding Principles for Mitigation.

No.	Principle	Explanation
1.	Types of Mitigation	In order of priority: Avoidance, On-site, Off-Site
2.	Mitigation Approach	On-site, Critical Habitat on the South Platte, and Systems Approach
3.	Functional Value	Tied to baseline of habitat function and value resulting from overlap analysis and habitat value indices
4.	Habitat Overlap and Indicator Species	Preble's acts as surrogate for impacts to riparian/wetland/bird communities where appropriate
5.	Habitat Equivalency Indices	Describe the functional units and quantify values

The approach for on-site mitigation would be to develop a series of habitat enhancement or creation activities that would target specific acres with certain habitat values. On-site is considered the area within the Corps' "Chatfield Lake Project Area."

The approach for off-site mitigation would be two-fold: 1) activities in critical habitat in the South Platte River drainage and 2) the Systems Approach in the Plum Creek drainage. The Systems Approach would use a systemwide view of conservation goals and maximum benefit of mitigation sites. The Systems Approach looks for overall benefit to a large area or wildlife community. Mitigation opportunities would be prioritized based on the greatest overall functional benefit provided by conservation, enhancement, and creation of habitat.

Potential mitigation sites for Preble's are most restrictive compared to bird habitats or wetland mitigation sites. Preble's are not found below Chatfield Dam; therefore, sites for mitigation are limited to areas above the reservoir (and above the proposed inundated areas) along the South Platte River and Plum Creek. Site selection for bird habitat mitigation and wetland mitigation is much less restrictive. Sites can be targeted along Deer Creek, Massey Draw, and Marcy Gulch, as well as the South Platte River and Plum Creek.

References

To be added

ERO Resources Corp.
1842 Clarkson Street
Denver, CO 80218
(303) 830-1188
Fax: 830-1199
www.eroresources.com
ero@eroresources.com

Chatfield Reallocation Functional Assessment Methods

Meeting Minutes for

December 3, 2008

1:00 pm to 4:00 pm

ERO Resources Office

1842 Clarkson Street

Attendees:

Eric Laux (via teleconference) – U.S. Army Corp of Engineers (Corps)
Betty Peake (via teleconference) – Corps
Glenn Covington (via teleconference) – Corps
Karen Sitoski – Corps
Ann Bonnell – Audubon Society of Greater Denver/South Platte Group of the Sierra Club
Cecily Mui – South Suburban Park and Recreation District/South Platte Park
Mike Mueller – Sierra Club
Rick McLoud – Centennial (via teleconference)
Ray Sperger - Chatfield Basin Conservation Network
Brooke Fox – Chatfield Basin Conservation Network
Tom Ryon – Ottertail Environmental
Ron Beane – ERO
Jana Pedersen – ERO
Mary L. Powell – ERO

Meeting Summary:

1. Review of last meeting
    a. Generally wrapped up birds
2. Discuss final EFVs
    a. Cecily ask about the sensitive attribute. She's concerned about how the final numbers ended up. Ann has similar concerns.

b. Eric points out that the purpose is to develop a way to help make good planning decisions, not develop detailed analytical data. Making minor changes wouldn't ultimately make a difference.

c. Cecily suggest that we rethink because species abundance and richness for uplands is too low.

d. Discussion continues on validity of numbers and how they translate to on and off-site mitigation.

e. Grasslands lower because of fragmentation, human presence, mowing, etc.

3. Discussion on next steps for mitigation process

   a. Explain that as part of impact assessment, baseline conditions of habitat that will be impacted will be determined. Provides a standard against which mitigation will be measured.

   b. The discussion of documenting baseline conditions goes a long way in addressing Cecily, Ann, and Karen's concerns.

   c. In consultation with FWS, weighting factors will be developed using proximity to impacts, upland buffer, connectivity, etc. Primarily focused on Preble's because of regulatory issues.

   d. Corps' model review/certification process.

   e. Incorporation into conceptual mitigation plan.