Assessment of Wetland Condition on the Rio Grande National Forest

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on the Rio Grande National Forest

Prepared for:

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All photos taken by Colorado Natural Heritage Program Staff.

EXECUTIVE SUMMARY

The Rio Grande National Forest (RGNF) covers 1.83 million acres in south central Colorado and contains the very headwaters of the Rio Grande River. The Forest's diverse geography creates a template for equally diverse wetlands, which provide important ecological services to both the RGNF and lands downstream. Though now recognized as a vital component of the landscape, many wetlands have been altered by a range of human land uses since European settlement. Across the RGNF, mining, logging, reservoirs, water diversions, grazing, and recreation have all impacted wetlands. In order to adequately manage and protect wetland resources on the RGNF, reliable data are needed on their location, extent and condition.

Between 2008 and 2011, Colorado Natural Heritage Program (CNHP) partnered with Colorado Parks and Wildlife (CPW) on a U.S. Environmental Protection Agency (EPA) funded effort to map and assess the condition of wetlands throughout the Rio Grande Headwaters River Basin, which includes the RGNF. Existing paper maps of wetlands created by the U.S. Fish and Wildlife Service (USFWS)'s National Wetland Inventory (NWI) program were converted to digital data by GIS Analysts at CPW. In addition to the mapping, 137 wetlands were surveyed across the Rio Grande Headwaters basin using condition assessment methods developed at CNHP over the past decade. Of the wetlands surveyed, 52 were located on the RGNF in 10 different watersheds. To supplement the EPA-funded study, the U.S. Forest Service (USFS) provided funding through a Challenge Cost Share Agreement for additional wetland sampling in the RGNF to develop more comprehensive information about the types, abundances, distribution, and condition of the Forest's wetlands. Through this agreement, 25 additional wetlands on the RGNF were surveyed and all data from the RGNF were summarized.

Based on digitized NWI mapping, there are 42,862 acres of wetlands and water bodies within the RGNF, of which lakes and rivers comprise 4,687 acres or 11%. This estimate for wetlands and water bodies represents approximately 2% of the total land area in the RGNF. Slightly over half (55%) of NWI mapped acres are freshwater herbaceous wetlands. Shrub wetlands make up another 30%. When broken down by hydrologic regime, saturated wetlands are the most common, comprising 73% of NWI acres. Within the Forest, 82% of all lakes are mapped with a dammed/impounded modifier, indicating that most lakes are reservoirs of one kind or another. Beavers influence only 4% of all wetland acres, but 23% of ponds are mapped as beaver ponds and 6% of shrub wetlands are mapped with beaver influence. Sixty-five percent of all NWI acres occur in the subalpine ecoregions, which make up roughly the same proportion of the Forest's land area. Another 29% of NWI acres occur in the alpine zone. Lower elevation zones contain very few wetland acres.

In total, 77 wetland sites were surveyed across the RGNF, including 30 riparian shrublands, 27 wet meadows, 17 fens, two riparian woodlands, and one marsh. Nearly 500 plant taxa were encountered during the surveys, including 445 identified to the species level. Of the 445 identified to species level, 420 (94%) were native species and 25 were non-native species. Noxious weeds, an aggressive subset of non-natives, were present in only four plots.

Wetland condition measures indicate that wetlands on the RGNF are in excellent to good condition. Floristic quality assessment indices were high for most wetlands, though did vary by both elevation and wetland type. Multi-metric Ecological Integrity Assessment (EIA) scores rated most wetlands with

an A- or B-rank, indicating that wetlands were either in reference condition or deviated only slightly from reference condition. A handful of wetlands received C-ranks, due to stressors including grazing, hydrologic modifications, and surrounding land use.

Information from this and other similar studies of wetlands and riparian areas on the RGNF can aid in future management of the Forest's important resource base.

ACKNOWLEDGEMENTS

The author would like to acknowledge the U.S. Forest Service (USFS) for their financial support of the project. Special recognition goes to Dean Erhard, former Ecologist with the Rio Grande National Forest (RGNF), for initiating the Challenge Cost Share Agreement and to Harold “Dave” Dyer, RGNF Forest Planner, for seeing it through the final stages.

Thanks are also due to the U.S. Environmental Protection Agency (EPA) Region 8 and Colorado Parks and Wildlife (CPW)’s Wetlands Program for supporting the larger study of wetlands in the Rio Grande Headwaters River Basin, which this project benefits from. Jill Minter, former EPA Region 8 Wetland Monitoring and Assessment Coordinator, was especially important in supporting Colorado’s growing wetland assessment program. Brian Sullivan, CPW Wetlands Program Coordinator, and Grant Wilcox, CPW GIS Analyst, both contributed extensive time and energy to the larger Rio Grande Headwaters project. Grant Wilcox also created the random sample survey design used to select the additional wetlands sampled in this project.

Kevin Bon, Bruce Droster, and Jane Harner from U.S. Fish and Wildlife Services (USFWS)’s National Wetland Inventory (NWI) Program have been incredibly helpful over the years as we grow our capacity to map wetlands in Colorado. Zack Reams, former GIS Analyst with both CPW and CNHP, deserves particular recognition as our first Wetland Mapping Specialist. Zack’s hard work, resourcefulness and ingenuity laid the foundation for all current and future wetland mapping done by our programs. Digitization of RGNF NWI polygons was done by Zack in 2008 while working for CPW.

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1.0 INTRODUCTION

1.1 Project Background and Objectives

The Rio Grande National Forest (RGNF) in south central Colorado contains the very headwaters of the Rio Grande River. The Forest is predominantly located in the San Juan Mountains, east of the Continental Divide and west of Colorado's San Luis Valley. However, the RGNF also arcs north and west to include the narrow line of Sangre de Cristo Mountains, which form the eastern edge of the San Luis Valley and the Rio Grande Headwaters River Basin.

The diverse geography of the RGNF creates a template for equally diverse wetlands. Heavy snowfall in the San Juan Mountains percolates through shallow mountain soils and creates alpine wet meadows, riparian shrublands, and peat-forming wetlands known as fens. In addition to precipitation, beavers play an important role creating and maintain wetlands in the subalpine and montane zones by building dams that impound and store water. Downstream of the mountains, rivers and creeks deliver peak spring flows and carry sediment to the valley below. Flooding rivers constantly rework their banks and create a mosaic of riparian shrublands, woodlands, and backwater channels.

Wetlands provide important ecological services to both the RGNF and lands downstream. They act as natural filters, helping to protect water quality by retaining sediments and potential toxins, as well as removing excess nutrients such as nitrogen and phosphorus. Wetlands also help to regulate local and regional hydrologic processes by stabilizing base flow, attenuating floods, and replenishing belowground aquifers. In addition, wetlands support numerous plant and animals species that depend on aquatic habitats for some portion of their life cycle and provide important opportunities for recreation. Though now recognized as a vital component of the landscape, many wetlands have been altered by a range of human land uses since European settlement. Across the RGNF, mining, logging, construction of reservoirs, water diversions, grazing, and recreation have all impacted wetlands.

Between 2008 and 2011, Colorado Natural Heritage Program (CNHP) partnered with Colorado Parks and Wildlife (CPW) on a U.S. Environmental Protection Agency (EPA) funded effort to map and assess the condition of wetlands throughout the Rio Grande Headwaters River Basin, which includes the RGNF (Lemly et. al 2011). Through the EPA-funded project, all existing paper maps of wetlands created by the U.S. Fish and Wildlife Service (USFWS)'s National Wetland Inventory (NWI) program were converted to digital data by GIS Analysts at CPW. In addition to the mapping, 137 wetlands were surveyed across the Rio Grande Headwaters basin using condition assessment methods developed at CNHP over the past decade. Of the wetlands surveyed, 52 were located on the RGNF in 10 different watersheds. However, because the goal of the EPA project was to assess the condition of wetlands across the entire basin, sample points on the RGNF were not evenly distributed and did not provide an adequate sample to address wetland condition across the Forest.

To supplement the EPA-funded study, the U.S. Forest Service (USFS) provided funding through a Challenge Cost Share Agreement for additional wetland sampling in the RGNF to develop more comprehensive information about the types, abundances, distribution, and condition of the Forest's wetlands. Through this agreement, 25 additional wetlands on the RGNF were surveyed. With information from both projects, USFS will be better prepared to address the management of wetlands on the RGNF. The mapping provides a reasonably accurate estimate of wetland acreage on the RGNF.

The surveys provide a thorough characterization and assessment of each wetland visited, including a compressive species list, soil profile, and condition scores. This information will serve as a foundation for understanding the major wetland types across the Forest.

1.2 Ecological Integrity Assessment and Ecological System Classification

The condition assessment methodology used in this study is based on the Ecological Integrity Assessment (EIA) Framework developed by NatureServe[1] and ecologists from several Natural Heritage Programs across the country (Faber-Langendoen et al. 2008). The framework shares characteristics of established wetland assessment methods, such as the California Rapid Assessment Method for Wetlands (CRAM: CWMW 2012) and the Ohio Rapid Assessment Method (ORAM: Ohio EPA 2001). The EIA Framework evaluates wetland condition based on a multi-metric index. Biotic and abiotic metrics are selected to measure the integrity of key wetland attributes within four major categories:

1) Landscape context
2) Biotic condition
3) Hydrologic condition
4) Physiochemical condition.

Using field and GIS data, each metric is rated according to deviation from its natural range of variability, defined based on the current understanding of wetlands from pre-European settlement to today. This is determined using the range of variability observed in reference wetlands (those with no or minimal human disturbance) that exist on the landscape at the present time. Where field data are lacking or no reference condition wetlands remain, information from the literature is also used to define historic reference condition. The further a metric deviates from its natural range of variability, the lower the rating it receives. Numeric and narrative criteria define rating thresholds for each metric. Once metrics are rated, scores are rolled up into the four major categories. Ratings for these four categories are then rolled up into an overall EIA score. For ease of communication, category scores and the overall EIA score are converted to ranks following the ranges shown in Table 1. The scores and ranks can be used to track change and progress toward meeting management goals and objectives.

EIA metrics and ratings are specific to Ecological Systems. The Ecological System classification (Comer et al. 2003) is a component of the International Vegetation Classification System (Grossman et al. 1998; Faber-Langendoen et al. 2009), developed by NatureServe and the Natural Heritage Network. It provides a finer scale of resolution than traditional wetland classification systems such as the U.S. Fish and Wildlife Service's Cowardin classification (Cowardin et al. 1979) and the hydrogeomorphic (HGM) classification system (Brinson 1993), but is a coarser-scale than individual plant associations. The Ecological System approach uses both biotic (structure and floristics) and abiotic (hydrogeomorphic template, elevation, soil chemistry, etc.) criteria to define units. These classes allow for greater specificity in developing conceptual models of natural variability and the thresholds that relate to stressors. A key to wetland and riparian are Ecological Systems in the Rocky Mountains is presented in Appendix A.

[1] NatureServe is a non-profit conservation organization whose mission is to provide the scientific basis for effective conservation action. For more information about NatureServe, see their website: www.natureserve.org.

With past funding from EPA Region 8 and Colorado Parks and Wildlife, CNHP developed and tested EIA protocols for all Ecological Systems in the Southern Rocky Mountain Ecoregion (Rocchio 2006a-g; Lemly and Rocchio 2009). These protocols were used in the EPA-funded wetland condition assessment of the Rio Grande Headwaters River Basin (Lemly et al. 2011) and a subsequent project in the North Platte River Basin (Lemly and Gilligan 2012). CNHP's EIA methods can be carried out at various levels of intensity.[2] For this study, both Level 2 (rapid assessment) and Level 3 (intensive sampling) protocols were used. This study also used detailed vegetation data to calculate metrics based on the Floristic Quality Assessment (FQA) for Colorado (Rocchio 2007)

Table 1. Definition of Ecological Integrity Assessment ratings.

Rank Value	Description
A	**Reference Condition (No or Minimal Human Impact):** Wetland functions within the bounds of natural disturbance regimes. The surrounding landscape contains natural habitats that are essentially unfragmented with little to no stressors; vegetation structure and composition are within the natural range of variation, nonnative species are essentially absent, and a comprehensive set of key species are present; soil properties and hydrological functions are intact. Management should focus on preservation and protection.
B	**Slight Deviation from Reference:** Wetland predominantly functions within the bounds of natural disturbance regimes. The surrounding landscape contains largely natural habitats that are minimally fragmented with few stressors; vegetation structure and composition deviate slightly from the natural range of variation, nonnative species and noxious weeds are present in minor amounts, and most key species are present; soils properties and hydrology are only slightly altered. Management should focus on the prevention of further alteration.
C	**Moderate Deviation from Reference:** Wetland has a number of unfavorable characteristics. The surrounding landscape is moderately fragmented with several stressors; the vegetation structure and composition is somewhat outside the natural range of variation, nonnative species and noxious weeds may have a sizeable presence or moderately negative impacts, and many key species are absent; soil properties and hydrology are altered. Management would be needed to maintain or restore certain ecological attributes.
D	**Significant Deviation from Reference:** Wetland has severely altered characteristics. The surrounding landscape contains little natural habitat and is very fragmented; the vegetation structure and composition are well beyond their natural range of variation, nonnative species and noxious weeds exert a strong negative impact, and most key species are absent; soil properties and hydrology are severely altered. There may be little long term conservation value without restoration, and such restoration may be difficult or uncertain.

[2] EPA´s National Wetlands Monitoring Workgroup has endorsed the concept of a Level 1, 2, 3 approach to monitoring. Level 1 (landscape assessment) relies on coarse, landscape scale inventory information, typically gathered through remote sensing and preferably stored in, or convertible to, a geographic information system (GIS) format. Level 2 (rapid assessment) is at the specific wetland site scale, using relatively simple, rapid protocols. Level 3 (intensive site assessment) uses intensive research-derived, multi-metric indices of biological integrity. For more information, see http://www.epa.gov/owow/wetlands/pdf/techfram.pdf.

2.0 STUDY AREA

The RGNF covers 1.83 million acres[3] within the Rio Grande Headwaters River Basin in south central Colorado and spans a broad elevation range from 8,000 to 14,261 ft. (Figure 2). The Forest is located on the eastern flank of the Continental Divide, which runs 236 miles along the Forest's western border. Much of the RGNF is located in the high San Juan Mountains, which contain the very headwaters of the Rio Grande River. However, the RGNF extends beyond the mountain peaks of the San Juans. The Forest is 20–45 miles wide from east to west, over 100 miles from north to south, and extends downslope of the mountains into foothill zone above the San Luis Valley. In addition to the San Juan Mountains, the RGNF also includes the long thin line of the Sangre de Cristo Mountains to the east, which jut abruptly from the valley below. Climatic gradients are extreme within the RGNF. The high peaks of the San Juans receive up to 50 inches a year in total precipitation, while lower elevations near can receive as little as 10–20 inches. Bedrock geology in the RGNF is predominantly volcanic rocks in the San Juan Mountains, but also contains ancient Precambrian basement rock in the Sangre de Cristos and is interspersed with layers of sedimentary rocks and more recent Quaternary deposits.

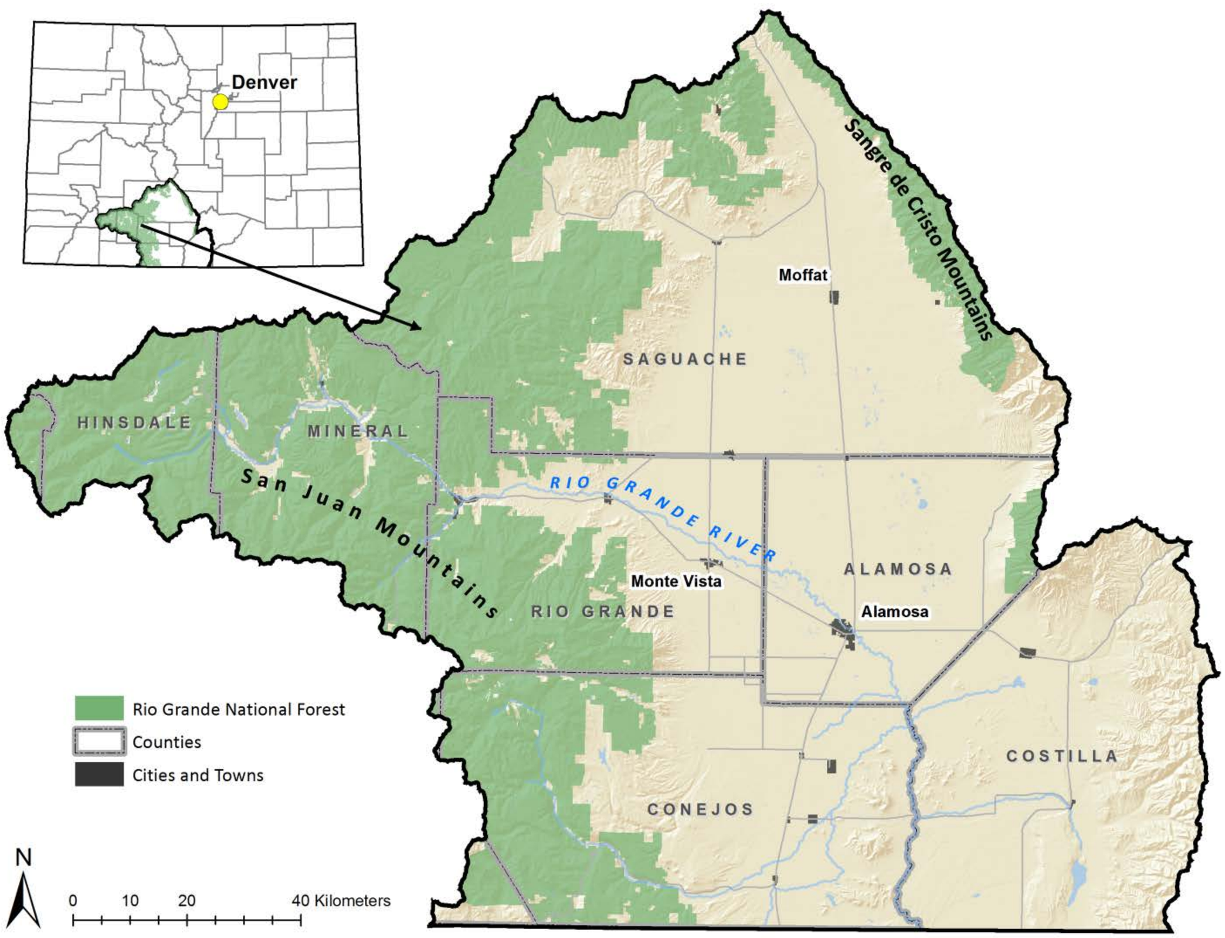

Figure 1. Rio Grande National Forest (RGNF) in south central Colorado. Inset map shows study area in relation to Denver and all counties in the state.

[3] Acreage calculations for the RGNF were derived from 2009 GIS data and are restricted to the Rio Grande Headwaters River Basin. These figures may be slightly different than total acres owned or managed by RGNF in 2012.

3.0 METHODS

3.1 Wetland Mapping and Summary of Wetland Resources

At the outset of the EPA-funded assessment of wetlands in the Rio Grande Headwaters River Basin, digital wetland mapping from U.S. Fish and Wildlife Service (USFWS)'s National Wetland Inventory (NWI) program was available for less than 10% of the RGNF. However, paper maps drawn between the late 1970s and early 1980s existed for the entire area. Through the EPA-funded project, CPW scanned the original paper maps for all topographic quads in the basin lacking digital spatial data and converted them to geo-rectified digital polygons, producing a wall-to-wall map of wetlands. The maps were not updated in the digital conversion, but land use change in the basin has been minimal in the 30 years since the maps were drawn. This is especially true for lands within the RGNF. For this report, the extent of wetland resources within the RGNF was summarized based on the completed digital NWI mapping and ancillary data sources. Summary statistics include wetland acreage by NWI system/class, hydrologic regime, extent modified, and Level IV Ecoregion (Omernik 1987).[4] More information on the process used to digitize the maps can be found in Lemly et al. (2011).

3.2 Survey Design and Site Selection

The following paragraphs detail survey design parameters (i.e., target population, classification, sample size, sample frame, and site selection rules) used to select wetlands surveyed on the RGNF during the 2010 field season with funding from USFS. Wetlands sampled during the 2008 field season through the EPA-funded project were selected using a different survey design that is detailed in Lemly et al. (2011). Both designs were point-based, spatially balanced, random sample survey designs. The major difference is that the EPA-funded project employed a two-stage design in which target watershed were selected first and target wetland points were selected second from within the target watersheds. The original intent of the USFS-funded project was to add additional watersheds to the existing design. However, because that design was developed for the entire river basin, adding points from additional watersheds did not improve the spatial distribution of survey points across the RGNF and included many points outside the RGNF that needed to be filtered out. Therefore, a new design was developed to selected additional sites using a one-stage selection process stratified by ecoregion and confined to wetlands on the RGNF.

3.2.1 Target Population

The target population for both the EPA and USFS-funded projects was all naturally occurring and naturalized wetlands within the RGNF. The target population did not include deep water lakes or stream channels, though we report out the acreage of these features in the wetland summary. Minimum size criteria of 0.1 hectares in area and 10 m in width were also implemented. For safety reasons, we excluded wetland area with water > 1 m deep from field sampling.

The operational definition used in this project is the USFWS definition used for NWI mapping (Cowardin et al. 1979):

[4] For more information on Omernik/EPA Ecoregions and to download GIS shapefiles, visit the following website: http://www.epa.gov/wed/pages/ecoregions.htm.

"Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification wetlands must have one or more of the following attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year."

The USFWS definition is different than the definition of wetland used by the U.S. Army Corps of Engineers (ACOE) and the EPA for regulatory purposes under Section 404 of the Federal Clean Water Act (ACOE 1987):

"[Wetlands are] those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions."

The primary difference between the two definitions is that the Clean Water Act definition requires positive identification of all three wetland parameters (hydrology, vegetation, and soils) while the USFWS definition requires only one to be present. It is important to note that wetlands surveyed through this study may or may not be classified as jurisdictional wetlands under the Clean Water Act and that NWI mapped boundaries should not be interpreted as wetland delineations.

We used standard wetland identification and delineation techniques to determine inclusion in the sample population. We relied heavily on materials produced by the ACOE and the Natural Resources Conservation Service (NRCS), such as the *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (ACOE 2008) and the *Indicators of Hydric Soils in the United States* (NRCS 2010). However, we only needed positive identification of one or two parameters, not all three.

3.2.2 Subpopulations/Classification

The target population was classified into subpopulations based Ecological Systems (Table 2). Because elements within the sample frame (NWI polygons) were not attributed according to the Ecological System classification, these subpopulations were not part of the survey design *a priori.* Individual estimates of condition were calculated post hoc for subpopulations where sufficient data were collected. Sites were classified by Ecological Systems following the key in Appendix A. While Ecological Systems was the primary classification system used, each sampled wetland was also classified onsite by the HGM (Appendix B) and Cowardin systems in order to report on numbers of sites and scores by those systems as well.

Table 2. Wetland Ecological Systems found in the RGNF.

Ecological System
Rocky Mountain Alpine-Montane Wet Meadow
Rocky Mountain Subalpine-Montane Fen
Rocky Mountain Subalpine-Montane Riparian Shrubland
Rocky Mountain Subalpine-Montane Riparian Woodland
Western North American Emergent Freshwater Marsh

3.2.3 Sample Size

The number of sites targeted for sampling through the 2010 USFS-funded project was 30. However, we were not able to sample all target sites given access issues and time constraints. Over the 2010 field season, 25 wetland sites were sampled. In addition to the 52 sites sampled during the 2008 field season through the EPA-funded project, the total number of sites sampled on the RGNF was 77.

3.2.4 Sample Frame

The sample frame was based on digital polygons converted from original NWI paper maps. From the NWI dataset, we eliminated all polygons that represented unvegetated surfaces, deep water lakes, and artificial hydrologic regimes. To build the final sample frame, all area within the included NWI polygons was converted into a 10-meter grid of potential sample points. A 10-meter grid was chosen as the smallest sample unit possible under the constraints of computer processing time and file size, but ensured that even small polygons would include points. Target sample points were selected from within this grid of points and not from polygon centroids because of extreme variation in the size of individual polygons. All estimates made during analysis are for wetland area, not percent or number of individual wetlands.

3.2.5 Selection Criteria

The study employed a one-stage survey design stratified by Level IV Ecoregions. The study area contains eleven Level IV Ecoregions (Table 3). However, to reduce the number of strata, Level IV Ecoregions that occupy < 5% of the study area were combined with ecoregions at similar elevations. All subalpine ecoregions were combined (21b, 21e, 21g), all mid-elevation ecoregions were combined (21c, 21f, 21h), and all ecoregions in the foothill zone and lower were combined (21d, 22a, 22e). Target sample points were selected from each of the resulting five ecoregional strata using the Reversed Randomized Quadrant-Recursive Raster (RRQRR) approach in ArcGIS 9.3 (Theobald et al. 2007). To enforce a wider geographic distribution, the number of sample points selected per strata was proportional to the area occupied by that stratum. This forced a few more sample points in the lower elevations than would be selected with no stratification. In addition, four points were specifically selected from the Sangre de Cristo side of the Forest (Figure 2).

Table 3. Ecoregional strata and number of target sample points used in the RGNF survey design. Strata listed in order of descending elevation.

Ecoregional strata / Level IV Ecoregions	Total acres	Percent of study area	Target sample points
Alpine Zone	**342,706**	**19%**	**6**
21a: Alpine Zone	342,706	19%	-
Subalpine Forests	**1,117,783**	**61%**	**18**
21g: Volcanic Subalpine Forests	1,047,307	57%	-
21b: Crystalline Subalpine Forests	40,149	2%	-
21e: Sedimentary Subalpine Forests	30,329	2%	-

Ecoregional strata / Level IV Ecoregions	Total acres	Percent of study area	Target sample points
Mid-Elevation Forests and Shrublands	**219,419**	**12%**	**4**
21h: Volcanic Mid-Elevation Forests	209,302	11%	-
21c: Crystalline Mid-Elevation Forests	4,880	< 1%	-
21f: Sedimentary Mid-Elevation Forests	5,241	< 1%	-
Grassland Parks	**50,982**	**3%**	**1**
21j: Grassland Parks	50,982	3%	-
Foothills, Shrublands, and Sand Dunes	**104,438**	**6%**	**2**
21d: Foothill Shrublands	98,173	5%	-
22a: Shrublands and Hills	5,234	< 1%	-
22e: Sand Dunes and Sand Sheets	1,032	< 1%	-
Total	**1,835,326**	**100%**	**30**

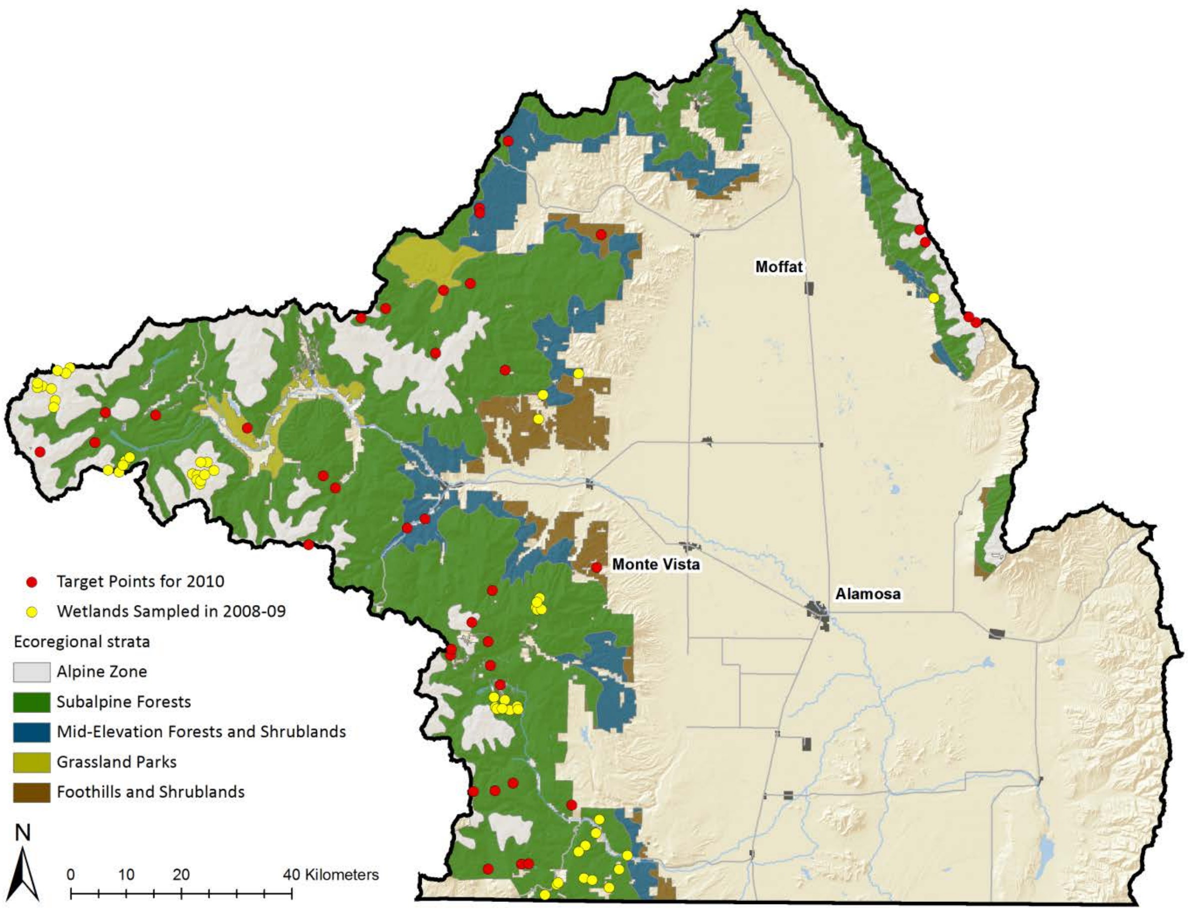

Figure 2. Target wetland sample points drawn for the RGNF. Target points shown include backup points in case highest priority points are inaccessible.

3.3 Field Methods

Field methods used in this project were based on the Ecological Integrity Assessment (EIA) framework (Faber-Langendoen et al. 2008) and Colorado-specific EIA protocols developed at CNHP (Rocchio 2006a-g; Lemly & Rocchio 2009; Lemly et al 2011; Lemly and Gilligan 2012). All wetlands sampled were assessed with the Level 2 rapid EIA field form, which takes ~2–3 hours. In 25 out of 77 sites sampled on the RGNF (19 in 2008 and 6 in 2010), vegetation data were collected with intensive Level 3 protocols based on a modification of the Flexible Plot or Carolina Vegetation Survey (CVS) method (Peet et al. 1998). The CVS plot takes up to 8 hours to carry out and provides more detailed vegetation data. For the remaining sites, vegetation data were collected with more rapid field methods. Some modifications were made to the field protocols between the 2008 field season and the 2010 field season. Details on the 2008 field protocols can be found in Lemly et. al (2011). Modifications are described below where appropriate. See Appendix C for a copy of the field form used during the 2010 field season.

3.3.1 Defining the Wetland Assessment Area (AA)

The basis of this study is the identification and establishment of an assessment area (AA) within the target wetland population. An AA is the boundary of the wetland (or portion of the wetland) targeted for sampling and analysis. Sample points were randomly selected from the sample frame within areas presumed to meet the target population. Before any sampling occurred, all points were screened in the office to remove sites that were clearly non-target. Once in the field, crews verified the target status of each point and either carried out sampling protocols or rejected the point. To accommodate slight inaccuracies within the sample frame and variable precision of GPS receivers, crews were able to shift up to 60 m from the original target point in order to establish an AA within a sampleable target wetland.

At each sample point determined to meet the target population, an AA was defined as all wetland area of the same Ecological System and HGM class in a 0.1–0.5 ha area surrounding the target point. Where possible, the AA was delineated as a 40 m radius circle around the point (0.5 ha). However, the size and shape of the AA could vary depending on site conditions. During data processing, the actual area of each AA was delineated in GIS based on GPS data and field notes in order to calculate estimates for total wetland area based on the area sampled. Prior to field visits, two field maps were made for each targeted sample point. The field maps outlined the potential AA boundary (40 m radius circle around the sample point) and a 100-m and 500-m radius envelope around the AA. During the 2008 field seasons, the AA was defined as all wetland area of the same Ecological System and HGM class within a 100 m radius of the sample point, though few sites surveyed were actually that large. The size was reduced in 2010 to be more manageable for field crews to survey.

Once at the target sample point, field crew members determined the appropriate dimensions of the AA. This determination was made by first estimating the approximate boundaries of the wetland within the potential AA. Readily observable ecological criteria such as vegetation, soil, and hydrological characteristics were used to define wetland boundaries, regardless of whether they met jurisdictional criteria for wetlands regulated under the Clean Water Act. The second step was to delineate the Ecological Systems and HGM classes present within the wetland boundary based on the keys in Appendix A and Appendix B. Because field methods vary by Ecological System, it was important to focus the assessment on one Ecological System. In most instances, the potential AA included only one

Ecological System; but in some instances, there were more than one within the area. For example, fens may occur along the margins of a valley and adjacent to riparian shrublands on the valley floor. Similarly, wet meadows with mineral soil are often interspersed with organic soil fens, depending on groundwater flow patterns. For such scenarios, it was necessary to delineate the boundaries of the separate Ecological Systems based on the minimum size criteria associated with each system. If an Ecological System patch was less than its minimum size, it was considered an inclusion within the type in which it was embedded. If the target sample point was at the edge of a wetland or at the edge of one Ecological System, field crews were able to adjust the center of the AA up to 60 m to be more squarely the within the target area.

3.3.2 Classification and Description of the AA

Once the AA was established, standard site variables were collected from each sample location. This included:

- UTM coordinates at four locations around the AA
- Elevation, slope, and aspect
- Place name, county, and land ownership
- Ecological System classification
- HGM classification
- Cowardin classification
- Vegetation zones within the AA
- Description of onsite and adjacent ecological processes and land use
- Description of general site characteristics and a site drawing
- At least four photos were taken at each site along the edge of the AA looking in towards the site (Figure 3).
- Additional photos were taken as need to document the wetland and surrounding landscape.

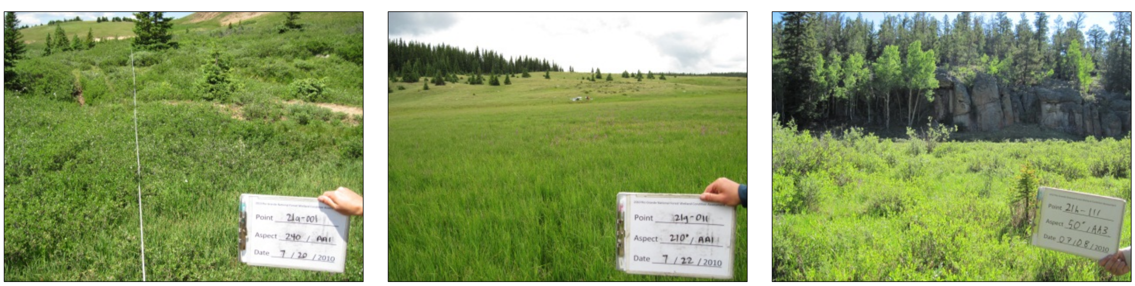

Figure 3. Example AA photos from the RGNF wetland condition assessment.

3.4.3 Ecological Integrity Assessment

For every target sample point surveyed, a Level 2 rapid EIA field form was filled out according to Ecological System and HGM Class. EIA metrics used in the RGNF study are summarized in Table 4. Metric narrative ratings and scoring formulas are included as Appendix D. Slight modifications were made to the EIA metrics between the 2008 field season and the 2010 field season. Most changes were made to clarify metrics that field crew found confusing or to add specificity were metric language had been general. The overall EIA framework, intended meaning of metrics, and general scoring formulas remains the same. Scores from both data collection efforts are comparable in general terms.

Table 4. Final EIA metrics used for the RGNF.

Ecological Categories	Key Ecological Attributes	Indicators and Metrics
Landscape Context	Buffer	• Buffer Extent • Buffer Width • Buffer Condition
	Landscape Connectivity	• Landscape Fragmentation • Riparian Corridor Continuity[1]
Biotic Condition	Community Composition	• Relative Cover Native Plant Species • Absolute Cover Noxious Weeds • Absolute Cover Aggressive Native Species • Mean C
	Community structure	• Regeneration of Native Woody Species[2] • Litter Accumulation • Structural Complexity
Hydrologic Condition	Hydrology	• Water Source • Hydrologic Connectivity • Alteration to Hydroperiod[3] • Upstream Water Retention[1] • Water Diversions / Additions[1] • Bank Stability[1] • Beaver Activity[1,4]
Physiochemical Condition	Physiochemistry	• Water Quality • Algal Growth • Substrate / Soil Disturbance

[1] Metric recorded in Riverine HGM wetlands only.
[2] Only applied to sites where woody species are naturally common.
[3] Metric recorded in Non-Riverine HGM wetlands only.
[4] Only applied to sites where beaver activity is expected.

3.3.4 Vegetation Data Collection

Level 3 Intensive Plots: If the target sample point was selected for intensive Level 3 vegetation sampling, a 20 m x 50 m reléve plot was used to collect vegetation data. The method has been in use by the North Carolina Vegetation Survey for over 10 years (Peet et al. 1998), has been used to successfully fro wetland assessment in Ohio (Mack 2004a; Mack 2004b). The structure of the plot consists of ten 10 m x 10 m (100 m^2) modules typically arranged in a 2 x 5 array (Figure 4).

The plot was subjectively placed within the AA to maximize abiotic/biotic heterogeneity. Capturing heterogeneity within the plot ensures adequate representation of local micro-variations in the floristic data produced by such things as hummocks, water tracks, side-channels, pools, wetland edge, micro-topography, etc. The following guidelines were used to determine plot locations within the AA[5]:

- The plot should be located in a representative area of the AA which incorporates as much microtopographic variation as possible.

[5] Many of the guidelines are based on (Mack 2004a; Mack 2004b).

- If the AA is homogeneous and there is no direction or orientation evident in the vegetation, the plot should be centered within the AA and laid out either N-S or E-W.
- If the AA is not homogeneous, is oddly shaped, or is directional (i.e. follows a stream), the plot should be oriented so it adequately represents the wetland features. In the case of a riparian area, this may mean along the stream bank or cutting across the stream obliquely.
- If the wetland has an irregular shape and the 20 m x 50 m plot does not "fit" within the AA, the 2 x 5 array of modules can be restructured to accommodate the shape of the AA. For example, a 1 x 5 array of 100-m^2 modules can be used for narrow, linear areas and a 2 x 2 array of 100-m^2 modules can be used for small, circular sites.
- The plot should attempt to capture the range of diversity within the AA, but should avoid crossing over into the upland. No more than 10% of the plot should be in upland areas beyond the wetland. If end modules do cross into the upland, these should not be sampled as intensive modules.
- If a small patch of another wetland type is present in the AA (but not large enough to be delineated as a separate ecological system type), the plot should be placed so that at least a portion of the patch was in the plot.
- Localized, small areas of human-induced disturbance should be included in the plot according to their relative representation of the AA.

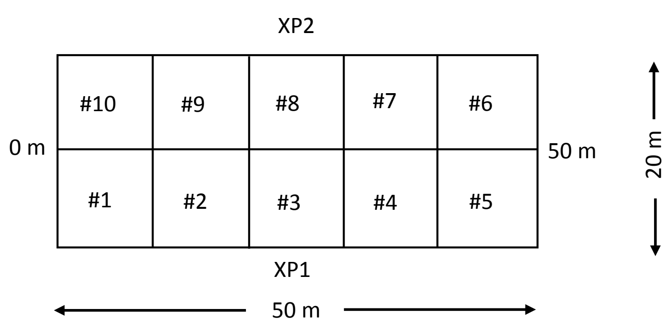

Figure 4. Schematic of the 20 m x 50 m vegetation plot with a two by five array of ten 10 m x 10 m modules. Photos and GPS waypoints taken at the 0 m and 50 m ends and at XP1 and XP2 crossplots.

Floristic measurements including presence/absence and abundance (i.e., cover) of all vascular plant species were made within four intensive modules, selected to represent the range of vegetation. Nomenclature for all plant species followed Weber and Wittman (2001a) and all species were recorded on the field form using the fully spelled out scientific name. Any unknown species were entered on the field form with a descriptive name and all unknown species were collected by the field crew. The only species not collected were those identified as or suspected to be federally or state listed species.

Once all species within a module were identified, cover was visually estimated for the module using the following cover classes (Peet et al. 1998).

1 =	trace (one or two individuals)	6 =	>10–25%
2 =	0–1%	7 =	>25–50%
3 =	>1–2%	8 =	>50–75%
4 =	>2–5%	9 =	>75–95%
5 =	>5–10%	10 =	>95%

After sampling each of the intensive modules, the remaining (i.e. residual) modules were walked through to document presence of any species not recorded in the intensive modules. Percent cover of these species was estimated over the entire 1000-m^2 plot.

Level 2 Rapid Plots: If the target sample point was not selected for Level 3 vegetation sampling, vegetation data were collected in a plotless sample design. All species present within the AA were identified and listed on the field form and the overall cover within the AA was visually estimated using the same cover classes as the VIBI plots. The search for species was limited to no more than one hour to minimize the amount of time spent at the site.

4.3.5 Soil Profile Descriptions and Groundwater Chemistry

At least two soil pits were dug within each AA with a 40-cm sharp shooter shovel. For Level 3 plots, the pits were placed in or near the vegetation plot and within vegetation types captured by the plot. For Level 2 plots, pits were located in area that represented the dominant vegetation type. Pits were dug to the depth of one shovel length (35–40 cm) and only slightly larger than the width of the shovel on all sides to minimize disturbance to the ground surface. A bucket auger was used to examine the soil deeper in the profile if needed to find hydric soil indicators. Because of difficulty digging soil pits in areas with deep standing water, if standing water was a significant part of the AA, crews concentrated on areas near the water's edge.

Following guidance in the ACOE *Regional Supplement* (ACOE 2008) and the Natural Resources Conservation Service (NRCS) *Field Indicators of Hydric Soils in the United States* (NRCS 2010), crews identified and described each distinct layer in the soil profile. For each layer, the following information was recorded: 1) color (based on a Munsell Soil Color Chart) of the matrix and any redoximorphic concentrations (mottles and oxidized root channels) and depletions; 2) soil texture; and 3) any specifics about the concentration of roots, the presence of gravel or cobble, or any usual features to the soil. Based on the characteristics, the crew identified which, if any, hydric soil indicators occur at the pit.

3.4 Data Management

To efficiently store and analyze data collected from the wetland condition assessment, EIA metrics and vegetation data were entered into a Microsoft Access™ database at the completion of the field season. For Level 3 vegetation plots, relative and mean cover values for each species were averaged across the intensive modules for use in data analysis. For those species only occurring in the residual plots, the cover value for the residual plots was used for analysis. To eliminate spelling errors, a pre-defined species list was used for species entry. During data entry, if a number in a couplet from the nested corners (presence/cover) was missing, it was assumed that the species was present in the plot and that the second value was simply overlooked. For these situations, a default cover value of 1 was entered. Unknown or ambiguous species (e.g., *Carex* sp.) were entered into the database, but not included in data analysis. Data entry was reviewed by an independent observer for quality control.

The species table from the Colorado FQA (Rocchio 2007) was used as the pre-defined species list and to populate life history traits, wetland indicator status, and C-values in the database for each species in each plot. The FQA species table was updated and modified when converted to Microsoft Access™ in 2008 and species primary nomenclature now follows Weber and Wittmann (2001a,b), though all names are cross-referenced to the nationally accepted names in the U.S. Department of Agriculture's PLANTS Database[6]. Life history traits and cover data were used to calculate FQA and VIBI metric values using Visual Basic queries programmed in the database. Calculations made by the queries were randomly checked to ensure that the queries were constructed correctly.

3.5 Data Analysis

For all sites sampled on the RGNF, vegetation data collected with either the Level 2 or Level 3 protocols were used to calculate FQA metrics (Rocchio 2007). One FQA metric (Mean C) is included in the Biotic Condition category of the EIA protocol and represents perhaps the single strongest measures of biotic wetland condition (Lemly and Rocchio 2009). For all sites sampled, FQA metrics are shown both independently and as a component of the EIA scores.

EIA metrics were used to calculate Level 2 scores and ranks for each site visited in the RGNF following scoring formulas presented in Appendix D. Scores and ranks were calculated for each major ecological category, as well as the overall Ecological Integrity score. Results are presented in tables and graphs that depict the range of scores observed in the field. To estimate overall wetland condition across the RGNF, results were summarized by ecoregion. Each ecoregion represents a different proportion of the wetland area within the RGNF. Summaries by ecoregion, paired with the proportion of wetland area they contain, illustrate the range of overall condition within the basin. Scores are also summarized by Ecological System to illustrate the range of condition by wetland type.

[6] PLANTS National Database can be accessed at the following website: http://plants.usda.gov. The National nomenclature in the Colorado FQA is based on a download from the website in January 2008.

4.0 RESULTS

4.1 Summary of Wetland Resources

The RGNF covers 1,835,326 acres in south central Colorado. Based on digital NWI mapping, there are 42,862 acres of wetlands and water bodies within the Forest, representing approximately 2% of the total land area (Figure 5; Table 5). Along with vegetated and unvegetated wetlands, NWI mapping includes deep water bodies, such as lakes and river channels, which are important aquatic resources but are not considered true wetlands. In the RGNF, lakes and rivers comprise 4,687 acres or 11% of the total NWI acres. Slightly over half (55%) of NWI mapped acres are Palustrine Emergent or freshwater herbaceous wetlands. When lakes and rivers are excluded, herbaceous wetlands make up 62% of wetland acres. Shrub wetlands are the second most common class, making up 30% of all NWI acres and 33% of wetland acres.

When broken down by hydrologic regime, saturated wetlands are the most common, comprising 73% of NWI acres and 82% of wetland acres (Table 6). This hydrologic regime represents wetlands that maintain high groundwater tables throughout the growing season and may have standing water early in the summer. Examples include as fens, alpine wet meadows, and the wettest riparian shrublands. Seasonally flooded wetlands, which are more connected to stream flow pulses and typically dry by the end of the growing season, make up 12% of NWI acres and 11% of wetland acres. Wetter hydrologic regimes of semi-permanently flooded and intermittently exposed account for few acres comparatively (1% and 4%, respectively) and are mostly ponds (Table 7). The permanently flooded regime is used primarily for lakes and rivers.

The NWI classification includes several modifiers that describe aspects of human and natural alteration. Two human-induced modifiers were mapped in the RGNF (excavated and dammed/impounded) and one natural modifier was mapped (beaver influenced). The vast majority of acres were not mapped with a modifier (88% of all NWI acres and 95% of wetland acres: Table 8). For certain wetland classes, however, there are exceptions. Within the Forest, 82% of all lakes are mapped with a dammed/impounded modifier, indicating that most lakes are reservoirs of one kind or another. Some are entirely created while others are natural lakes that have been modified to increase water holding capacity. Six percent of ponds are also mapped as dammed/impounded. These likely represent stock ponds and other modified or created small ponds. Beavers influence only 4% of all wetland acres, but 23% of ponds are mapped as beaver ponds and 6% of shrub wetlands are mapped with beaver influence.

To understand the spatial distribution of wetlands across the Forest, wetland area was summarized by ecoregion and wetland type (Figure 6; Table 9) and by ecoregion and hydrologic regime (Table 10). From these summaries, 65% of all NWI mapped acres occur in the subalpine ecoregions, which make up roughly the same proportion of the Forest's land area (61%). Another 29% of NWI acres occur in the alpine zone, which covers 19% of the Forest. Lower elevation zones represent very few wetland acres. Of the subalpine NWI acres, just over half (56%) are herbaceous wetlands, another 26% are shrub wetlands, and 12% are lakes. These proportions are roughly similar between the elevation zones, but the alpine zone has a greater proportion of shrubs and mid-elevation zones have more river acres. Herbaceous wetlands in the subalpine zones represent roughly a third of all NWI acres (36%), subalpine shrublands represent 17%, alpine herbaceous wetlands are 15%, and alpine shrublands are 11% (data not shown). No other category comprises more than 10% of NWI acres.

While the saturated hydrologic regime is the most common across all NWI acres, there is a strong relationship with elevation (Table 10). Saturated wetlands make up 88% of NWI acres in the alpine zone, 69% in the subalpine zones, 50% in the mid-elevation zones, 45% in the grassland parks, and only 25% in the foothills. As the percent of saturated wetlands drops off, seasonally flooded wetlands increase. Beaver-influenced wetlands are most common in the subalpine and mid-elevation zones, but still make up less than 5% of NWI acres in any zone. Human altered wetlands are most common in the subalpine zone, where they comprise 12% of NWI acres. These are primarily dammed lakes.

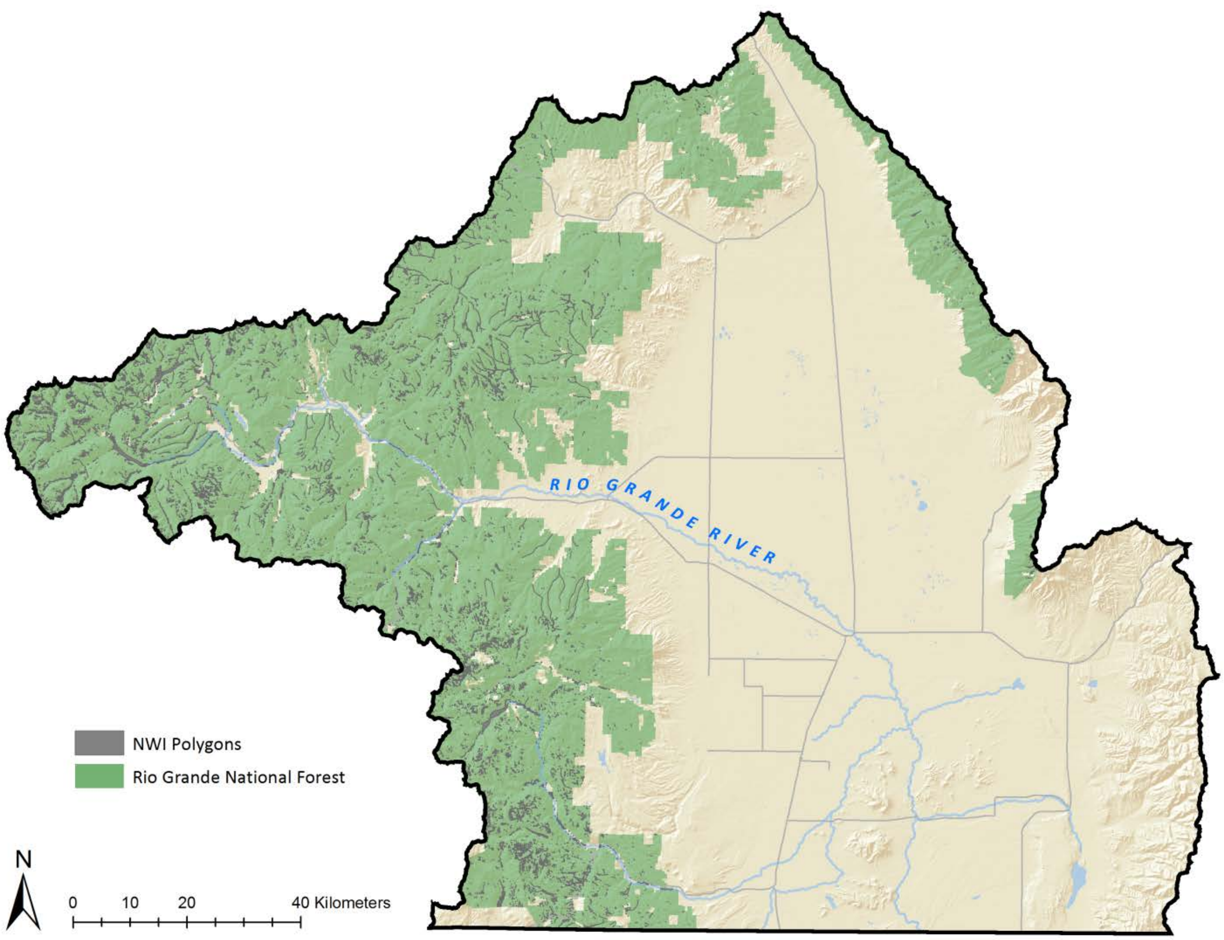

Figure 5. Digital NWI mapping in the RGNF.

Table 5. Wetland acreage in the RGNF by NWI system and class.

NWI Wetland Type	NWI Code	NWI System & Class	All NWI Acres	% Wetlands & Waterbodies	% Wetlands (excl. Lakes & Rivers)
Herbaceous Wetlands	PEM	Palustrine Emergent	23,709	55%	62%
Shrub Wetlands	PSS	Palustrine Scrub-Shrub	12,674	30%	33%
Forested Wetlands	PFO	Palustrine Forested	60	< 1%	< 1%
Ponds	PAB/UB/US	Palustrine Aquatic Bed / Unconsolidated Bottom / Unconsolidated Shore	1,731	4%	5%
Lakes	L1/2	Lacustrine	3,961	9%	NA
Rivers/Streams	R2/3/4	Riverine	726	2%	NA
Total Wetlands & Waterbodies			42,862	100%	NA
Total Wetlands (excl. Lakes & Rivers)			38,174	NA	100%

Table 6. Wetland acreage in the RGNF by NWI hydrologic regime.

NWI Code	NWI Hydrologic Regime	All NWI Acres	% Wetlands & Waterbodies	% Wetlands (excl. Lakes & Rivers)
A	Temporarily Flooded	1,026	2%	2%
B	Saturated	31,222	73%	82%
C	Seasonally Flooded	5,216	12%	11%
F	Semipermanently Flooded	219	1%	1%
G	Intermittently Exposed	1,631	4%	4%
H	Permanently Flooded	3,547	8%	< 1%
Wetlands & Waterbodies		42,862	100%	NA
Wetlands (excl. Lakes & Rivers)		38,174	NA	100%

Table 7. Wetland acreage in the RGNF by NWI wetland type and hydrologic regime.

NWI Wetland Type	All NWI Acres	NWI Acres by Hydrologic Regime					
		A	B	C	F	G	H
Herbaceous Wetlands	23,709	194	21,656	1,853	6	-	-
Shrub Wetlands	12,674	670	9,559	2,445	-	-	-
Forested Wetlands	60	36	7	18	-	-	-
Ponds	1,731	7	-	41	211	1,467	4
Lakes	3,961	8	-	701	2	164	3,085
Rivers/Streams	726	111	-	158	-	-	457
Wetlands & Waterbodies	42,862	1,026	31,222	5,216	219	1,631	3,547
Wetlands (excl. Lakes & Rivers)	38,174	907	Z1,222	4,357	217	1,467	4

Table 8. Wetland acreage in the RGNF by NWI wetland type and modifier.

NWI Wetland Type	No modifier		Excavated		Dammed / Impounded		Beaver Influenced	
	NWI Acres	% of Class	NWI Acres	% of Class	NWI Acres	% of Class	NWI Acres	% of Class
Herbaceous Wetlands	23,339	98%	8	< 1%	194	1%	164	1%
Shrub Wetlands	11,794	93%	-	-	67	1%	812	6%
Forested Wetlands	60	100%	-	-	-	-	-	-
Ponds	1,216	70%	3	< 1%	107	6%	404	23%
Lakes	726	18%	-	-	3,235	82%	-	-
Rivers/Streams	726	100%	-	-	-	-	-	-
Wetlands & Waterbodies	42,862	88%	12	< 1%	3,603	8%	1,380	3%
Wetlands (excl. Lakes & Rivers)	38,174	95%	12	< 1%	369	1%	1,308	4%

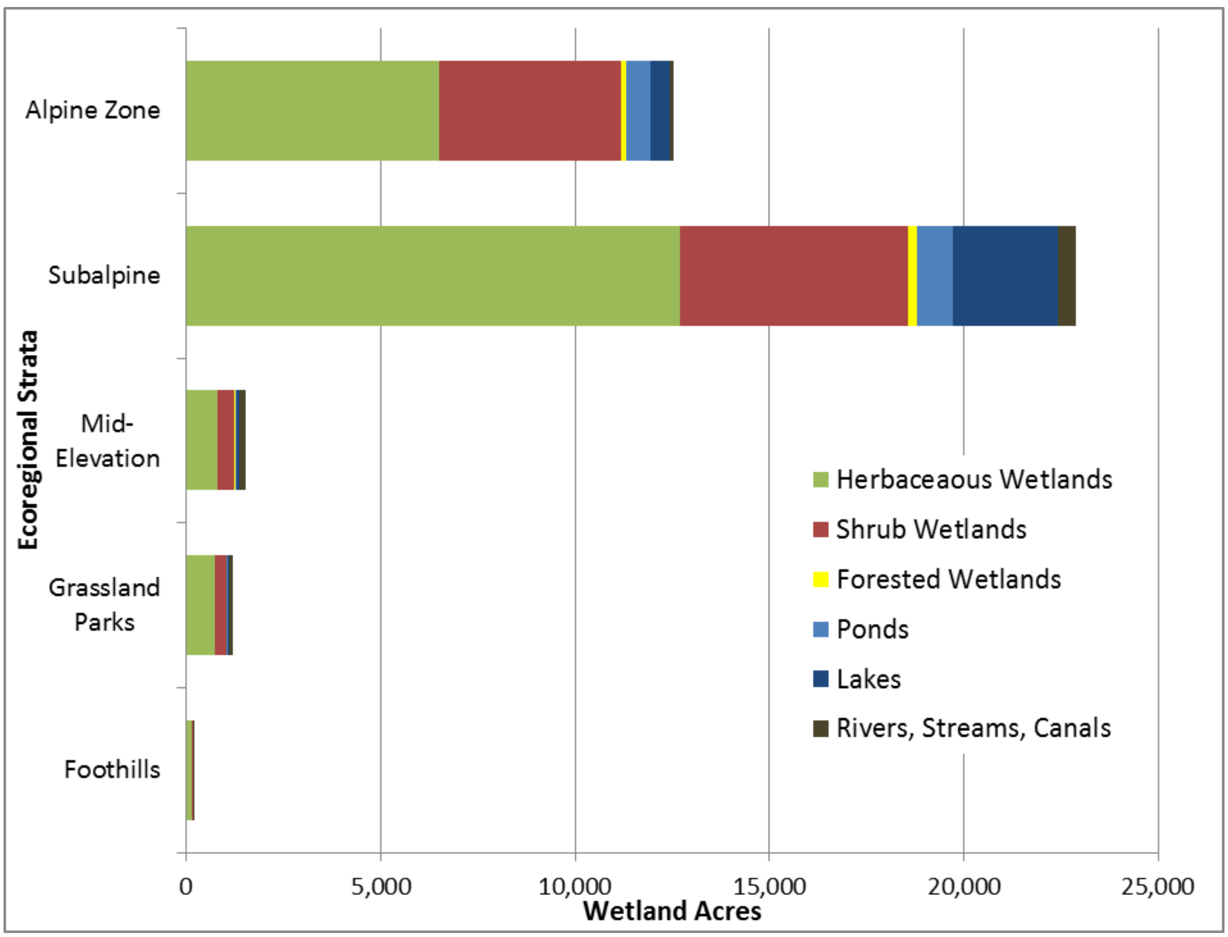

Figure 6. Wetland acreage in the RGNF by ecoregion and NWI wetland type.

Table 9. Wetland acreage in the RGNF by Level 4 Ecoregion and NWI wetland type. Ecoregions ordered by elevation and grouped by ecoregional strata used in the sample design.

Level III / IV Ecoregion	Total Land Area		Total NWI Acres		NWI Acres within each Ecoregion by NWI Wetland Type					
	Acres	%	Acres	%	Herb	Shrub	Forest	Pond	Lake	River
Alpine Zone	**342,706**	**19%**	**12,296**	**29%**	**6,531**	**4,664**	**6**	**611**	**484**	**-**
21a: Alpine Zone	342,706	19%	12,296	29%	6,531	4,664	6	611	484	-
Subalpine Forests	**1,117,783**	**61%**	**27,653**	**65%**	**15,513**	**7,245**	**40**	**1,018**	**3,343**	**495**
21g: Volc Subalpine Forests	1,047,307	57%	22,529	64%	15,432	7,236	22	1,009	3,336	495
21b: Cryst Subalpine Forests	40,149	2%	22	< 1%	17	-	-	4	-	-
21e: Sed Subalpine Forests	30,329	2%	102	< 1%	64	9	18	5	6	-
Mid-Elevation Forests and Shrublands	**219,419**	**12%**	**1,529**	**4%**	**805**	**426**	**15**	**55**	**81**	**147**
21h: Volc Mid-Elev Forests	209,302	11%	1,527	4%	804	426	15	53	81	147
21c: Cryst Mid-Elev Forests	4,880	< 1%	1	< 1%	1	-	-	-	-	-
21f: Sedi Mid-Elev Forests	5,241	< 1%	2	< 1%	-	-	-	2	-	-
Grassland Parks	**50,982**	**3%**	**1,198**	**3%**	**731**	**292**	**-**	**44**	**53**	**78**
21j: Grassland Parks	50,982	3%	1,198	3%	731	292	-	44	53	78
Foothills, Shrublands, and Sand Dunes	**104,438**	**6%**	**185**	**< 1%**	**130**	**47**	**-**	**2**	**-**	**6**
21d: Foothill Shrublands	98,173	5%	183	< 1%	129	47	-	2	-	5
22a: Shrublands and Hills	5,234	< 1%	2	< 1%	1	-	-	-	-	1
22e: Sand Dunes and Sand Sheets	1,032	< 1%	-	-	-	-	-	-	-	-
Total	**1,835,326**	**100%**	**42,862**	**100%**	**23,709**	**12,674**	**60**	**1,731**	**3,961**	**726**

Table 10. Wetland acreage in the RGNF by Level 4 Ecoregion and NWI hydrologic regime and modifiers. "Human altered" includes both dammed/impounded and excavated.

Level III / IV Ecoregion	Total NWI Acres	NWI Acres within each Ecoregion by Hydrologic Regime						Percent Beaver Altered	Percent Human Altered
		A: Temp Flooded	B: Saturated	C: Season-ally Flooded	F: Semi-permanent Flooded	G: Inter-mittently Exposed	H: Perm Flooded		
Alpine Zone	**12,296**	**81**	**10,793**	**355**	**119**	**481**	**467**	**< 1%**	**< 1%**
21a: Alpine Zone	12,296	81	10,793	355	119	481	467	< 1%	< 1%
Subalpine Forests	**27,653**	**776**	**19,086**	**3,878**	**81**	**1,072**	**2,759**	**2%**	**12%**
21g: Volc Subalpine Forests	22,529	775	19,043	3,814	78	1,066	2,753	2%	12%
21b: Cryst Subalpine Forests	22	-	17	-	-	4	-	11%	-
21e: Sed Subalpine Forests	102	1	26	64	3	2	6	4%	-
Mid-Elevation Forests and Shrublands	**1,529**	**50**	**761**	**471**	**14**	**42**	**191**	**4%**	**6%**
21h: Volc Mid-Elev Forests	1,527	50	760	471	14	41	191	4%	6%
21c: Cryst Mid-Elev Forests	1	-	1	-	-	-	-	-	-
21f: Sedi Mid-Elev Forests	2	-	-	-	-	2	-	100%	-
Grassland Parks	**1,198**	**114**	**536**	**382**	**4**	**35**	**127**	**1%**	**7%**
21j: Grassland Parks	1,198	114	536	382	4	35	127	1%	8%
Foothills, Shrublands, and Sand Dunes	**185**	**5**	**46**	**131**	**-**	**1**	**1**	**1%**	**3%**
21d: Foothill Shrublands	183	4	46	130	-	1	1	1%	31%
22a: Shrublands and Hills	2	1	-	1	-	-	-	-	-
22e: Sand Dunes and Sand Sheets	-	-	-	-	-	-	-	-	-
Total	**42,862**	**1,026**	**31,222**	**5,216**	**219**	**1,631**	**3,547**	**3%**	**8%**

4.2 Sampled Wetlands

In total, 77 wetland sites were surveyed across the RGNF. This includes 52 sites sampled in 2008 through the EPA-funded project and 25 additional sites sampled in 2012 with funding from the USFS (Figure 7; Appendix E). Sites sampled in 2008 were primarily located in the alpine and subalpine zones, though three were in the foothills zone (Table 11). The revised survey design used in 2010 added sites in the mid-elevation zone and grassland parks. In total, the spread of points across the ecoregions was very similar to the distribution of wetland acres across ecoregions. In addition to broadening the elevation range of sampled points, the 2010 surveys also included a range of management units within the RGNF, including the Weminuche, Sangre de Cristo, South San Juan, and La Garita Wilderness Areas (Table 12).

Sampled wetlands represented a range of Ecological Systems, referred to as systems throughout this text. Riparian shrublands were the most common system encountered with 30 sites and making up 39% of all sites surveyed (Table 13; Figure 8). Riparian shrublands were broadly distributed from the alpine to the foothills zone, but most were found in the subalpine zones. Riparian shrublands were generally willow *(Salix)* dominated, but species composition varied by elevation. High elevation shrublands were dominated by short willows, such as planeleaf willow *(Salix planifolia)* and Wolf's willow *(Salix wolfii),* and were often fed by snowmelt and groundwater discharge. Lower elevation shrublands were more directly connected to stream flows and overbank flooding and contained taller shrubs, such as Geyer's willow *(Salix geyeriana),* mountain willow *(Salix monticola),* and mountain alder *(Aluns incana* ssp*. tenuifolia).*

Wet meadows were the second most common system with 27 sites surveyed. These wetlands were also distributed between elevation zones. Higher elevation meadows were more commonly dominated by a mix of sedge, grass, and forb species, including water sedge *(Carex aquatilis),* Rocky Mountain sedge (*Carex scopulorum),* beaked sedge *(Carex utriculata),* tufted hairgrass *(Deschampsia cespitosa),* bluejoint grass *(Calamagrostis canadensis),* and marsh marigold *(Psychrophila leptosepala)*. Wet meadows at lower elevations were most often dominated by arctic rush *(Juncus arcticus* ssp. *ater* [syn. *Juncus balticus*]).

Seventeen fens were surveyed, of which 13 were found in the subalpine zones. Common dominant species include water sedge, beaked sedge, few-flowered spikerush *(Eleocharis quinqueflora)* and planeleaf willow. Two riparian woodlands were surveyed. One was located on a hillside groundwater seep and contained an open canopy of Engelmann spruce *(Picea engelmannii)* over lush herbs. The other was located along the South Fork of the Rio Grande River and with a mixed canopy of narrowleaf cottonwood *(Populus angustifolia)* and Engelmann spruce. One marsh was surveyed and it was dominated by pale spikerush *(Eleocharis macrostachya).*

Along with the primary Ecological System classification, surveyed wetlands were also classified by the Hydrogeomorphic (HGM) system in the field. Though some terminology overlaps between the HGM and NWI classification systems (e.g. the words riverine and lacustrine are used in both systems), the meanings are different. As noted in previously, riverine acres mapped by NWI represent actual rivers and streams and lacustrine acres represent actual lakes. In the HGM classification system, riverine wetlands are those wetlands influenced by rivers and streams, but not the rivers and streams themselves. The same is true for lacustrine wetlands in the HGM classification system. This HGM class represents wetlands on lake margins that are influenced by the rise and fall of lake waters. In the RGNF, slope and riverine HGM classes were the most common, with 58% and 31% of sites, respectively (Table 14). These wetlands were present across the range of elevation and ecoregions, but slope wetlands were far more common that riverine wetlands in the alpine zone, where they often form the headwaters of small streams. A handful of depressional wetlands were surveyed, but no lacustrine fringe wetlands were observed.

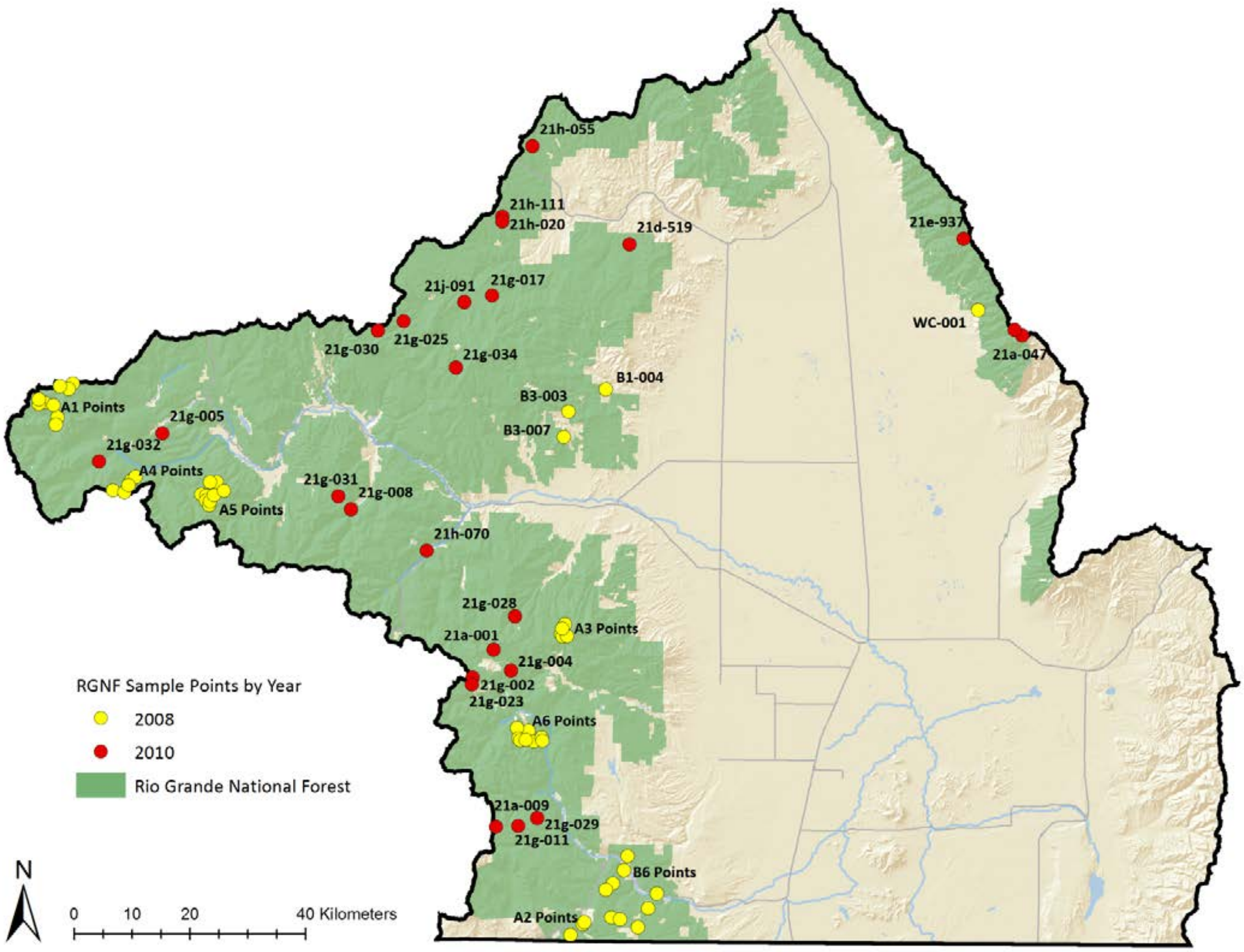

Figure 7. Randomly selected wetlands sampled in the RGNF.

Table 11. Sampled wetlands by ecoregional strata and year.

Ecoregional Strata	2008	2010	Total	% of Sites
Alpine Zone	18	4	22	29%
Subalpine	31	15	46	60%
Mid-Elevation	-	4	4	5%
Grassland Parks	-	1	1	1%
Foothills	3	1	4	5%
Total	52	25	77	100%
% of Sites	68%	325	100%	

Table 12. Sampled wetlands by RGNF management unit and year.

Management Unit	2008	2010	Total	% of Sites
Rio Grande National Forest	39	15	54	70%
Weminuche Wilderness Area	13	3	16	21%
Sangre de Cristo Wilderness Area	-	3	3	4%
South San Juan Wilderness Area	-	3	3	4%
La Garita Wilderness Area	-	1	1	1%
Total	52	25	77	100%
% of Sites	68%	32%	100%	

Table 13. Sampled wetlands by ecoregional strata and Ecological System.

Ecoregional Strata	Riparian Shrublands	Wet meadows	Fens	Riparian Woodlands	Freshwater Marshes	Total
Alpine Zone	8	11	3			22
Subalpine	20	11	13	1	1	46
Mid-Elevation		2	1	1		4
Grassland Parks	1					1
Foothills	1	3				4
Total	30	27	17	2	1	77
% of Sites	39%	35%	22%	3%	1%	100%

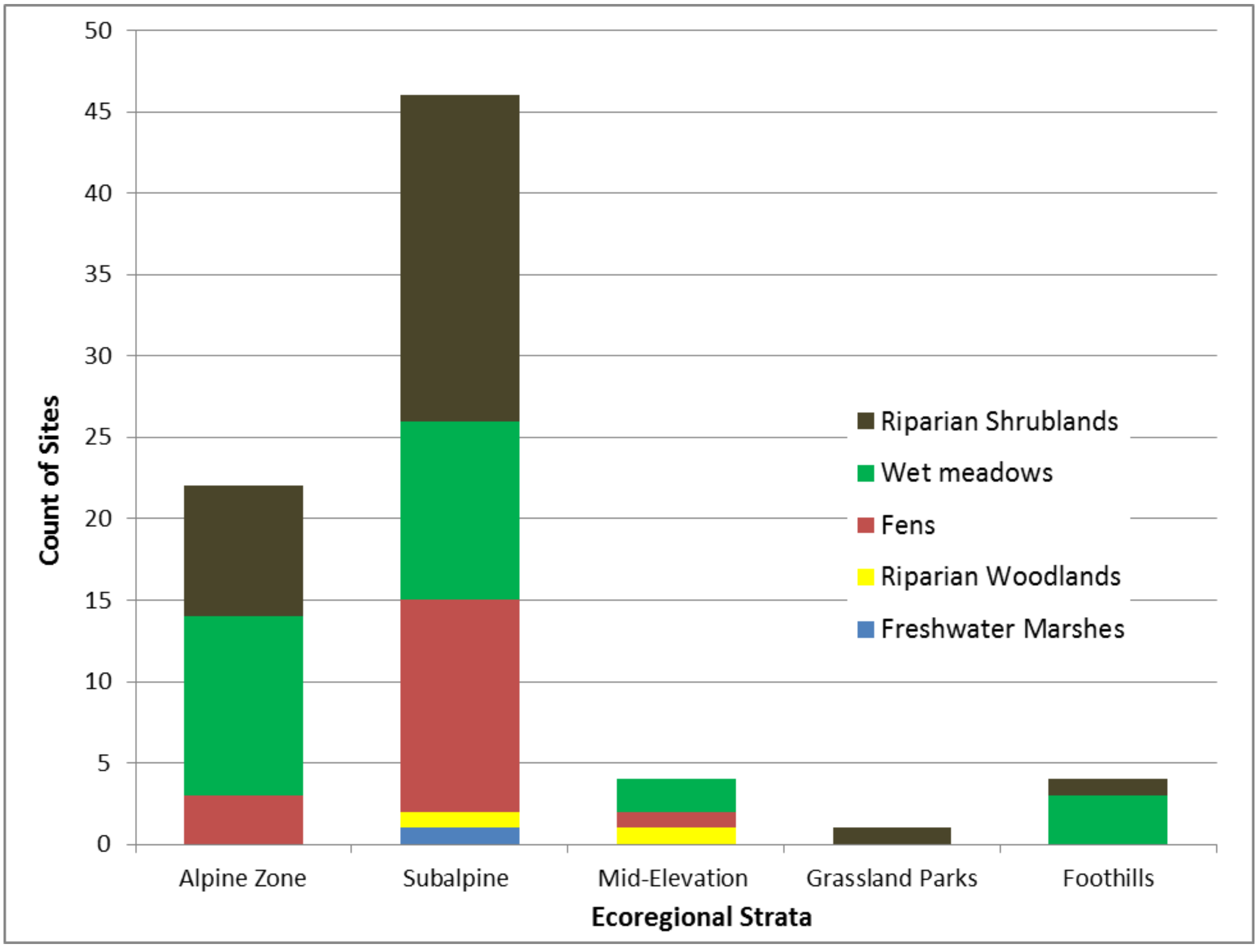

Figure 8. Sampled wetlands by ecoregional strata and Ecological System.

Table 14. Sampled wetlands by ecoregional strata and HGM class.

Ecoregional Strata	Slope	Riverine	Depressional	Total
Alpine Zone	19	2	1	22
Subalpine	21	19	6	46
Mid-Elevation	2	1	1	4
Grassland Parks		1		1
Foothills	3	1		4
Total	45	24	8	77
% of Sites	58%	31%	10%	100%

4.3 Characterization of Wetland Vegetation

Within surveyed wetlands, both species and community diversity was high. In total, 494 individual plant taxa were encountered in the 77 sites. This number includes 49 taxa identified only to the genus or family level because they were found either early or late in the season and lacked the floristic parts necessary for identification. Discounting those taxa, 445 species were identified to species level, which represents ~14% of the entire Colorado flora. Of the 612 total taxa, 180 were only encountered once and another 65 were only encountered twice. The high percentage of species found only once or twice indicates the high diversity found in wetlands across the RGNF, and it is likely that more species would be found with additional surveys. The average number of species per site was 39, but this ranged from 5 to 100 species per site. Sedges (*Carex* spp.) were the most diverse genus found in the survey, with 42 individual species. Willows (*Salix* spp.) and bluegrass (*Poa* spp.) were also diverse, with 15 individual species each. Of the 445 species identified to species level, 420 (94%) were native species and 25 were non-native species. Noxious weeds, an aggressive subset of non-natives, were present in only four plots.[7] Three of those four contained Canada thistle (*Breea arvensis* [syn. *Cirsium arvense*]) and one contained common mullein (*Verbascum thapsus*). Aggressive native species (e.g. cattails: *Typha latifolia),* which can dominate sites with excess nutrients, were not a problem in any site surveyed in the RGNF.

The most common species encountered across all sites was tufted hairgrass *(Deschampsia cespitosa),* a facultative wet (FACW) species that can inhabit many wetland types from wet meadows to riparian shrublands to fens. This species occurred in 65 out of 77 sites (Table 15). Out of the top twenty species, only common dandelion *(Taraxacum officinale)* is non-native. This ubiquitous plant was found everywhere from disturbed lands to nearly pristine mountain meadows. It is highly adapted to spread widely, but is not considered a noxious weed. Ten of the top twenty species have high C-values of 7 or 8, indicating a high affinity for natural, undisturbed areas. All but two of the top twenty are facultative to obligate wetland species. The remaining two species (common dandelion and western yarrow) are widespread in wetlands as well as uplands. Patterns in species distribution were seen by ecoregion (Table 16). Though some species were found across the RGNF, many species common in the higher elevation zones were not common at lower elevations.

[7] For the purpose of this project, noxious weeds were defined based on the Colorado Department of Agriculture's Noxious Weed list from 2008. For more information, see: http://www.colorado.gov/cs/Satellite/Agriculture-Main/CDAG/1174084048733.

Table 15. Twenty most common plant species encountered in RGNF wetlands.

Scientific Name	Common Name	Occurrences	Rank	Wetland Indicator Status[1]	Native Status	C-Value[2]
Deschampsia cespitosa	tufted hairgrass	65	1	FACW	Native	4
Carex aquatilis	water sedge	58	2	OBL	Native	6
Taraxacum officinale	common dandelion	58	2	FACU	Non-native	0
Phleum commutatum	alpine timothy	54	4	FAC	Native	6
Achillea lanulosa	western yarrow	51	5	FACU	Native	4
Psychrophila leptosepala	white marsh marigold	51	5	OBL	Native	7
Pedicularis groenlandica	elephanthead lousewort	46	7	OBL	Native	8
Veronica nutans	American alpine speedwell	44	8	FAC	Native	7
Salix planifolia	planeleaf willow	43	9	OBL	Native	7
Carex utriculata	Northwest Territory sedge	40	10	OBL	Native	5
Cardamine cordifolia	heartleaf bittercress	38	11	FACW	Native	8
Geum macrophyllum	largeleaf avens	38	11	OBL	Native	6
Clementsia rhodantha	redpod stonecrop	37	13	FACW	Native	8
Bistorta vivipara	alpine bistort	35	14	FAC	Native	8
Bistorta bistortoides	American bistort	35	14	FAC	Native	7
Pentaphylloides floribunda	shrubby cinquefoil	32	16	FACW	Native	4
Juncus arcticus ssp. ater	mountain rush	32	16	FACW	Native	4
Mertensia ciliata	tall fringed bluebells	31	18	OBL	Native	7
Calamagrostis canadensis	bluejoint	30	19	OBL	Native	6
Conioselinum scopulorum	Rocky Mountain hemlockparsley	29	20	FACW	Native	7

[1] Wetland Indicator Status based on the USFWS 1996 list (USFWS 1996). OBL = obligate wetland species, found in wetlands 99% of the time; FACW = facultative wetland species, found in wetlands 67–99% of the time; FAC = facultative species, found in wetlands 34–66% of the time; FACU = facultative upland species, found in uplands 67–99% of the time; UPL = obligate upland species, found in uplands 99% of the time.

[2] C-values are from the Floristic Quality Assessment for Colorado (Rocchio 2007).

Table 16. Ten most common plant species encountered in RGNF wetlands by ecoregion.

Rank	Ecoregional Strata[1]			
	Alpine Zone	Subalpine	Mid-Elevation	Foothills
1	*Phleum commutatum*	*Carex aquatilis*	*Achillea lanulosa*	*Achillea lanulosa*
2	*Deschampsia cespitosa*	*Deschampsia cespitosa*	*Taraxacum officinale*	*Juncus arcticus* ssp. *ater*
3	*Psychrophila leptosepala*	*Carex utriculata*	*Aster lanceolatus* ssp. *hesperius*	*Taraxacum officinale*
4	*Salix planifolia*	*Taraxacum officinale*	*Calamagrostis canadensis*	*Allium geyeri*
5	*Veronica nutans*	*Achillea lanulosa*	*Carex aquatilis*	*Iris missouriensis*
6	*Bistorta bistortoides*	*Phleum commutatum*	*Critesion brachyantherum*	*Orthocarpus luteus*
7	*Bistorta vivipara*	*Psychrophila leptosepala*	*Deschampsia cespitosa*	*Pentaphylloides floribunda*
8	*Pedicularis groenlandica*	*Pedicularis groenlandica*	*Poa pratensis*	Numerous species tied with two occurrences
9	*Clementsia rhodantha*	*Geum macrophyllum* var. *perincisum*	Numerous species tied with two occurrences	
10	*Juncus drummondii*	*Pentaphylloides floribunda*		

[1] Grassland Parks not shown because only one site was sampled.

4.4 Floristic Quality Assessment

Vegetation surveys were conducted in all sampled wetlands, though the intensity of the protocols varied between Level 2 and Level 3 sites. Regardless of data collection intensity, FQA metrics (Rocchio 2007) were calculated for all 77 sites. From past experience testing differences between FQA metrics collected using Level 2 and Level 3 protocols, we know that metrics related to relative cover or abundance (percent-based metrics) are very similar between the two protocols, while absolute species richness is generally lower with the less intensive plot methods (Lemly and Rocchio 2009). Given this experience, we felt confident that Mean C values were comparable across sites, regardless of sampling protocols.

The overall average Mean C score was 6.07. Mean C values for sampled sites ranged from 3.65–7.50, with a very slight bimodal distribution (Figure 9). The range of Mean C scores varied by both ecoregional strata (Figure 10) and Ecological System (Figure 11). On the whole, Mean C values for the RGNF wetlands were relatively high compared to sites sampled through other projects at lower elevations and under different land ownership (Lemly et al. 2011; Lemly & Gilligan 2012).

The average of Mean C scores was highest for the alpine zone and lowest for the foothills strata (Figure 10). However, the subalpine and mid-elevation zones both showed high variability. This trend in Mean C scores over elevation is not surprising, as human influence is greater at lower elevations than in the alpine zone. Similarly, fen wetlands, which are characteristic of higher elevations, had the highest average Mean C values (Figure 11). However, riparian shrublands and wet meadows also had some very high Mean C values along with some lower values. The one marsh sampled had a lower Mean C than the overall average, which was consistent with Mean C's of marshes sampled in the other studies (Lemly et al. 2011; Lemly & Gilligan 2012).

While Mean C is a strong single measure of wetland condition, it must be viewed in light of the potential Mean C of a particular wetland type (Rocchio 2007). Even in a reference state, each wetland type is characterized by a different hydrologic and natural disturbance regime. Fens have very stable groundwater fed hydrology and experience relatively little natural disturbance. This leads to a typical suite of species with higher C-values. Marshes and saline wetlands naturally experience higher fluctuations in water levels both within and between years. This higher level of natural disturbance leads to a typical suite of species with lower C-values. For this reason, when incorporated into the biotic score of the EIA methodology (see below for results and Appendix D for scoring thresholds), each wetland type is score on a different range of Mean C values.

In addition to Mean C, the FQA methodology includes a number of different metrics that can be evaluated to gauge biotic condition. Table 17 shows means and standard deviations for each FQA metric by Ecological System group. The additional metrics vary by their inclusion or exclusion of non-native species, the use of cover–weighting to emphasize dominant species, and incorporation of species richness into the equation.

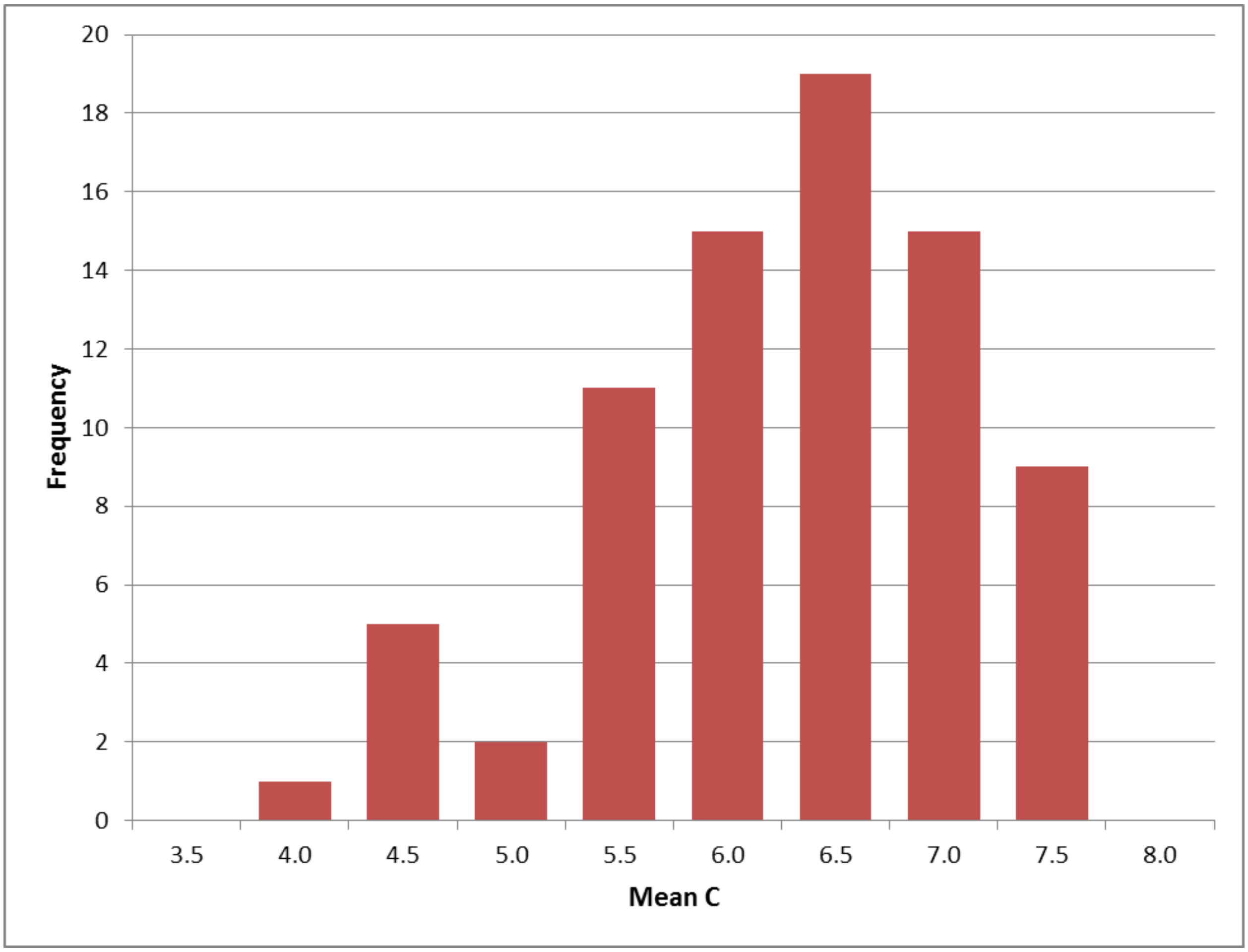

Figure 9. Frequency of Mean C values for all sampled wetlands. Number under each bar represents the upper bound of the bin.

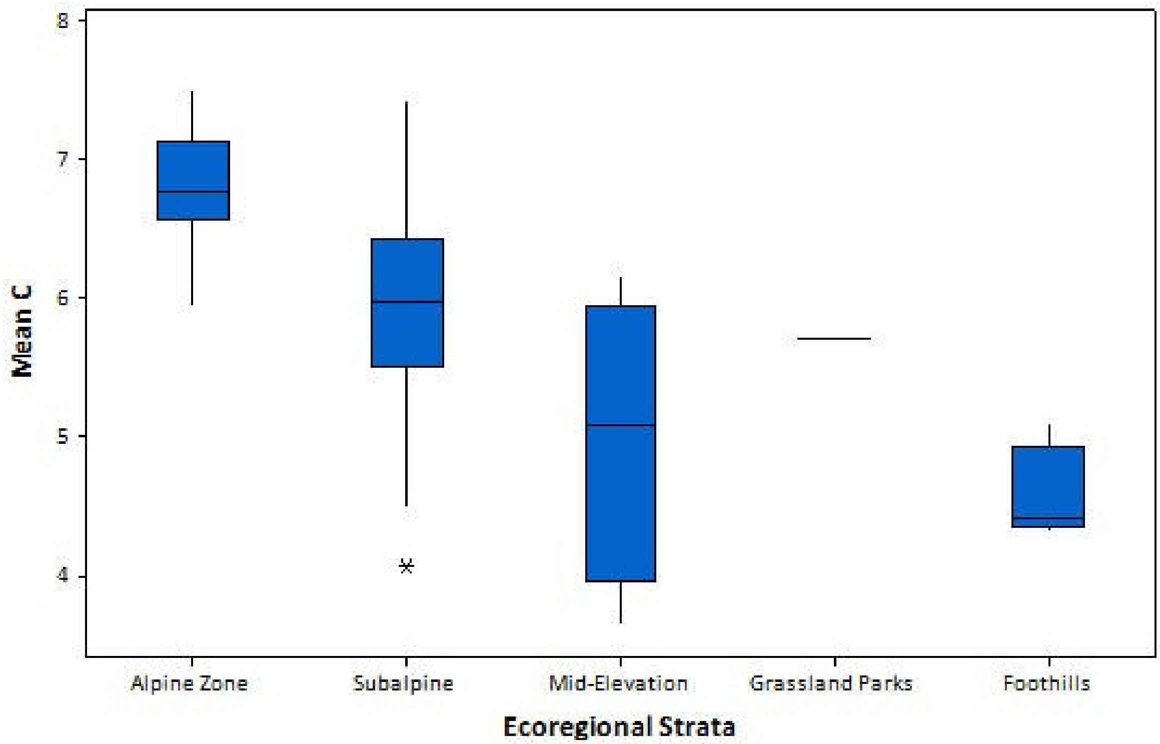

Figure 10. Range of Mean C scores by ecoregional strata. Boxes represent 75th percentile to 25th percentile. Horizontal line represents the median. Whiskers extend to 95th and 5th percentiles and stars are outliers.

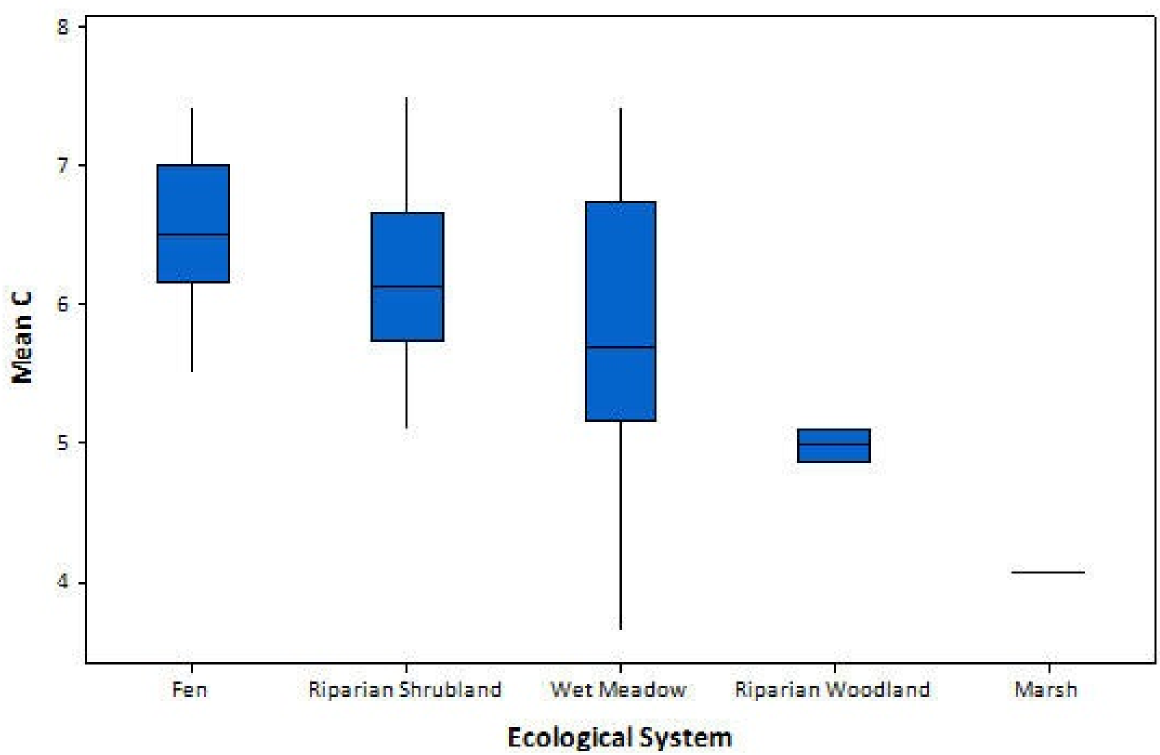

Figure 11. Range of Mean C scores by Ecological System. Boxes represent 75th percentile to 25th percentile. Horizontal line represents the median. Whiskers extend to 95th and 5th percentiles.

Table 17. Means and standard deviations of all FQA metrics by Ecological System.

FQA Indices	Riparian Shrublands *n* = 30		Wet Meadows *n* = 27		Fens *n* = 17		Riparian Woodlands *n* = 2		Freshwater Marshes *n* = 1
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Value SD=n/a
Total species richness	49	17	34	10	29	14	56	62	16
Native species richness	45	15	31	10	27	13	43	48	12
Non-native species richness	2	1	2	2	1	1	6	7	3
% Non-native	4.0%	2.5%	7.0%	5.7%	1.6%	1.9%	11.3%	1.8%	20.0%
Mean C of all species	6.2	0.6	5.8	1.0	6.6	0.5	5.0	0.2	4.1
Mean C of native species	6.4	0.5	6.2	0.8	6.7	0.5	5.6	0.1	5.2
Cover-weighted Mean C of all species	6.4	0.9	5.5	1.2	6.6	0.7	5.1	0.7	3.6
Cover-weighted Mean C of native species	6.5	0.9	5.9	1.0	6.6	0.7	5.6	0.8	3.9
FQI of all species	41.1	7.6	31.9	8.1	33.1	9.2	30.5	20.3	15.2
FQI of native species	42.0	7.6	33.0	7.7	33.4	9.4	32.6	22.0	17.2
Cover-weighted FQI of all species	42.8	9.8	30.1	8.0	33.3	9.7	33.4	26.6	13.3
Cover-weighted FQI of native species	42.5	9.8	31.7	8.3	33.2	9.9	34.0	26.8	13.0
Adjusted FQI	63.1	5.1	59.9	9.0	66.3	5.2	53.0	1.1	45.9
Cover-weighted adjusted FQI	63.5	8.9	57.3	10.5	65.7	6.9	52.4	7.1	34.7

4.5 Ecological Integrity Assessment

Level 2 condition scores were calculated based on the EIA framework for all 77 wetlands sampled in the RGNF. Across all sites, scores ranged from 3.22–4.96 out of a possible range of 1.00–5.00. For ease of discussion, EIA scores are translated into a 4-tiered ranking system of A, B, C, and D based on the scoring thresholds outlined in Appendix D. These ranks can be interpreted as:

- A = Reference (no or minimal human impact)
- B = Slight deviation from reference
- C = Moderate deviation from reference
- D = Significant or severe deviation from reference

Within the RGNF, EIA ranks never reached the worst class of D, where wetland conditions and their associated functions are considered significantly compromised and unlikely to be restorable. Of the 77 wetlands surveyed, 41 were A-ranked, 32 were B-ranked, and only 4 were C-ranked. Trends among the ranks were evident between both ecoregion (Table 15; Figure 12) and Ecological System (Table 19; Figure 13). A-ranked sites were observed primarily in the alpine and subalpine zones. In fact, all alpine wetlands were A-ranked. Lower elevations were more likely to receive B ranks. Among Ecological Systems, riparian shrublands, wet meadows and fens mostly received A and B ranks. Riparian woodlands and the marsh had slightly lower ranks.

To explore drivers of the overall EIA scores, it is important to look at the component ranks of landscape context, biotic condition, hydrologic condition, and physiochemical condition (Table 20). In the case of landscape context, biotic condition and hydrologic condition, there are more sites with A ranks in the individual category (47, 46, 50, respectively) than A ranks in the overall score (41). This indicates that most sites were high in some categories even if low in others. Few sites had low scores across the board.

Landscape context ranks for most wetland types were spread between A and B ranks, along with five C ranks and one D rank. High landscape context ranks indicate wide buffers around wetlands and unfragmented landscapes. Lower ranks indicate narrow buffers, buffers dominated by non-native species, fragmentation due to roads, or heavy human land use in the watershed (logging, historic mining, recreation). Biotic condition was generally high, with most wetland types receiving A and B ranks. Besides the one marsh, wet meadows were the only type that received C and D ranks for biotic condition. Hydrologic condition was also generally good, with most sites scoring A or B ranks. The seven sites with C-ranked hydrology were impacted by a range of issues, such as culverts, small diversions, upstream dams, and grazing that channelized water flow. On the whole, physiochemical ranks had the least A-ranks, indicating some negative alterations to soil integrity and water quality were evident in many sites, most often from cattle grazing, but these were not severe.

Scores for individual sites are presented in Appendix F. Tabular data, GIS shapefiles, and photos for all sites have been submitted to RGNF along with this report.

Table 18. EIA ranks by ecoregional strata.

Ecoregional Strata	A	B	C	D	Total
Alpine Zone	22	-	-	-	22
Subalpine	18	25	3	-	46
Mid-Elevation	1	2	1	-	4
Grassland Parks	-	1	-	-	1
Foothills	-	4	-	-	4
Total	41	32	4	-	95
% of Sites	53%	42%	5%	-	100%

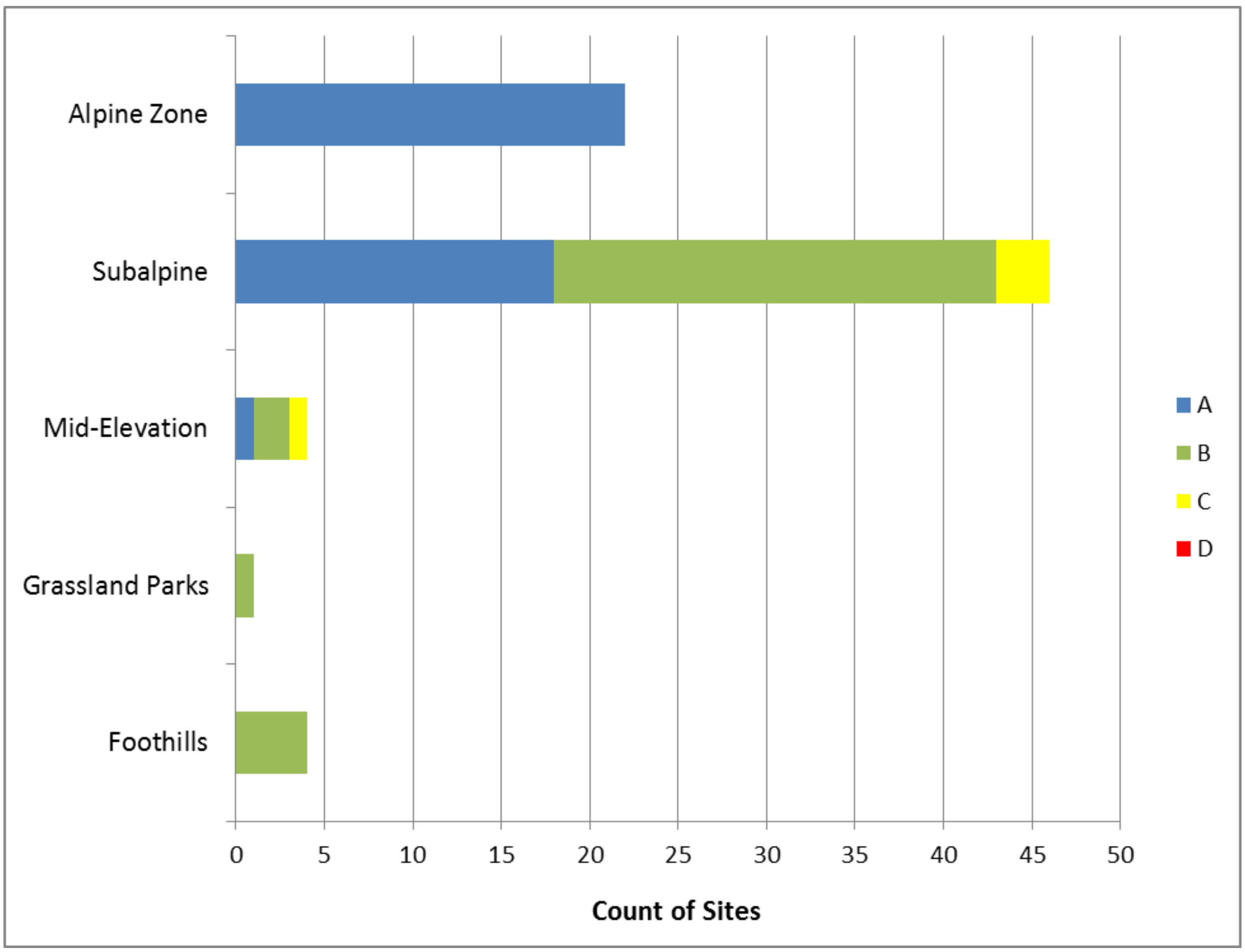

Figure 12. EIA ranks by ecoregional strata.

Table 19. EIA ranks by Ecological Systems.

Ecological System	A	B	C	D	Total
Riparian Shrublands	19	11	-	-	30
Wet Meadows	12	13	2	-	27
Fens	10	7	-	-	17
Riparian Woodlands	-	1	1	-	2
Freshwater Marshes	-	-	1	-	1
Total	41	32	4	-	95
% of Sites	53%	42%	5%	-	100%

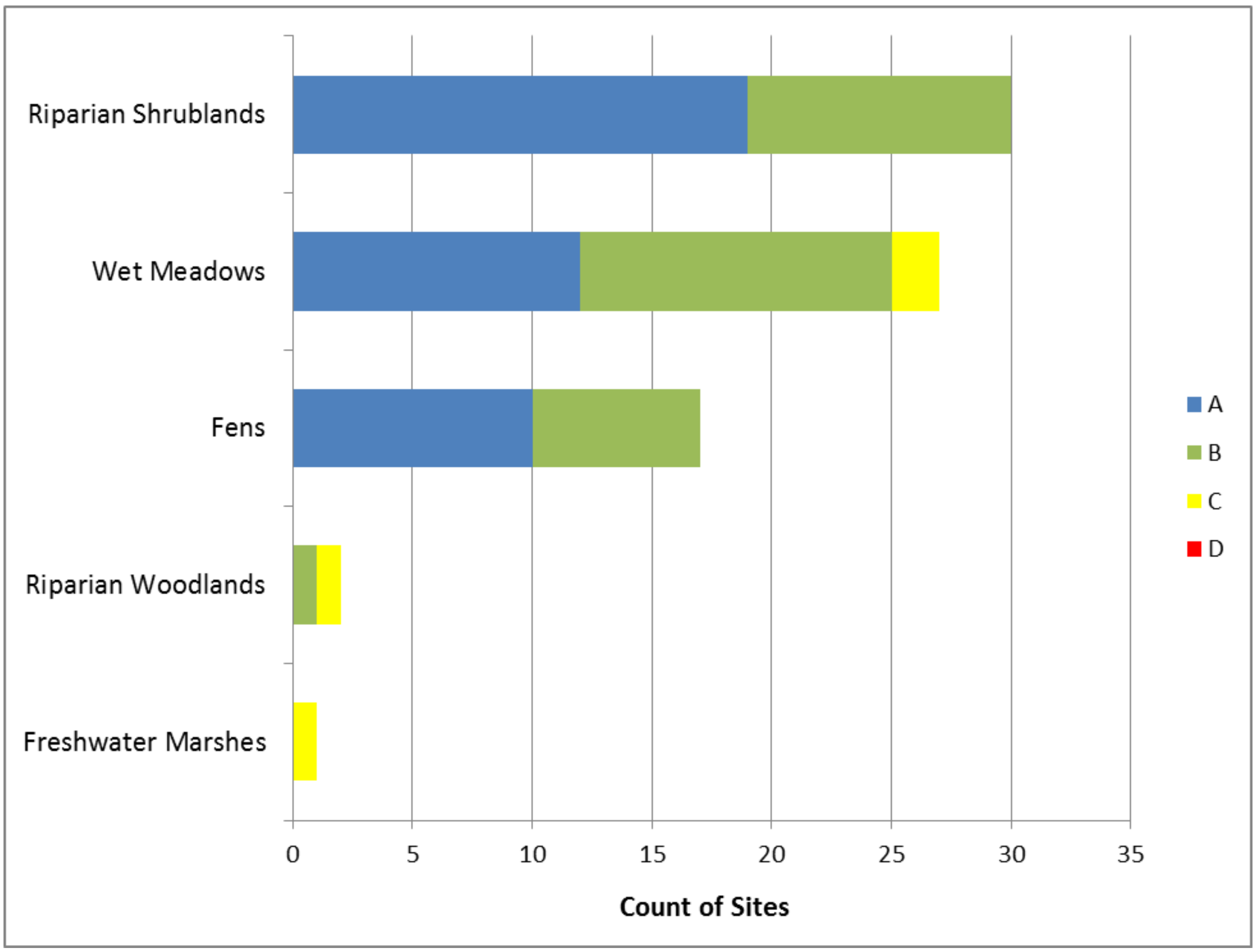

Figure 13. EIA ranks by Ecological Systems.

Table 20. Component EIA ranks by Ecological Systems.

	A	B	C	D	Total
Landscape Context Rank					
Riparian Shrublands	23	5	1	1	30
Wet Meadows	14	12	1	-	27
Fens	10	6	1	-	17
Riparian Woodlands	-	1	1	-	2
Freshwater Marshes	-	-	1	-	1
Total	**47**	**24**	**5**	**1**	**77**
Biotic Condition Rank					
Riparian Shrublands	22	8	-	-	30
Wet Meadows	11	8	7	1	27
Fens	13	4	-	-	17
Riparian Woodlands	-	2	-	-	2
Freshwater Marshes	-	-	1	-	1
Total	**46**	**22**	**8**	**1**	**77**
Hydrologic Condition Rank					
Riparian Shrublands	21	8	1	-	30
Wet Meadows	17	7	3	-	27
Fens	12	4	1	-	17
Riparian Woodlands	-	-	2	-	2
Freshwater Marshes	-	1	-	-	1
Total	**50**	**20**	**7**	**-**	**77**
Physiochemical Condition Rank					
Riparian Shrublands	18	9	3	-	30
Wet Meadows	9	16	2	-	27
Fens	6	11	-	-	17
Riparian Woodlands	1	1	-	-	2
Freshwater Marshes	1	-	-	-	1
Total	**35**	**37**	**5**	**-**	**77**

5.0 DISCUSSION

Colorado's wetlands and riparian areas are vital components of the landscape due to the functions and services they provide in an otherwise arid landscape. On the RGNF, these ecosystems have been impacted by past and current human land use, including hydrologic modifications, mining, logging, grazing, and recreation. In order to adequate manage and protect wetland resources on the RGNF, the USFS needs reliable data on their location, extent and condition.

5.1 Wetland Resources on the RGNF

Prior to this and the companion EPA-funded project, it was difficult to systematically estimate the extent of wetland acreage across the RGNF. Two previous mapping products provided coarse estimates of wetland acres, but both had limitations. The general vegetation map produced by the USFS (R2 Veg geodatabase)[8] delineates existing homogeneous units of vegetation of five or more acres (two or more acres of wetlands and riparian area). Within this geodatabase, vegetation structure, lifeform and dominant species information are described for each polygon at a level necessary for large-scale forest planning. Polygons flagged as wetlands and riparian areas can be extracted from these data, but they often include non-wetland area, do not use a wetland-specific classification system, and do not contain information on hydrologic regimes. Similarly, riparian mapping produced in the 1990s by Colorado Parks and Wildlife[9] (then Colorado Division of Wildlife), which covers a portion of the RGNF, also classifies polygons by dominant vegetation but often includes upland areas and cannot be summarized by general wetland type or hydrologic regime.

Digitized NWI mapping now provides the USFS with an estimate of 38,174 acres of wetlands and 4,687 acres of lakes, rivers, and streams. This estimate represents approximately 2% of the land area within the Forest, a proportion that is similar to coarse estimates calculated for the entire state of Colorado (Dahl 1990). Though relatively much less abundant than the surrounding upland communities, the importance of wetlands far surpasses the area they cover. This new mapping provides the USFS with finer-scale data on wetland location than previously available, which will help in many aspects of resource management.

Though more precise than previous estimates, the newly digitized NWI mapping should also be viewed as an estimate. The photo delineation of these maps was conducted by USFWS in the late 1970s (Sangre de Cristos portion) to early 1980s (remainder of the RGNF). Some land use change has occurred in the intervening years and remote sensing techniques have also improved. While the boundaries of polygons may not be exact, the mapping is a reasonably accurate representation of wetlands and can be used as a screening tool for land use planning.

Of particular importance is the high percentage of wetland acres mapped with the saturated soil regime, especially in the alpine and subalpine. Many of these areas are likely fens (Figure 14), considered old growth wetlands because it takes centuries to build up their organic soils. Fens are

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[8] Metadata for the R2Veg geodatabase is available at: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsm9_012554.pdf

[9] Information on CPW's riparian mapping is available at: http://ndis1.nrel.colostate.edu/riparian/riparian.htm.

an irreplaceable resource that should to be managed for conservation and restoration. The San Juan Mountains has an especially high concentration of fens and their contribution to biodiversity is significant (Chimner et al. 2010). While not all acres mapped with the saturated hydrologic regime are fens, wetlands mapped with this hydrologic regime have a higher likelihood of being fen than other mapped wetlands. The NWI mapping, complete with hydrologic regime data, provides a starting point for targeting and surveying fens across the Forest, as was recently conducted on the White River National Forest (Malone et al. 2011).

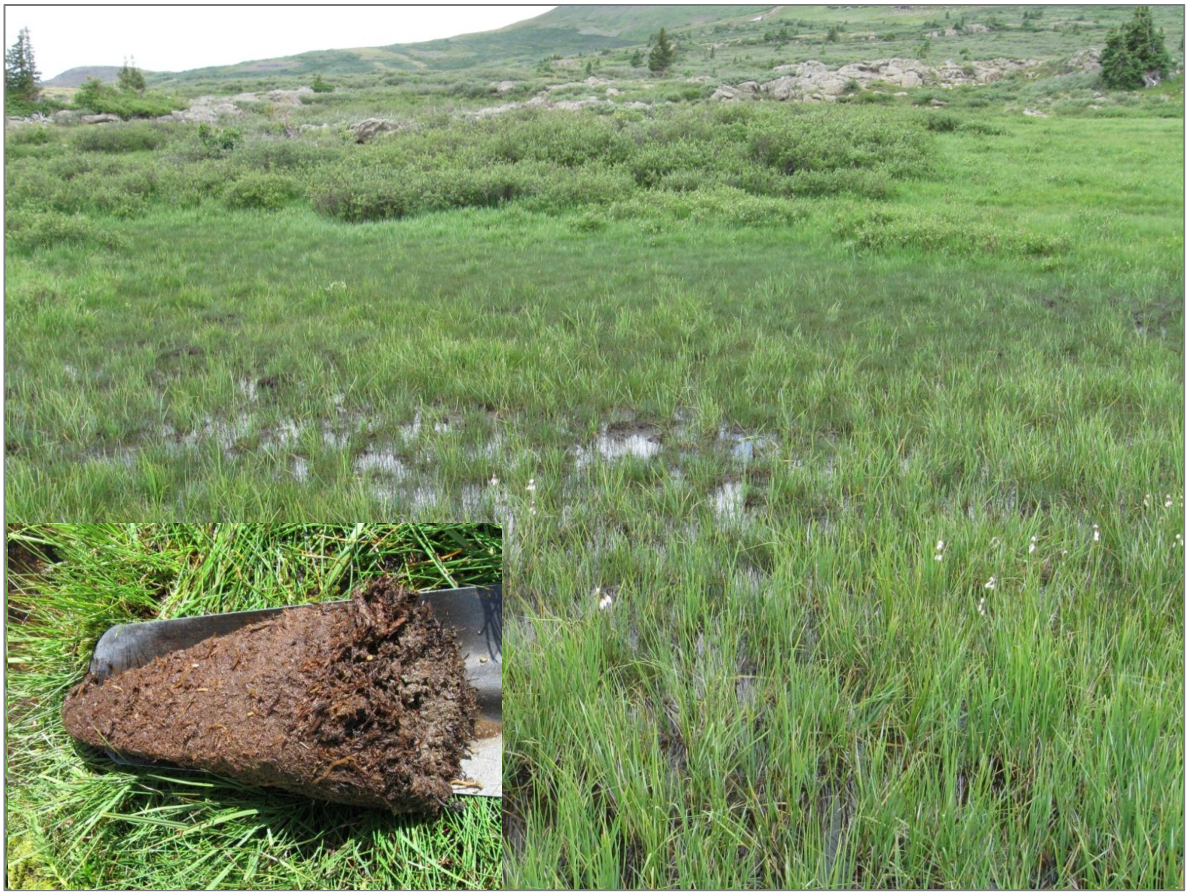

Figure 14. Fen wetland in the Texas Creek watershed of the RGNF. Inset photo of organic (peat) soil.

5.2 Condition of Wetlands on the RGNF

Overall, the wetlands sampled through this project were in excellent or good condition. Management of RGNF wetlands appears to be effective at minimizing severe impacts. Over half the wetlands sampled were A-ranked, meaning they were considered to be in reference condition. All wetlands sampled in the alpine zone were A-ranked (Figure 15), as were 40% of wetlands in the subalpine zones. Another 42% of all wetlands surveyed were B-ranked, meaning they were considered to be in good condition and deviated slightly, but not significantly, from reference condition. These wetlands face some stressors, but the impacts are manageable. Management of B-ranked wetlands should focus on preventing further alteration to ensure these wetlands stay in good condition.

Figure 15. Pristine alpine wetlands on the RGNF. Pole Creek watershed (left) and Texas Creek watershed (right).

A handful of wetlands were C-ranked, meaning they were in fair condition and deviated moderately from reference condition. These wetlands face more severe threats and management action may be needed to restore certain ecological attributes. The lowest scoring wetland, 21h-070, was the only wetland in the dataset to be ranked D for biotic condition (Figure 16). This wet meadow was encircled by a fence and had been heavily used by either livestock or native ungulates. The species composition contained significant cover of non-native species.

Figure 16. Site 21h-070, near Spanish Creek, a tributary to Saguache Creek, in the northeast portion of the RGNF.

Other lower scoring wetlands were surveyed in 2008, when sites were clustered by watersheds. Due to the clustering, when specific stressors were evident in a given watershed, they were often observed in several wetlands in that watershed. For instance, evidence of moderate to heavy grazing was observed in several wetlands in the A2 watershed, which straddled the Rio de los Pinos River along the Colorado-New Mexico border. The impact to wetlands included down cutting of streams and soil disturbance known as "pugging", which occurs when heavy animals repeatedly trample through wet vegetation (Figure 17). Pugging results in artificially formed hummocks or pedestals of vegetation that can dry out over time. Both down cutting and pugging can affect the hydrology of wetlands.

Figure 17. Down cutting of a small stream (left) and heavy pugging (right) observed in wetlands of the Rio de los Pinos watershed of the RGNF.

For the A3 watershed, located at the headwaters of Bennett Creek, below Bennett Peak and Sheep Mountains, landscape level stressors were fairly high, but the wetlands remained in good biotic condition. This watershed had been recently logged in several sections and evidence of tree removal was seen very close to surveyed wetlands (Figure 18). At the time of the surveys, the wetlands themselves did not appear to be affected directly. Species composition remained predominantly native and diversity was high. However, wetlands this close to logging activity should be monitored for changes to hydrology and species composition. The area contains several fens (Figure 19), which depend on groundwater input to maintain their saturated soils. Road building, soil compaction, and hydrologic diversion within the immediate watershed can alter the groundwater flow patterns and may eventually lead to a drying of peat soils (Cooper et al. 1998).

Figure 18. Evidence of recent logging in the Bennett Creek watershed of the RGNF.

Figure 19. Shrub dominated fen wetland within the Bennett Creek watershed.

In conclusion, the RGNF contains thousands of acres of high quality wetlands that provide essential services to the Forest and lands downstream. This study, in conjunction with others carried out by CNHP over the past two decades (Sarr & Sanderson 1998; Kittel et al. 1999; Rocchio et al. 2000; Neid & Jones 2008), provides the RGNF with detailed information on specific wetlands throughout the RGNF along with generalize conclusion on the extent, distribution, and condition of wetlands. This information can be used for a variety of management purposes.

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APPENDIX A: Field Key to Wetland and Riparian Ecological Systems of Montana, Wyoming, Utah, and Colorado

1a. Wetland defined by groundwater inflows and peat (organic soil) accumulation of at least 40 cm. Vegetation can be woody or herbaceous. If the wetland occurs within a mosaic of non-peat forming wetland or riparian systems, then the patch must be at least 0.1 hectares (0.25 acres). If the wetland occurs as an isolated patch surrounded by upland, then there is no minimum size criteria. .... **Rocky Mountain Subalpine-Montane Fen**

1b. Wetland does not have at least 40 cm of peat (organic soil) accumulation or occupies an area less than 0.1 hectares (0.25 acres) within a mosaic of other non-peat forming wetland or riparian systems **2**

2a. Total woody canopy cover generally 25% or more within the overall wetland/riparian area. Any purely herbaceous patches are less than 0.5 hectares and occur within a matrix of woody vegetation. Note: Relictual woody vegetation such as standing dead trees and shrubs are included here............................ . ... **GO TO KEY A: Woodland and Shrubland Ecological Systems**

2b. Total woody canopy cover generally less than 25% within the overall wetland/riparian area. Any woody vegetation patches are less than 0.5 hectares and occur within a matrix of herbaceous wetland vegetation **3**

3a. Total vegetation canopy cover generally 10% or more .... **GO TO KEY B: Herbaceous Ecological Systems**

3b. Total vegetation canopy cover generally less than 10% .... **GO TO KEY C: Sparse Vegetation**

KEY A: Woodland and Shrubland Ecological Systems

1a. Woody wetland associated with any stream channel, including ephemeral, intermittent, or perennial (Riverine HGM Class) **2**

1b. Woody wetland associated with the discharge of groundwater to the surface or fed by snowmelt or precipitation. This system often occurs on slopes, lakeshores, or around ponds. Sites may experience overland flow but no channel formation. (Slope, Flat, Lacustrine, or Depressional HGM Classes) **9**

2a. Riparian woodlands and shrublands of the montane or subalpine zone (refer to lifezone table) **3**

2b. Riparian woodlands and shrublands of the plains, foothills, or lower montane zone (refer to lifezone table) **4**

3a. Montane or subalpine riparian woodlands (canopy dominated by trees). This system occurs as a narrow streamside forest lining small, confined low- to mid-order streams. Common tree species include *Abies lasiocarpa*, *Picea engelmannii*, *Pseudotsuga menziesii*, and *Populus tremuloides*.. .... **Rocky Mountain Subalpine-Montane Riparian Woodland**

3b. Montane or subalpine riparian shrublands (canopy dominated by shrubs with sparse or no tree cover). Within the Riverine HGM Class, this system occurs as either a narrow band of shrubs lining streambanks of steep V-shaped canyons *or* as a wide, extensive shrub stand on alluvial terraces in low-gradient valley bottoms (sometimes referred to as a shrub carr). Beaver activity is common within the wider occurrences. Species of *Salix*, *Alnus*, or *Betula* are typically dominant.. .... **Rocky Mountain Subalpine-Montane Riparian Shrubland**

4a. Riparian woodlands and shrublands of the foothills or lower montane zones of the Northern, Middle, and Southern Rockies, Wyoming Basin, Wasatch and Uinta Mountains, and Great Basin **5**

4b. Riparian woodlands and shrublands of the Northwestern or Western Great Plains of eastern Montana, central Wyoming, or northeastern Colorado **7**

5a. Foothill or lower montane riparian woodlands and shrublands associated with mountain ranges of the Northern Rockies in northwestern Montana. This type *excludes* island mountain ranges east of the Continental Divide in Montana. *Populus balsamifera* ssp. *trichocarpa* is typically the canopy dominant in woodlands. Other common tree species include *Populus tremuloides*, *Betula papyifera*, *Betula occidentalis*, and *Picea glauca*. Shrub understory species include *Cornus sericea*, *Acer glabrum*, *Alnus incana*, *Oplopanax horridus*, and *Symphoricarpos albus*. Areas of riparian shrubland and open wet meadow are common .... **Northern Rocky Mountain Lower Montane Riparian Woodland and Shrubland**

5b. Foothill or lower montane riparian woodlands and shrublands of other mountain regions **6**

6a. Foothill or lower montane riparian woodlands and shrublands associated with mountain ranges of the Southern and Middle Rockies, Wyoming Basin, and Wasatch and Uinta Mountains. This type also includes island mountain ranges in central and eastern Montana. Woodlands are dominated by *Populus* spp. including *Populus angustifolia*, *Populus balsamifera* ssp. *trichocarpa*, *Populus deltoides*, and *Populus fremontii*. Common shrub species include *Salix* spp., *Alnus incana*, *Crataegus* spp., *Cornus sericea*, and *Betula occidentalis*.......... **Rocky Mountain Lower Montane-Foothill Riparian Woodland and Shrubland**

6b. Foothill or lower montane riparian woodlands and shrublands associated with mountain ranges of the Great Basin in Utah. Woodlands are dominated by *Abies concolor*, *Populus angustifolia*, *Populus balsamifera* ssp. *trichocarpa*, *Populus fremontii*, and *Pseudotsuga menziesii*. Important shrub species include *Artemisia cana*, *Betula occidentalis*, *Cornus sericea*, *Salix exigua*, *Salix lutea*, *Salix lemmonii*, and *Salix lasiolepis*.......... **Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland**

7a. Woodlands and shrublands of draws and ravines associated with permanent or ephemeral streams, steep north-facing slopes, or canyon bottoms that do not experience flooding. Common tree species include *Fraxinus* spp., *Acer negundo*, *Populus tremuloides*, and *Ulmus* spp. Important shrub species include *Crataegus* spp., *Prunus virginiana*, *Rhus* spp., *Rosa woodsii*, *Symphoricarpos occidentalis*, and *Shepherdia argentea*. .... **Western Great Plains Wooded Draw and Ravine**

7b. Woodlands and shrublands of small to large streams and rivers of the Northwestern or Western Great Plains. Overall vegetation is lusher than above and includes more wetland indicator species. Dominant species include *Populus balsamifera* ssp. *trichocarpa*, *Populus deltoides*, and *Salix* spp. **8**

8a. Woodlands and shrublands of riparian areas of medium and small rivers and streams with little or no floodplain development and typically flashy hydrology.......... **Northwestern/Western Great Plains Riparian**

8b. Woodlands and shrublands of riparian areas along medium and large rivers with extensive floodplain development and periodic flooding.......... **Northwestern/Western Great Plains Floodplain**

9a. Woody wetland associated with small, shallow ponds in northwestern Montana. Ponds are ringed by trees including *Populus balsamifera* ssp. *trichocarpa*, *Populus tremuloides*, *Betula papyrifera*, *Abies grandis*, *Abies lasiocarpa*, *Picea engelmannii*, *Pinus contorta*, and *Pseudotsuga menziesii*. Typical shrub species include *Cornus sericea*, *Amelanchier alnifolia*, and *Salix* spp. .... **Northern Rocky Mountain Wooded Vernal Pool**

9b. Woody wetland associated with the discharge of groundwater to the surface, or sites with overland flow but no channel formation. **10**

10a. Coniferous woodlands associated with poorly drained soils that are saturated year round or seasonally flooded. Soils can be woody peat but tend toward mineral. Common tree species include *Thuja plicata*, *Tsuga heterophylla*, and *Picea engelmannii*. Common species of the herbaceous understory include *Mitella* spp., *Calamagrostis* spp., and *Equisetum arvense* .... **Northern Rocky Mountain Conifer Swamp**

10b. Woody wetlands dominated by shrubs.......... **11**

11a. Subalpine to montane shrubby wetlands that occur around seeps, fens, lakes, and isolated springs on slopes away from valley bottoms. This system can also occur within a mosaic of multiple shrub- and herb-dominated communities within snowmelt-fed basins. Vegetation dominated by species of *Salix*, *Alnus*, or *Betula.* Within Slope, Flat, Lacustrine, or Depressional HGM Classes, this system has a similar species composition as occurrences within the Riverine HGM Class, but occurs in different landscape settings .... **Rocky Mountain Subalpine-Montane Riparian Shrubland**

11b. Lower foothills to valley bottom shrublands restricted to temporarily or intermittently flooded drainages or flats and dominated by *Sarcobatus vermiculatus* .... **Inter-Mountain Basins Greasewood Flat**

KEY B: Herbaceous Wetland Ecological Systems

1a. Herbaceous wetlands of the Northwestern Glaciated Plains, Northwestern Great Plains, or Western Great Plains regions of eastern Montana, central Wyoming, or northeastern Colorado **2**

1b. Herbaceous wetlands of other regions **5**

2a. Wetland occurs as a complex of depressional wetlands within the glaciated plains of northern Montana. Typical species include *Schoenoplectus* spp. and *Typha latifolia* on wetter, semi-permanently flooded sites, and *Eleocharis* spp., *Pascopyrum smithii*, and *Hordeum jubatum* on drier, temporarily flooded sites .... **Great Plains Prairie Pothole**

2b. Wetland does not occur as a complex of depressional wetlands within the glaciated plains of Montana **3**

3a. Depressional wetlands in the Western Great Plains with saline soils. Salt encrustations can occur on the surface. Species are typically salt-tolerant such as *Distichlis spicata*, *Puccinellia* spp., *Salicornia* spp., and *Schoenoplectus maritimus*.. **Western Great Plains Saline Depression Wetland**

3b. Depressional wetlands in the Western Great Plains with obvious vegetation zonation dominated by emergent herbaceous vegetation, including *Eleocharis* spp., *Schoenoplectus* spp., *Phalaris arundinacea*, *Calamagrostis canadensis*, *Hordeum jubatum*, and *Pascopyrum smithii* **4**

4a. Depressional wetlands in the Western Great Plains associated with open basins that have an obvious connection to the groundwater table. This system can also occur along stream margins where it is linked to the basin via groundwater flow. Typical plant species include species of *Typha*, *Carex*, *Schoenoplectus*, *Eleocharis*, *Juncus*, and floating genera such as *Potamogeton*, *Sagittaria*, and *Ceratophyllum*.. .... **Western Great Plains Open Freshwater Depression Wetland**

4b. Depressional wetlands in the Western Great Plains primarily within upland basins having an impermeable layer such as dense clay. Recharge is typically via precipitation and runoff, so this system typically lacks a groundwater connection. Wetlands in this system tend to have standing water for a shorter duration than Western Great Plains Open Freshwater Depression Wetlands. Common species include *Eleocharis* spp., *Hordeum jubatum*, and *Pascopyrum smithii* .... **Western Great Plains Closed Depression Wetland**

5a. Small (<0.1 ha) depressional, herbaceous wetlands occurring within dune fields of the Great Basin, Wyoming Basin, and other small inter-montane basins.. **Inter-Mountain Basins Interdunal Swale Wetland**

5b. Herbaceous wetlands not associated with dune fields **6**

6a. Depressional wetlands occurring in areas with alkaline to saline clay soils with hardpans. Salt encrustations can occur on the surface. Species are typically salt-tolerant such as *Distichlis spicata*, *Puccinellia* spp., *Leymus* sp., *Poa secunda*, *Salicornia* spp., and *Schoenoplectus maritimus*. Communities within this system often occur in alkaline basins and swales and along the drawdown zones of lakes and ponds. .... **Inter-Mountain Basins Alkaline Closed Depression**

6b. Herbaceous wetlands not associated with alkaline to saline hardpan clay soils. **7**

7a. Wetlands with a permanent water source throughout all or most of the year. Water is at or above the surface throughout the growing season, except in drought years. This system can occur around ponds, as fringes around lakes and along slow-moving streams and rivers. The vegetation is dominated by common emergent and floating leaved species including species of *Scirpus*, *Schoenoplectus*, *Typha*, *Juncus*, *Carex*, *Potamogeton*, *Polygonum*, and *Nuphar*. ....**Western North American Emergent Marsh**

7b. Herbaceous wetlands associated with a high water table or overland flow, but typically lacking standing water. Sites with *no channel formation* are typically associated with snowmelt and not subjected to high disturbance events such as flooding (Slope HGM Class). Sites *associated with a stream channel* are more tightly connected to overbank flooding from the stream channel than with snowmelt and groundwater discharge and may be subjected to high disturbance events such as flooding (Riverine HGM Class). Vegetation is dominated by herbaceous species; typically graminoids have the highest canopy cover including *Carex* spp., *Calamagrostis* spp., and *Deschampsia caespitosa* ....**Rocky Mountain Alpine-Montane Wet Meadow**

KEY C: Sparsely Vegetated Ecological Systems

1a. Sites are restricted to drainages with a variety of sparse or patchy vegetation including *Sarcobatus vermiculatus*, *Ericameria nauseosa*, *Artemisia cana*, *Artemisia tridentata*, *Grayia spinosa*, *Distichlis spicata*, and *Sporobolus airoides*. ....**Inter-Mountain Basins Wash**

1b. Sites occur on barren or sparsely vegetated playas that are intermittently flooded and may remain dry for several years. Soil is typically saline, and salt encrustrations are common. Plant species are salt-tolerant and can include *Sarcobatus vermiculatus*, *Distichlis spicata*, and *Atriplex* spp. ....**Inter-Mountain Basins Playa**

Appendix A, Table 1. General life zones found in Colorado, Montana, Wyoming, and Utah. Note that elevations at which a life zone begins and ends is dependent upon latitude, aspect, and topographic variation.

	Colorado		Montana		Wyoming		Utah	
Life Zone	Elevation range (feet)	Dominant vegetation	Elevation range (feet)	Dominant vegetation	Elevation range (feet)	Dominant vegetation	Elevation range (feet)	Dominant vegetation
Foothills - Lower Montane	<5,500-8,000	Gambel oak, pinon-juniper, sagebrush in foothills to ponderosa pine, Douglas-fir in lower montane	<4,000-6,000	bunchgrasses, ponderosa pine, juniper, sagebrush	>5,000-6,000	bunchgrasses, ponderosa pine, juniper, sagebrush	<5,500-8,000	pinyon-juniper woodlands, oak-maple shrublands.
Montane	8,000-9,500	Douglas-fir, lodgepole pine, aspen	>4,500-7,600	Douglas-fir, spruce, cedar, lodgepole pine	6,000-7,600	Douglas-fir, spruce, lodgepole pine	8,000-9,500	lodgepole pine, ponderosa pine, aspen, Douglas-fir
Subalpine	9,500-11,500	subalpine fir, Engelmann spruce	5,000-8,800	subalpine fir, Engelmann spruce	7,600-10,000	subalpine fir, Engelmann spruce	>9,500	spruce-fir
Alpine	>11,500	grassland/tundra	>6,000-8,800	grassland/tundra	>10,000	grassland/tundra	>11,200	grassland/tundra

APPENDIX B: Field Key to Hydrogeomorphic Classes in the Rocky Mountains

1a. Entire wetland unit is flat and precipitation is the primary source (>90%) of water. Groundwater and surface water runoff are not significant sources of water to the unit .... **Flats HGM Class**

1b. Wetland does not meet the above criteria; primary water sources include groundwater and/or surface water **2**

2a. Entire wetland unit meets ***all*** of the following criteria: a) the vegetated portion of the wetland is on the shores of a permanent open water body at least 8 ha (20 acres) in size; b) at least 30% of the open water area is deeper than 2 m (6.6 ft); c) vegetation in the wetland experiences bidirectional flow as the result of vertical fluctuations of water levels due to rising and falling lake levels. .... **Lacustrine Fringe HGM Class**

2b. Wetland does not meet the above criteria; wetland is not found on the shore of a water body, water body is either smaller or shallower, OR vegetation is not effected by lake water levels.. **3**

3a. Entire wetland unit meets ***all*** of the following criteria: a) wetland unit is in a valley, floodplain, or along a stream channel where it is inundated by overbank flooding from that stream or river; b) overbank flooding occurs at least once every two years; and c) wetland does not receive significant inputs from groundwater. **NOTE:** *Riverine wetlands can contain depressions that are filled with water when the river is not flooding such as oxbows and beaver ponds*.. **Riverine HGM Class**

3b. Wetland does not meet the above criteria; if the wetland is located within a valley, floodplain, or along a stream channel, it is outside of the influence of overbank flooding or receives significant hydrologic inputs from groundwater. **4**

4a. Entire wetland unit is located in a topographic depression in which water ponds or is saturated to the surface at some time during the year. **NOTE:** *Any outlet, if present, is higher than the interior of the wetland.* .... **Depressional HGM Class**

4b. Wetland does not meet all of the above criteria. Instead, wetland meets part or all if the following : a) wetland is on a slope (slope can be very gradual or nearly flat); b) groundwater is the primary hydrologic input; c) water, if present, flows through the wetland in one direction and usually comes from seeps or springs; and d) water leaves the wetland without being impounded. **NOTE:** *Small channels can form within slope wetlands, but are not subject to overbank flooding. Surface water does not pond in these types of wetlands, except occasionally in very small and shallow depressions or behind hummocks (depressions are usually < 3ft diameter and less than 1 foot deep).*.. **Slope HGM Class**

Adapted from:

- Hruby, Tom. (2004) *Washington State Wetland Rating System for Eastern Washington - Revised.* Publication #04-06-15. Washington State Department of Ecology, Olympia, Washington.
- Williams, H. M., A. J. Miller, R. S. McNamee, and C. V. Klimas. (2010) *A Regional Guidebook for Applying the Hydrogeomorphic Approach to the Functional Assessment of Forested Wetlands in Alluvial Valleys of East Texas.* ERCD/EL TR-10-17. Army Corps of Engineers, Engineer Research and Development Center, Wetlands Regulatory Assistance Program. 144 p.

APPENDIX C: Rio Grande National Forest Wetland Condition Assessment Field Forms

2010 RIO GRANDE NATIONAL FOREST WETLAND CONDITION ASSESSMENT FIELD FORM

LOCATION AND GENERAL INFORMATION

Point Code: ______________________ Site Name: ____ ☐ Level 2 OR ☐ Level 3

Date: ___________________________ Surveyors: ____ ☐ Team A ☐ Team B ☐ Team C

General Location: ____ County: _______________________________________

General Ownership: _______________________ Specific Ownership: ____

USGS Quad Name: ____ USGS Quad Code: ______________________________

Directions to Point and Access Comments:

GPS COORDINATES OF TARGET POINT AND ASSESSMENT AREA (NAD 83 UTM Zone ________) Elevation (m): ______________

Point WP #: __________ UTM E: ___ ___ ___ ___ ___ ___ UTM N: ___ ___ ___ ___ ___ ___ ___ Error (+/-): ______________

Point is:	AA is:	Dimensions of AA:
____Within target population ____ Not within target population, but within 60 m of target population	____ Centered at point ____ Not centered at point, but includes point ____ Shifted, point outside	____40 m radius circle ____Rectangle, width______ length:______ ____Other, describe and take a GPS Track

AA-Center WP #: __________ UTM E: ___ ___ ___ ___ ___ ___ UTM N: ___ ___ ___ ___ ___ ___ ___ Error (+/-): ______________

AA-1 WP #: __________ UTM E: ___ ___ ___ ___ ___ ___ UTM N: ___ ___ ___ ___ ___ ___ ___ Error (+/-): ______________

AA-2 WP #: __________ UTM E: ___ ___ ___ ___ ___ ___ UTM N: ___ ___ ___ ___ ___ ___ ___ Error (+/-): ______________

AA-3 WP #: __________ UTM E: ___ ___ ___ ___ ___ ___ UTM N: ___ ___ ___ ___ ___ ___ ___ Error (+/-): ______________

AA-4 WP #: __________ UTM E: ___ ___ ___ ___ ___ ___ UTM N: ___ ___ ___ ___ ___ ___ ___ Error (+/-): ______________

AA-Track Track Name: ______________________________________ Comments: ____

AA Placement and Dimensions Comments:

Is AA Representative of Larger Wetland:

PHOTOS OF ASSESSMENT AREA (Taken at four points on edge of AA looking in. Record WPs of each photo in table above.)

AA-1 Photo #: ______________ Aspect: ______________

AA-2 Photo #: ______________ Aspect: ______________

AA-3 Photo #: ______________ Aspect: ______________

AA-4 Photo #: ______________ Aspect: ______________

Additional AA Photos and Comments:

Point Code__________________

ENVIRONMENTAL DESCRIPTION AND CLASSIFICATION OF ASSESSMENT AREA

Slope 1 (deg): ________________ Aspect 1 (deg): ________________ Comment: ____

Slope 2 (deg): ________________ Aspect 2 (deg): ________________ Comment: ____

Non-target Inclusions

% AA with > 1m standing water: ______________

% AA with upland inclusions: _________________

Wetland origin

____ Natural feature with minimal alteration

____ Natural feature, but altered or augmented by modification

____ Non-natural feature created by management action

Ecological System (see manual for key and rules on inclusions and pick *only one*) Conf: High Med Low

____SM Riparian Shrubland ____SM Fen ____IMB Greasewood Flat

____SM Riparian Woodland ____ Alpine-Montane Wet Meadow ____IMB Alkaline Closed Depression

____LMF Rip Woodland and Shrubland ____ NA Arid West Emergent Marsh ____IMB Playa

Cowardin Classification (pick *one each*) Conf: High Med Low

System and Class: Water Regime: Modifier (optional):

____ PEM ____ PAB ____ A ____ F ____ b ____ h

____ PSS ____ PUB ____ B ____ G ____ x ____ f

____ PFO ____ PUS ____ C ____H ____ d

HGM Class (pick *only one*) Conf: High Med Low

____Riverine* ____Lacustrine Fringe

____Depressional ____ Slope

____ Flats ____ Unknown

**Specific classification and metrics apply to the Riverine HGM Class*

***RIVERINE SPECIFIC* CLASSIFICATION OF THE ASSESSMENT AREA**

Confined vs. Unconfined Valley Setting

Estimated Valley Width (m): _________________________________

Estimated Bankfull Width (m): _______________________________

____Confined Valley Setting (valley width < 2x bankfull width)

____Unconfined Valley Setting (valley width ≥ 2x bankfull width)

Hydrologic Regime Conf: High Med Low

____Perennial (streams that hold water throughout the year; water in channel ~80% of the time)

____Intermittent (stream that holds water during wet portions of the year; water in channel 10–80% of the time)

____Ephemeral (channel that holds water only during and immediately after rain events; water in channel <10% of the time)

AA Proximity to Channel and # of Banks Included:

______ Includes (2 banks) ______ Adjacent (1 bank) ______ Far from

Stream Depth at Time of Survey:

______ Wadeable ______ Non-wadeable

VEGETATION ZONES WITHIN THE ASSESSMENT AREA (See manual for rules and definitions. Mark each zone on the site sketch.)

Zone 1 Dom stratum ___________________________ Dom spp: ____ % of AA: ___________

Zone 2 Dom stratum ___________________________ Dom spp: ____ % of AA: ___________

Zone 3 Dom stratum ___________________________ Dom spp: ____ % of AA: ___________

Zone 4 Dom stratum ___________________________ Dom spp: ____ % of AA: ___________

Zone 5 Dom stratum ___________________________ Dom spp: ____ % of AA: ___________

ENVIRONMENTAL AND CLASSIFICATION COMMENTS

ASSESSMENT AREA DRAWING
Add north arrow and approx scale bar. Document vegetation zones, inflows and outflows, and indicate direction of drainage. Include sketch of vegetation plot and soil pit placement.

ASSESSMENT AREA DESCRIPTION AND COMMENTS
Note wildlife species observed:

LEVEL 2 and 3 INTENSIVE DATA COLLECTION

VEGETATION PLOT

For Level 2 Assessments, walk through the AA and identify as many plant species as possible. Skip the vegetation plot set up and spend *no more* than 1–2 hour compiling the species list. Once the species list is compiled, use the first module column on the form to estimate cover for the entire AA. Estimate ground cover and vertical vegetation structure for the entire AA.

For Level 3 Assessments, carry out the full vegetation plot following directions in the field manual.

GPS COORDINATES OF VEGETATION PLOT (NAD 83 UTM Zone ________)

0 m WP #: __________ UTM E: ___ ___ ___ ___ ___ ___ UTM N: ___ ___ ___ ___ ___ ___ ___ Error (+/-): ______________

XP 1 WP #: __________ UTM E: ___ ___ ___ ___ ___ ___ UTM N: ___ ___ ___ ___ ___ ___ ___ Error (+/-): ______________

50 m WP #: __________ UTM E: ___ ___ ___ ___ ___ ___ UTM N: ___ ___ ___ ___ ___ ___ ___ Error (+/-): ______________

XP 2 WP #: __________ UTM E: ___ ___ ___ ___ ___ ___ UTM N: ___ ___ ___ ___ ___ ___ ___ Error (+/-): ______________

PHOTOS OF VEGETATION PLOT

0 m Photo #: _____________ Aspect: _____________

XP 1 Photo #: _____________ Aspect: _____________

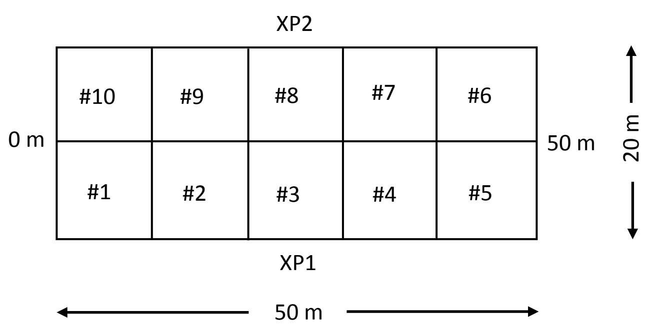
50 m Photo #: _____________ Aspect: _____________

XP 2 Photo #: _____________ Aspect: _____________

Additional AA Photos and Comments:

LAYOUT OF VEGETATION PLOT

Plot layout (circle intensive modules and note any changes to the plot layout, i.e. 1x5 or 2x2 plot)



Plot representativeness (discuss decisions for placement and/or whether the plot is representative of AA)

Point Code___________________

VEGETATION PLOT GROUND COVER AND VERTICAL STRATA						
	Module →					**R**
Cover Classes 1: trace 2: <1% 3: 1–<2% 4: 2–<5% 5: 5–<10% 6: 10–<25% 7: 25–<50% 8: 50–<75% 9: 75–<95% 10: >95%						
	Cover Class (unless otherwise noted) →	**C**	**C**	**C**	**C**	**C**
Ground Cover						
	Cover of water (any depth, vegetated or not, standing or flowing)					
Set 1	Cover of shallow water <20 cm / average depth shallow water (cm)	/	/	/	/	/
	Cover of deep water >20 cm / average depth deep water (cm)	/	/	/	/	/
Set 2	Cover of open water with no vegetation					
	Cover of water with submergent or floating aquatic vegetation					
	Cover of water with emergent vegetation					
	Cover of exposed bare ground – soil / sand / sediment					
	Cover of exposed bare ground – gravel / cobble (~2–250 mm)					
	Cover of exposed bare ground – bedrock / rock / boulder (>250 mm)					
	Cover of litter (all cover, including under water or vegetation)					
	Depth of litter (cm) – average of 4 locations where litter occurs					
	Predominant litter type (C = coniferous, E = broadleaf evergreen, D = deciduous, S = sod/thatch, F = forb)					
	Cover of standing dead trees (>5 cm diameter at breast height)					
	Cover of standing dead shrubs or small trees (<5 cm diameter at breast height)					
	Cover of downed coarse woody debris (fallen trees, rotting logs, >5 cm diameter)					
	Cover of downed fine woody debris (<5 cm diameter)					
	Cover bryophytes (all cover, including under vegetation or litter cover)					
	Cover lichens (all cover, including under vegetation or litter cover)					
	Cover macroalgea (all cover, including under vegetation or litter cover)					

Height Classes 1: <0.5 m 2: 0.5–1m 3: 1–2 m 4: 2–5 m 5: 5–10 m 6: 10–15 m 7: 15–20 m 8: 20–35 m 9: 35–50 m 10: >50 m										
Cover / Height →	**C**	**H**	**C**	**H**	**C**	**H**	**C**	**H**	**C**	**H**
Vertical Vegetation Strata										
(T1) Dominant canopy trees (>5 m and > 30% cover)										
(T2) Sub-canopy trees (> 5m but < dominant canopy height) or trees with sparse cover										
(S1) Tall shrubs or older tree saplings (2–5 m)										
(S2) Short shrubs or young tree saplings (0.5–2 m)										
(S3) Dwarf shrubs or tree seedlings (<0.5 m)										
(HT) Herbaceous total										
(H1) Graminoids										
(H2) Forbs										
(H3) Ferns and fern allies										
(AQ) Submergent or floating aquatics										

Point Code__________________

Vegetation Plot Species Table: For each intensive module, list all species within and overhanging the module and estimate percent cover for the module. List any species found in the remaining modules in the residual "R" column and estimate percent cover for the entire plot. Mark intensive modules on map for reference.

	#10	#9	#8	#7	#6	
0 m						50 m
	#1	#2	#3	#4	#5	

VEGETATION PLOT SPECIES TABLE												
		Module →									R	
		Presence / Cover →	P	C	P	C	P	C	P	C	P	C
Cover Classes 1: trace 2: <1% 3: 1–<2% 4: 2–<5% 5: 5–<10% 6: 10–<25% 7: 25–<50% 8: 50–<75% 9: 75–<95% 10: >95%												
Stratum	Species	Coll #										

Point Code__________________

VEGETATION PLOT SPECIES TABLE												
		Module →									**R**	
		Presence / Cover →	**P**	**C**	**P**	**C**	**P**	**C**	**P**	**C**	**P**	**C**
Cover Classes 1: trace **2:** <1% **3:** 1–<2% **4:** 2–<5% **5:** 5–<10% **6:** 10–<25% **7:** 25–<50% **8:** 50–<75% **9:** 75–<95% **10:** >95%												
Stratum	**Species**	**Coll #**										

SOIL PROFILE DESCRIPTION – SOIL PIT 1

Module # or GPS Waypoint ______________ (mark on site sketch)

Soil survey unit: ____ Soil pit matches soil survey unit? ☐ Yes ☐ No Explain in comments.

Depth to saturated soil (cm): ____________ Depth to free water (cm): _____________ ☐ Not observed* Groundwater pH: ______________ EC: ______________ Temp: ______________

Horizon (optional)	Depth (cm)	Matrix Color (moist)	Redox Concentrations Color (moist)	%	Redox Depletions Color (moist)	%	Texture	Remarks
________	_______	______________	______________	________	_____________	________	______________	____
________	_______	______________	______________	________	_____________	________	______________	____
________	_______	______________	______________	________	_____________	________	______________	____
________	_______	______________	______________	________	_____________	________	______________	____
________	_______	______________	______________	________	_____________	________	______________	____

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

____Histosol (A1)
____Histic Epipedon (A2/A3)
____Mucky Mineral (S1/F1)
____Hydrogen Sulfide Odor (A4)
____Gleyed Matrix (S4/F2)
____Depleted Matrix (A11/A12/F3)
____Redox Concentrations (S5/F6/F8)
____Redox Depletions (S6/F7)

Comments:

*If free water is not observed in pit, note if pit appears to be filling slowly or if it appears dry.

SOIL PROFILE DESCRIPTION – SOIL PIT 2

Module # or GPS Waypoint ______________ (mark on site sketch)

Soil survey unit: ____ Soil pit matches soil survey unit? ☐ Yes ☐ No Explain in comments.

Depth to saturated soil (cm): ____________ Depth to free water (cm): _____________ ☐ Not observed* Groundwater pH: ______________ EC: ______________ Temp: ______________

Horizon (optional)	Depth (cm)	Matrix Color (moist)	Redox Concentrations Color (moist)	%	Redox Depletions Color (moist)	%	Texture	Remarks
________	_______	______________	______________	________	_____________	________	______________	____
________	_______	______________	______________	________	_____________	________	______________	____
________	_______	______________	______________	________	_____________	________	______________	____
________	_______	______________	______________	________	_____________	________	______________	____
________	_______	______________	______________	________	_____________	________	______________	____

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

____Histosol (A1)
____Histic Epipedon (A2/A3)
____Mucky Mineral (S1/F1)
____Hydrogen Sulfide Odor (A4)
____Gleyed Matrix (S4/F2)
____Depleted Matrix (A11/A12/F3)
____Redox Concentrations (S5/F6/F8)
____Redox Depletions (S6/F7)

Comments:

*If free water is not observed in pit, note if pit appears to be filling slowly or if it appears dry.

SOIL PROFILE DESCRIPTION – SOIL PIT 3 **Module # or GPS Waypoint _____________ (mark on site sketch)**

Soil survey unit: ______________________________ Soil pit matches soil survey unit? ☐ Yes ☐ No Explain in comments.

Depth to saturated soil (cm): ____________ Depth to free water (cm): _____________ ☐ Not observed* Groundwater pH: ______________ EC: ______________ Temp: ______________

Horizon (optional)	Depth (cm)	Matrix Color (moist)	Redox Concentrations Color (moist)	Redox Concentrations %	Redox Depletions Color (moist)	Redox Depletions %	Texture	Remarks

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

____Histosol (A1)
____Histic Epipedon (A2/A3)
____Mucky Mineral (S1/F1)
____Hydrogen Sulfide Odor (A4)
____Gleyed Matrix (S4/F2)
____Depleted Matrix (A11/A12/F3)
____Redox Concentrations (S5/F6/F8)
____Redox Depletions (S6/F7)

Comments:

*If free water is not observed in pit, note if pit appears to be filling slowly or if it appears dry.

SOIL PROFILE DESCRIPTION – SOIL PIT 4 **Module # or GPS Waypoint _____________ (mark on site sketch)**

Soil survey unit: ______________________________ Soil pit matches soil survey unit? ☐ Yes ☐ No Explain in comments.

Depth to saturated soil (cm): ____________ Depth to free water (cm): _____________ ☐ Not observed* Groundwater pH: ______________ EC: ______________ Temp: ______________

Horizon (optional)	Depth (cm)	Matrix Color (moist)	Redox Concentrations Color (moist)	Redox Concentrations %	Redox Depletions Color (moist)	Redox Depletions %	Texture	Remarks

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

____Histosol (A1)
____Histic Epipedon (A2/A3)
____Mucky Mineral (S1/F1)
____Hydrogen Sulfide Odor (A4)
____Gleyed Matrix (S4/F2)
____Depleted Matrix (A11/A12/F3)
____Redox Concentrations (S5/F6/F8)
____Redox Depletions (S6/F7)

Comments:

*If free water is not observed in pit, note if pit appears to be filling slowly or if it appears dry.

Point Code__________________

LEVEL 2 ECOLOGICAL INTEGRITY ASSESSMENT FOR SOUTHERN ROCKY MOUNTAIN WETLANDS

1. LANDSCAPE CONTEXT METRICS – Circle the applicable letter score

1a. LANDSCAPE CONNECTIVITY: *NON-RIVERINE WETLANDS* (UNFRAGMENTED LANDSCAPE)

For non-riverine wetlands, select the statement that best describes the **landscape fragmentation** within a 500 m envelope surrounding the AA. To determine, identify the largest unfragmented block *that includes the AA* within the 500 m envelope and estimate its percent of the total envelope. Well traveled dirt roads and major canals count as fragmentation, but hiking trails and small ditches can be included in unfragmented blocks.	Intact: AA embedded in >90–100% unfragmented, natural landscape.	**A**
	Variegated: AA embedded in >60–90% unfragmented, natural landscape.	**B**
	Fragmented: AA embedded in >20–60% unfragmented, natural landscape.	**C**
	Relictual: AA embedded in ≤20% unfragmented, natural landscape.	**D**

1a. LANDSCAPE CONNECTIVITY: *RIVERINE WETLANDS* (RIPARIAN CORRIDOR CONTINUITY)

For riverine wetlands, select the statement that best describes the **riparian corridor continuity** within 500 m upstream and downstream of the AA. To determine, identify any non-buffer patches (see field manual, Table 3) within the riparian corridor (the floodplain) both upstream and downstream of the AA. Record their length in the table below and sum all patches. Specify if the patch occurs upstream or downstream (U/D) and on the right or left bank (R/L). *For AAs that include only one stream bank,* only consider the riparian corridor on that side of the channel.

(U / D)	(R / L)	Length (m)
_______	_______	_____________
_______	_______	_____________
_______	_______	_____________
_______	_______	_____________
_______	_______	_____________
_______	_______	_____________
	Combined patch length:	_____________

Intact: >90–100% natural habitat upstream and downstream. Combined patch length <200 m for AAs with two banks and <100 m for AAs with one bank.	**A**
Variegated: >60–90% natural habitat upstream and downstream. Combined patch length <800 m for AAs with two banks and <400 m for AAs with one bank.	**B**
Fragmented: >20–60% natural habitat upstream and downstream. Combined patch length <1600 m AAs with two banks and <800 m for AAs with one bank.	**C**
Relictual: ≤20% natural habitat upstream and downstream. Combined patch length ≥1600 m for AAs with two banks and ≥800 m for AAs with one bank.	**D**

Landscape connectivity comments:

1b. BUFFER EXTENT

Select the statement that best describes the **extent of buffer land cover** surrounding the AA. To determine, estimate the percent of the AA surrounded by buffer land covers (see field manual, Table 3). Each segment must be ≥ 30 m wide and ≥ 5 long. *For AAs that include only one stream bank,* only consider the buffer on that side of the channel.	Buffer land covers surround >75–100% of the AA.	**A**
	Buffer land covers surround >50–75% of the AA.	**B**
	Buffer land covers surround >25–50% of the AA.	**C**
	Buffer land covers surround ≤25% of the AA.	**D**

1c. BUFFER WIDTH

Select the statement that best describes the **buffer width**. To determine, estimate width (up to 200 m from AA) at eight evenly spaced intervals where buffer land cover exists. *For AAs that include only one stream bank,* only consider the buffer on that side of the channel.

1: ____________	5: ____________	Average buffer width is >200 m	**A**
2: ____________	6: ____________	Average buffer width is >100–200 m	**B**
3: ____________	7: ____________	Average buffer width is >50–100 m	**C**
4: ____________	8: ____________	Average buffer width is ≤50 m OR no buffer exists	**D**
Average width: ______________________			

1d. BUFFER CONDITION			
Select the statement that best describes the **buffer condition**. Select one statement per columns. Only consider buffer land covers up to 200 m from the AA from 1b and 1c.			
Abundant (≥95%) cover native vegetation and little or no (<5%) cover of non-native plants.	**A**	Intact soils and little or no trash or refuse.	**A**
Substantial (≥75–95%) cover of native vegetation and low (5–25%) cover of non-native plants.	**B**	Intact or moderately disrupted soils, moderate or lesser amounts of trash, OR minor intensity of human visitation or recreation.	**B**
Moderate (≥50–75%) cover of native vegetation.	**C**	Moderate or extensive soil disruption, moderate or greater amounts of trash, OR moderate intensity of human use.	**C**
Low (<50%) cover of native vegetation.	**D**	Barren ground and highly compacted or otherwise disrupted soils, moderate or greater amounts of trash, moderate or greater intensity of human use, OR no buffer at all.	**D**
Buffer comments:			

1e. ONSITE AND SURROUNDING LAND USE

Using the table below, estimate the percent cover of each **land use within the AA and within a 500 m envelope** of the AA. Where two or more land uses overlap, use the land use with the lowest score, but mark the other land uses with a star (*) and explain in the comments section. Multiply the percent by the land use coefficient. Based on the total land use scores, select the appropriate metric ratings from the choices below.

Land Use Categories	*Coefficient*	*Assessment Area*		*500 m Envelope*	
		% Area	*Score*	*% Area*	*Score*
Paved roads / parking lots	0.00				
Domestic or commercially developed buildings	0.00				
Gravel pit operation, open pit mining, strip mining	0.00				
Unpaved Roads (e.g., driveway, tractor trail, 4-wheel drive roads)	0.10				
Mining (other than gravel, open pit, and strip mining), abandoned mines	0.10				
Resource extraction (oil and gas)	0.10				
Agriculture - tilled crop production	0.20				
Intensively managed golf courses, sports fields	0.20				
Vegetation conversion (chaining, cabling, rotochopping, clearcut)	0.30				
Heavy grazing by livestock	0.30				
Intense recreation (ATV use / camping / popular fishing spot, etc.)	0.30				
Logging or tree removal with 50-75% of trees >50 cm dbh removed	0.40				
Agriculture – permanent crop (hay pasture, vineyard, orchard, nursery, berry field)	0.50				
Agriculture – permanent tree plantation	0.50				
Dam sites and flood disturbed shorelines around water storage reservoirs	0.50				
Recent old fields and other disturbed fallow lands dominated by non-native species	0.50				
Moderate grazing on rangeland	0.60				
Moderate recreation (high-use trail)	0.70				
Selective logging or tree removal with <50% of trees >50 cm dbh removed	0.80				
Light grazing on rangeland	0.90				
Light recreation (low-use trail)	0.90				
Haying of native grassland	0.90				
Fallow with no history of grazing or other human use in past 10 yrs	0.95				
Natural area / land managed for native vegetation	1.00				
	Total Land Use Score				

RATING CRITERIA FOR ONSITE LAND USE		RATING CRITERIA ADJACENT LAND USE	
AA (onsite) land use score ≥95	**A**	500 m envelope (surrounding) land use score ≥95	**A**
AA (onsite) land use score = 80 to <95	**B**	500 m envelope (surrounding) land use score = 80 to <95	**B**
AA (onsite) land use score = 40 to <80	**C**	500 m envelope (surrounding) land use score = 40 to <80	**C**
AA (onsite) land use score <40	**D**	500 m envelope (surrounding) land use score <40	**D**

Land use comments:

1f. NATURAL COVER WITHIN A 100 M ENVELOPE (Supplemental Information)

Using the table below, estimate the percent cover of each **natural cover type within a 100 m envelope** of the AA. Natural cover does not need to be only native vegetation; it could contain a mix of native and non-native vegetation. This measure applies to the entire 100 m envelope and not just buffer land covers. Estimate the total combined cover and wetland and upland cover separately.

Natural Cover Type	*Total % Cover*	*Upland % Cover*	*Wetland % Cover*
Total non-natural cover (development, row crops, feed lots, etc).			
Total natural cover (breakdown by type below)			
Deciduous forest			
Coniferous forest			
Mixed forest type (neither deciduous nor coniferous trees dominate)			
Shrubland			
Perennial herbaceous			
Annual herbaceous or bare (generally weedy and disturbed)			

Natural cover comments (note the dominant species from above):

1g. NATURAL DISTURBANCES / STRESSORS (Supplemental Information)

Using the tables below and the field manual, estimate the scope and severity of each natural disturbances factor within the AA or 500 m envelope. Natural disturbance factors may lead to a either a decrease or increase in wetland condition depending on wetland type. See the field manual for scope and severity (sever) ratings. If the disturbance is not noted, write a slash through the boxes.

Disturbance Factor	*AA*		*500 m*		*Comments*
	Scope	*Sever*	*Scope*	*Sever*	
Beaver presence and use					
Heavy browsing by native ungulates					
Heavy trampling, paths by native ungulates					
Beatle killed conifers					
Evidence of recent fire (< 5 yrs)					
Other:					

Natural disturbance comments:

2. *VEGETATION CONDITION METRICS – Circle the applicable letter score*

2a. RELATIVE COVER NATIVE PLANT SPECIES		
Select the statement that best describes the **relative cover of native plant species** within the AA.	>99% of vegetation cover within the AA is comprised of native species.	A
	95–99% of vegetation cover within the AA is comprised of native species.	B
	80–95% of vegetation cover within the AA is comprised of native species.	C
	50–80% of vegetation cover within the AA is comprised of native species.	D
	<50% of vegetation cover within the AA is comprised of native species.	E

2b. ABSOLUTE COVER OF NOXIOUS WEEDS		
Select the statement that best describes the **absolute cover of noxious weeds** within the AA. Refer to the Colorado Noxious Weed Lists A, B, and C for non-native invasive species.	Noxious weeds absent.	A
	Noxious weeds present, but sporadic (<3% absolute cover).	B
	Noxious weeds common (3–10% absolute cover).	C
	Noxious weeds abundant (>10% absolute cover).	D

2c. ABSOLUTE COVER OF AGGRESSIVE NATIVE SPECIES		
Select the statement that best describes the presence of **absolute cover of aggressive native species** within the AA. Specific examples include cattails *(Typha latifolia)* and giant reed grass *(Phragmites australis).*	Aggressive native species present, but sporadic (<5% absolute cover).	A
	Aggressive native species common (5–10% absolute cover).	B
	Aggressive native species abundant (10-25% absolute cover).	C
	Aggressive native species dominant (>25% absolute cover).	D

Species composition comments:

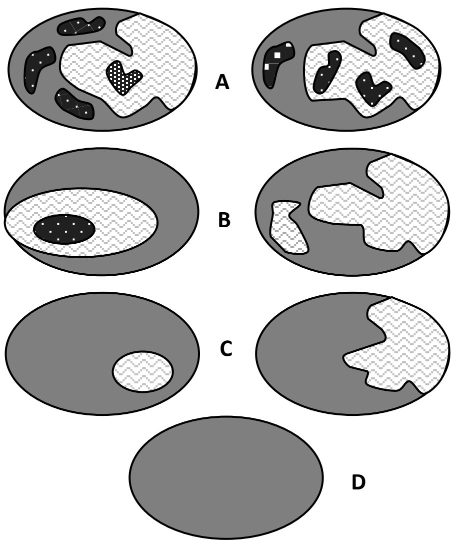
2d. REGENERATION OF NATIVE WOODY SPECIES	
Select the statement that best describes the **regeneration of native woody species** within the AA.	
All age classes of desirable (native) woody riparian species present OR woody species are naturally uncommon or absent.	A
Middle age group(s) absent. Other age classes well represented.	B
Seedlings, saplings, and middle age group(s) absent. Stand comprised of mainly mature species.	C
Woody species predominantly consist of decadent or dying individuals or AA has >5% canopy cover of Russian Olive and/or Salt Cedar.	D

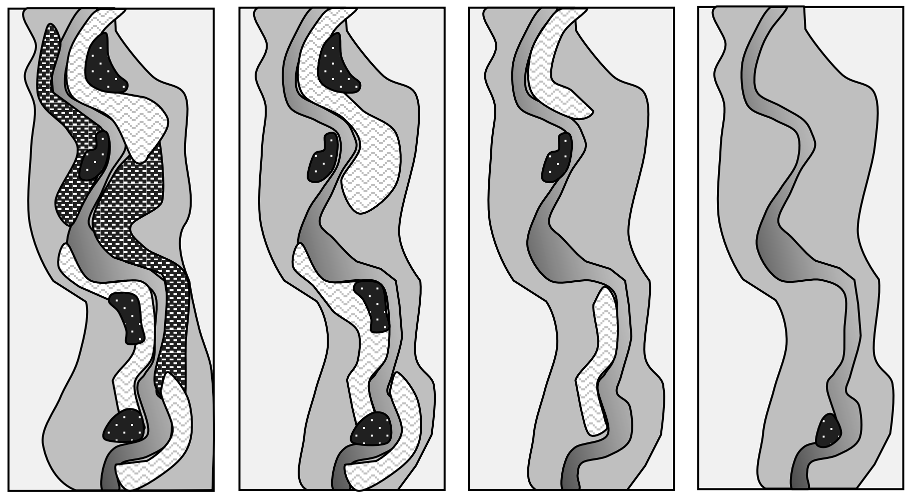
Regeneration comments:

2e. HERBACEOUS / DECIDUOUS LITTER ACCUMULATION	
Select the statement that best describes **herbaceous and/or deciduous litter accumulation** within the AA.	
AA characterized by moderate amount of fine or coarse litter. New growth is more prevalent than previous years'. Litter and duff layers in pools and topographic lows are thin. Organic matter is neither lacking nor excessive.	AB
AA characterized by small amounts of litter with little plant recruitment OR litter is somewhat excessive.	C
AA lacks litter OR litter is extensive and limiting new growth.	D

Herbaceous / deciduous litter accumulation comments:

2f. HORIZONTAL INTERSPERSION OF VEGETATION ZONES		
Refer to diagrams below and select the statement that best describes the **horizontal interspersion of vegetation zones** within the AA. Rules for defining vegetation zones are on page 14 in the field manual. Include zones of open water when evaluating interspersion.	High degree of horizontal interspersion: AA characterized by a very complex array of nested or interspersed vegetation zones with no single dominant zone.	**A**
	Moderate degree of horizontal interspersion: AA characterized by a moderate array of nested or interspersed vegetation zones with no single dominant zone.	**B**
	Low degree of horizontal interspersion: AA characterized by a simple array of nested or interspersed vegetation zones. One zone may dominate others.	**C**
	No horizontal interspersion: AA characterized by one dominant vegetation zone.	**D**





A **B** **C** **D**

Horizontal interspersion comments:

3. NON-RIVERINE HYDROLOGY METRICS – *Circle the applicable letter score*

3a. WATER SOURCES

Select the statement below that best describes the **water sources** feeding the AA during the growing season. Check off all *major* water sources in the table to the right. If the dominant water source is evident, mark it with a star.	_____ Overbank flooding _____ Alluvial storage / hyporheic flow _____ Groundwater discharge _____ Precipitation _____ Snowmelt	_____ Natural surface flow _____ Irrigation run-off / ditches _____ Urban run-off / culverts _____ Pipes (directly feeding wetland) _____ Other:

Sources are precipitation, groundwater, natural runoff, or natural flow from an adjacent freshwater body, or the AA naturally lacks water in the growing season. There is no indication that growing season conditions are controlled by artificial water sources.	**A**
Sources are mostly natural, but also obviously include occasional or small effects of modified hydrology (e.g., developed land or irrigated agricultural land that comprises less than 20% of the immediate drainage basin within about 2 km upstream of the AA, presence of a few small stormdrains or scattered homes with septic systems). No large point sources or dams control the overall hydrology.	**B**
Sources are primarily from anthropogenic sources (e.g., urban runoff, direct irrigation, pumped water, artificially impounded water, or another artificial hydrology). Indications of substantial artificial hydrology include developed or irrigated agricultural land that comprises more than 20% of the immediate drainage basin within about 2 km upstream of the AA, or the presence of major drainage point source discharges that obviously control the hydrology of the AA.	**C**
Natural sources have been eliminated based on the following indicators: impoundment of all wet season inflows, diversions of all dry-season inflows, predominance of xeric vegetation, etc.	**D**

Water source comments:

3b. HYDROLOGIC CONNECTIVITY: *NON-RIVERINE WETLANDS EXCEPT NATURALLY ISOLATED FENS*

Select the statement below that best describes **hydrologic connectivity** within the AA. *Rating criteria is different for isolated fens.*

Rising water has unrestricted access to adjacent areas without levees or other obstructions to the lateral movement of flood waters.	**A**
Unnatural features such as levees or road grades limit the amount of adjacent transition zone or the lateral movement of floodwaters, relative to what is expected for the setting, but limitations exist for <50% of the AA boundary. Restrictions may be intermittent along the margins of the AA, or they may occur only along one bank or shore.	**B**
The amount of adjacent transition zone or the lateral movement of flood waters to and from the AA is limited, relative to what is expected for the setting, by unnatural features such as levees or road grades, for 50–90% of the boundary of the AA. Flood flows may exceed the obstructions, but drainage out of the AA is probably obstructed.	**C**
The amount of adjacent transition zone or the lateral movement of flood waters is limited, relative to what is expected for the setting, by unnatural features such as levees or road grades, for >90% of the boundary of the AA.	**D**

3b. HYDROLOGIC CONNECTIVITY: *NATURALLY ISOLATED FENS*

Select the statement below that best describes **hydrologic connectivity** within the AA, *if the site is a naturally isolated fen*.

No artificial connectivity with the surrounding water bodies.	**AB**
Partial connectivity (e.g., ditching or draining to dry the fen).	**C**
Substantial to full artificial connectivity that has obvious effects of drying the peat body.	**D**

Hydrologic connectivity comments:

3c. HYDROPERIOD: *NON-RIVERINE WETLANDS*

Select the statement below that best describes the **hydroperiod** within the AA (extent and duration of inundation and/or saturation). Search the AA and 500 m envelope for indicators of altered hydroperiod. Check "Y" for all that apply and "N" for those not observed. Use best professional judgment to determine the overall condition of the hydroperiod. *Rating criteria is different for fens than for other non-riverine wetlands.*

Reduced extent and/or duration of hydroperiod	*Increased extent and/or duration of hydroperiod*
Y N	Y N
☐ ☐ Upstream spring boxes	☐ ☐ Berms
☐ ☐ Upstream impoundments and dams	☐ ☐ Dikes
☐ ☐ Pumps, diversions, ditches that move water *out* of the wetland	☐ ☐ Pumps, diversions, ditches that move water *into* the wetland
☐ ☐ Encroachment of terrestrial vegetation	☐ ☐ Late-season vitality of annual vegetation
☐ ☐ Stress or mortality of hydrophytes	☐ ☐ Recently drowned riparian vegetation
☐ ☐ Compressed or reduced plant zonation	☐ ☐ Extensive fine-grained deposits

RATING CRITERIA FOR NON-RIVERINE WETLANDS *EXCEPT FENS*		**RATING CRITERIA FOR FENS**	
Hydroperiod is characterized by natural patterns of filling or inundation and drying or drawdowns.	**A**	Hydroperiod of the site is characterized by stable, saturated hydrology or by naturally damped cycles of saturation and partial drying.	**A**
The filling or inundation patterns are of greater magnitude or duration than expected under natural conditions, but thereafter the AA is subject to natural drawdown or drying.	**B**	Hydroperiod of the site experiences minor altered inflows or drawdown/drying compared to more natural fens (e.g., minor ditching).	**B**
Hydroperiod is characterized by natural patterns of filling or inundation, but thereafter is subject to more rapid or extreme drawdown or drying compared to natural wetlands. –OR– The filling or inundation patterns are of substantially lower magnitude or duration that would be expected under natural conditions, but thereafter the AA is subject to natural drawdown or drying.	**C**	Hydroperiod of the site is somewhat altered by greater increased inflow from runoff or experiences moderate drawdown/drying compared to more natural fens (e.g., moderate ditching).	**C**
Both the inundation and drawdown of the AA deviate from natural conditions (either increased or decreased in magnitude and/or duration).	**D**	Hydroperiod of the site is greatly altered by greater increased inflow from runoff or experiences large drawdown/drying compared to more natural wetlands (e.g., severe ditching).	**D**

Non-riverine hydroperiod comments:

4. *RIVERINE HYDROLOGY METRICS (use when channel is within ~50 m)*

3a. WATER SOURCES		
Select the statement below that best describes the **water sources** feeding the AA during the growing season. Check off all *major* water sources in the table to the right. If the dominant water source is evident, mark it with a star.	_____ Overbank flooding _____ Alluvial storage / hyporheic flow _____ Groundwater discharge _____ Precipitation _____ Snowmelt	_____ Natural surface flow _____ Irrigation run-off / ditches _____ Urban run-off / culverts _____ Pipes (directly feeding wetland) _____ Other:

Sources are precipitation, groundwater, natural runoff, or natural flow from an adjacent freshwater body, or the AA naturally lacks water in the growing season. There is no indication that growing season conditions are controlled by artificial water sources.	**A**
Sources are mostly natural, but also obviously include occasional or small effects of modified hydrology (e.g., developed land or irrigated agricultural land that comprises less than 20% of the immediate drainage basin within about 2 km upstream of the AA, presence of a few small stormdrains or scattered homes with septic systems). No large point sources or dams control the overall hydrology.	**B**
Sources are primarily from anthropogenic sources (e.g., urban runoff, direct irrigation, pumped water, artificially impounded water, or another artificial hydrology). Indications of substantial artificial hydrology include developed or irrigated agricultural land that comprises more than 20% of the immediate drainage basin within about 2 km upstream of the AA, or the presence of major drainage point source discharges that obviously control the hydrology of the AA.	**C**
Natural sources have been eliminated based on the following indicators: impoundment of all wet season inflows, diversions of all dry-season inflows, predominance of xeric vegetation, etc.	**D**

Water source comments:

3b. HYDROLOGIC CONNECTIVITY: *RIVERINE WETLANDS* (ENTRENCHMENT RATIO)

Using the following worksheet, calculate the average **entrenchment ratio** for the channel. The steps should be conducted for each of three cross sections located in or adjacent to the AA at the approximate mid-points along straight riffles or glides, away from deep pools or meander bends. *Do not attempt to measure this for non-wadeable streams! Use best professional judgment to estimate entrenchment or* ***use the non-riverine criteria****.*

Steps	*Replicate cross-sections* →	*1*	*2*	*3*
1. Estimate bankfull width.	If the stream is entrenched, the height of bankfull flow is identified as a scour line, narrow bench, or the top of active point bars well below the top of apparent channel banks. If the stream is not entrenched, bankfull stage can correspond to the elevation of a broader floodplain with indicative riparian vegetation. Estimate or measure the distance between the right and left bankfull contours.			
2. Estimate max bankfull depth.	Imagine a line between right and left bankfull contours. Estimate or measure the height of the line above the thalweg (the deepest part of the channel).			
3. Estimate flood prone height.	Double the estimate of maximum bankfull depth from Step 2.			
4. Estimate flood prone width.	Imagine a level line having a height equal to the flood prone depth from Step 3. Note the location of the new height on the channel bank. Estimate the width of the channel at the flood prone height.			
5. Calculate entrenchment.	Divide the flood prone width (Step 4) by the max bankfull width (Step 1).			
6. Calculate average entrenchment	Average the results of Step 5 for all three cross-sections and enter it here.			

RATING CRITERIA FOR CONFINED RIVERINE WETLANDS		**RATING CRITERIA FOR UNCONFINED RIVERINE WETLANDS**	
Entrenchment ratio >2.0.	**A**	Entrenchment ratio >2.2.	**A**
Entrenchment ratio 1.6–2.0.	**B**	Entrenchment ratio 1.9–2.2.	**B**
Entrenchment ratio 1.2–1.5.	**C**	Entrenchment ratio 1.5–1.8.	**C**
Entrenchment ratio <1.2.	**D**	Entrenchment ratio <1.5.	**D**

Hydrologic connectivity comments:

3c. HYDROPERIOD: *RIVERINE WETLANDS* (CHANNEL STABILITY)	
Select the statement below that best describes **channel stability** within or adjacent to the AA, which provides a coarse understanding of the **hydroperiod**. To determine, visually survey the AA for field indicators of channel equilibrium, aggradation or degradation listed in the table below. Check "Y" for all that apply and "N" for those not observed. Use best professional judgment to determine the overall channel stability.	
Condition	*Field Indicators*
Indicators of Channel Equilibrium	Y N ☐ ☐ The channel (or multiple channels in braided systems) has a well-defined usual high water line or bankfull stage that is clearly indicated by an obvious floodplain, topographic bench that represents an abrupt change in the cross-sectional profile of the channel throughout most of the site. ☐ ☐ The usual high water line or bank full stage corresponds to the lower limit of riparian vascular vegetation. ☐ ☐ Leaf litter, thatch, wrack, and/or mosses exist in most pools. ☐ ☐ The channel contains embedded woody debris of the size and amount consistent with what is available in the riparian area. ☐ ☐ There is little or no active undercutting or burial of riparian vegetation. ☐ ☐ There is little evidence of recent deposition of cobble or very coarse gravel on the floodplain, although recent sandy deposits may be evident. ☐ ☐ There are no densely vegetated mid-channel bars and/or point bars. ☐ ☐ The spacing between pools in the channel tends to be 5-7 channel widths. ☐ ☐ The larger bed material supports abundant periphyton.
Indicators of Active Aggradation	☐ ☐ The channel through the site lacks a well-defined usual high water line. ☐ ☐ There is an active floodplain with fresh splays of sediment covering older soils or recent vegetation. ☐ ☐ There are partially buried tree trunks or shrubs. ☐ ☐ Cobbles and/or coarse gravels have recently been deposited on the floodplain. ☐ ☐ There is a lack of in-channel pools, their spacing is greater than 5-7 channel widths, or many pools seem to be filling with sediment. ☐ ☐ There are partially buried, or sediment-choked, culverts. ☐ ☐ Transitional or upland vegetation is encroaching into the channel throughout most of the site. ☐ ☐ The bed material is loose and mostly devoid of periphyton.
Indicators of Active Degradation	☐ ☐ The channel through the site is characterized by deeply undercut banks with exposed living roots of trees or shrubs. ☐ ☐ There are abundant bank slides or slumps, or the banks are uniformly scoured and unvegetated. ☐ ☐ Riparian vegetation declining in stature or vigor, and/or riparian trees and shrubs may be falling into channel. ☐ ☐ Abundant organic debris has accumulated on what seems to be the historical floodplain, indicating that flows no longer reach the floodplain. ☐ ☐ The channel bed appears scoured to bedrock or dense clay. ☐ ☐ The channel bed lacks fine-grained sediment. ☐ ☐ Recently active flow pathways appear to have coalesced into one channel (i.e. a previously braided system is no longer braided). ☐ ☐ There are one or more nick points along the channel, indicating headward erosion of the channel bed.

RATING CRITERIA FOR RIVERINE WETLANDS	
Most of the channel through the AA is characterized by equilibrium conditions, with little evidence of aggradation or degradation. Streambanks dominated (>90% cover) by stabilizing plant species, including trees, shrubs, herbs.	**A**
Most of the channel through the AA is characterized by some aggradation or degradation, none of which is severe, and the channel seems to be approaching an equilibrium form. Streambanks have 70–90% cover of stabilizing plant species.	**B**
There is evidence of severe aggradation or degradation of most of the channel through the AA or the channel is artificially hardened through less than half of the AA. Streambanks have 50–70% cover of stabilizing plant species.	**C**
The channel is concrete or otherwise artificially hardened through most of the AA. Streambanks have <50% cover of stabilizing plant species.	**D**
Riverine hydroperiod (channel stability) comments:	

5. *PHYSIOCHEMICAL METRICS – Circle the applicable letter score*

4a. STRUCTURAL PATCH TYPES WITHIN THE ASSESSMENT AREA

Using the following worksheet, mark all **structural patch types** that occur within or adjacent to the AA. Check "Y" for all those observed and "N" for those not observed. See the field manual for patch type definitions. For patch types present in the AA, estimate their overall cover class in the AA. Photos and comments are optional, but very helpful. *Metric rating criteria under development.*

Cover Classes 1: trace 2: <1% 3: 1–<2% 4: 2–<5% 5: 5–<10% 6: 10–<25% 7: 25–<50% 8: 50–<75% 9: 75–<95% 10: >95%

Patch type	*Present in AA? Y N*	*Cover within AA*	*Photos*	*Comments*
Open water - river / stream	☐ ☐			
Open water - tributary / secondary channel	☐ ☐			
Open water - oxbow / backwater channel	☐ ☐			
Open water - rivulets / streamlet / small channel	☐ ☐			
Open water - ditch or canal	☐ ☐			
Open water - pond or lake (>1000 m^2)	☐ ☐			
Open water - pools (<1000 m^2)	☐ ☐			
Open water - beaver pond	☐ ☐			
Active beaver dam	☐ ☐			
Beaver canal	☐ ☐			
Debris jams / woody debris in channel	☐ ☐			
Pools in stream	☐ ☐			
Riffles in stream	☐ ☐			
Point bar	☐ ☐			
Interfluve on floodplain	☐ ☐			
Bank slumps or undercut banks in channel or along shoreline	☐ ☐			
Adjacent or onsite seep / spring	☐ ☐			
Animal mounds or burrows	☐ ☐			
Mudflat	☐ ☐			
Salt flat / alkali flat	☐ ☐			
Hummock / tussock (naturally formed)	☐ ☐			
Water tracks / hollow	☐ ☐			
Floating mat	☐ ☐			
Marl / Limonite bed	☐ ☐			
Other:	☐ ☐			
Other:	☐ ☐			

Structural patch types comments:

4b. SUBSTRATE / SOIL DISTURBANCE	
Select the statement below that best describes **disturbance to the substrate or soil** within the AA.	
No bare soil OR bare soil areas are limited to naturally caused disturbances such as flood deposition or game trails OR soil is naturally bare (e.g., playas).	**A**
Some amount of bare soil present due to human causes, but the extent and impact is minimal. The depth of disturbance is limited to only a few inches and does not show evidence of ponding or channeling water. Any disturbance is likely to recover within a few years after the disturbance is removed.	**B**
Bare soil areas due to human causes are common and will be slow to recover. There may be pugging due to livestock resulting in several inches of soil disturbance. ORVs or other machinery may have left some shallow ruts. Damage is not excessive and the site will recover to potential with the removal of degrading human influences and moderate recovery times.	**C**
Bare soil areas substantially degrade the site due to altered hydrology or other long-lasting impacts. Deep ruts from ORVs or machinery may be present, or livestock pugging and/or trails are widespread. Water, if present, would be channeled or ponded. The site will not recover without restoration and/or long recovery times.	**D**
Substrate / soil comments:	

4c. WATER QUALITY - SURFACE WATER TURBIDITY / POLLUTANTS	
Select the statement that best describes the **turbidity or evidence or pollutants** in surface water within the AA.	
No visual evidence of degraded water quality. No visual evidence of turbidity or other pollutants.	**A**
Some negative water quality indicators are present, but limited to small and localized areas within the wetland. Water is slightly cloudy, but there is no obvious source of sedimentation or other pollutants.	**B**
Water is cloudy or has unnatural oil sheen, but the bottom is still visible. Sources of water quality degradation are apparent (identify in comments below). *Note: If the sheen breaks apart when you run your finger through it, it is a natural bacterial process and not water pollution.*	**C**
Water is milky and/or muddy or has unnatural oil sheen. The bottom is difficult to see. There are obvious sources of water quality degradation (identify in comments below). *Note: If the sheen breaks apart when you run your finger through it, it is a natural bacterial process and not water pollution.*	**D**
Surface water turbidity / pollutants comments:	

4d. WATER QUALITY - ALGAL GROWTH	
Select the statement that best describes **algal growth** within surface water in the AA.	
Water is clear with minimal algal growth.	**A**
Algal growth is limited to small and localized areas of the wetland. Water may have a greenish tint or cloudiness.	**B**
Algal growth occurs in moderate to large patches throughout the AA. Water may have a moderate greenish tint or sheen. Sources of water quality degradation are apparent (identify in comments below).	**C**
Algal mats are extensive, blocking light to the bottom. Water may have a strong greenish tint and the bottom is difficult to see. There are obvious sources of water quality degradation (identify in comments below).	**D**
Algal growth comments:	

APPENDIX D: Ecological Integrity Assessment (EIA) Metric Rating Criteria and Scoring Formulas for the Rio Grande National Forest

Table D1. Ecological Integrity Assessment (EIA) metric rating criteria and scoring formulas for the RGNF.

	Key Ecological Attribute	Indicator / Metric	Metric Rating Criteria				
		Rank / Score	**A / 5**	**B / 4**	**C / 3**	**D / 1 –OR– D / 2 and E / 1**	
		Interpretation	**Reference (No or Minimal Human Impact)**	**Slight Deviation from Reference**	**Moderate Deviation from Reference**	**Significant Deviation from Reference**	
LANDSCAPE CONTEXT	**Landscape Connectivity**	*1a. Landscape Fragmentation within 500 m*	Embedded in >90% unfragmented, natural landscape.	Embedded in >60–90% unfragmented, natural landscape.	Embedded in >20–60% unfragmented, natural landscape.	Embedded in ≤20% unfragmented, natural landscape.	
		1b. Riparian Corridor Continuity within 500 m[1] *RIVERINE ONLY*	>90% natural habitat upstream and downstream	>60–90% natural habitat upstream and downstream	>20–60% natural habitat upstream and downstream	≤20 natural habitat upstream and down-stream	
	Buffer	*1c. Buffer Extent*	Buffer at least 5 m wide surrounds 100% of AA	Buffer at least 5 m wide surrounds >75–<100% of AA	Buffer at least 5 m wide surrounds >50–75% of AA	Buffer at least 5 m wide surrounds >25–50% of AA	Buffer at least 5 m wide surrounds ≤25% of AA
		1d. Buffer Width	Average buffer width is >200 m	Average buffer width is >100–200 m	Average buffer width is >50–100 m	Average buffer width is ≤50 m or no buffer exists	
		1e. Buffer Condition – Vegetation	Abundant (>95%) cover native vegetation, little or no (<5%) cover of non-native plants, intact soils.	Substantial (75–95%) cover of native vegetation, low (5–25%) cover of non-native plants.	Moderate (25–50%) cover of non-native plants.	Dominant (>50%) cover of non-native plants.	
		1f. Buffer Condition – Soils	Intact soils with little-no trash, negligible intensity of human use.	Intact or moderately disrupted soils, moderate –lesser trash, OR minor intensity of human use.	Moderate-extensive soil disruption, moderate of greater amounts of trash, OR moderate intensity of human use.	Barren ground and highly compacted or disrupted soils, moderate-greater amounts of trash, moderate-greater intensity of human use, OR no buffer.	

[1] Metric used for Riverine HGM wetlands only

	Key Ecological Attribute	Indicator / Metric	Metric Rating Criteria				
		Rank / Score	A / 5	B / 4	C / 3	D / 1 –OR– D / 2 and E / 1	
		Interpretation	Reference (No or Minimal Human Impact)	Slight Deviation from Reference	Moderate Deviation from Reference	Significant or Severe Deviation from Reference	
BIOTIC CONDITION	**Community Composition**[1]	*2a. Relative Cover Native Plant Species*	Relative cover native plants > 99%	Relative cover native plants >95-99%	Relative cover native plants >80-95%	Relative cover native plants >50-80%	Relative cover native plants ≤50%
		2b. Absolute Cover Noxious Weeds	Absolute cover noxious weeds = 0%	Absolute cover noxious weeds >0-3%	Absolute cover noxious weeds >3-10%	Absolute cover noxious weeds >10% noxious	
		2c. Absolute Cover Aggressive Native Species	<10% cattail or <5% reed canary grass or giant reed grass	10-25% cattail or 5-10% reed canary grass or giant reed grass	>25-50% cattail or 10-25% reed canary grass or giant reed grass	>50% cattail or >25% reed canary grass or giant reed grass	
		2d. Mean C[2] *Riparian Areas and Fens* *Wet Meadows* *Saline Wetlands & Marshes*	 Mean C > 6.0 Mean C > 6.0 Mean C > 4.5	 Mean C > 5.5-6.0 Mean C > 5.5-6.0 Mean C > 4.0-4.5	 Mean C >5.0-5.5 Mean C >4.0-5.5 Mean C >3.0-4.0	 Mean C >4.5-5.0 Mean C >3.0-4.0 Mean C >2.0-3.0	 Mean C ≤ 4.0 Mean C ≤ 3.0 Mean C ≤ 2.0
	Community Structure	*2e. Regeneration of Native Woody Species* [3]	All age classes present (N/A if woody sp. naturally uncommon/absent)	No middle age groups, others present	No young-middle age groups, mature present	Woody sp. mainly decadent and dying or >5% cover Tamarisk or Russian Olive	
		2f. Litter Accumulation	Moderate litter and duff and organic matter, neither lacking nor excessive.		Small amounts of litter with little plant recruitment, or excessive litter.	AA lacks litter completely, or excessive litter that limits new growth.	
		2g. Structural Complexity	Horizontal structure consists of a very complex array of nested and/or interspersed, irregular biotic and abiotic patches with no single dominant patch type.	Horizontal structure consists of a moderate array of biotic and abiotic patches with no single dominant patch type.	Horizontal structure consists of a simple array of biotic and abiotic patches.	Horizontal structure consists of one dominant patch type and thus has relatively no interspersion.	

[1] All community composition metrics calculated from the vegetation data not derived from field for rank scores. Final thresholds are different from those shown on the field form.
[2] Mean C thresholds apply to specific Ecological Systems.
[3] Only applied to sites with where woody species are naturally common.

HYDROLOGIC CONDITION[1]	Indicator / Metric	Metric Rating Criteria			
	Rank / Score	A / 5	B / 4	C / 3	D / 1
	Interpretation	Reference (No or Minimal Human Impact)	Slight Deviation from Reference	Moderate Deviation from Reference	Significant Deviation from Reference
	3a. Water Source	Sources are precipitation, groundwater, natural runoff, or natural flow from an adjacent freshwater body, or the AA naturally lacks water in the growing season. There is no indication that growing season conditions are controlled by artificial water sources.	Sources are mostly natural, but also obviously include occasional or small effects of modified hydrology (e.g., developed land or irrigated agricultural land that comprises less than 20% of the immediate drainage basin within about 2 km upstream of the AA, presence of a few small storm drains or scattered homes with septic systems). No large point sources or dams control the overall hydrology.	Sources are primarily from anthropogenic sources (e.g., urban runoff, direct irrigation, pumped water, artificially impounded water, or another artificial hydrology). Indications of artificial hydrology include developed or irrigated agricultural land that comprises more than 20% of the immediate drainage basin within about 2 km upstream of the AA, or the presence of major drainage point source discharges that obviously control the hydrology.	Natural sources have been eliminated based on the following indicators: impoundment of all wet season inflows, diversions of all dry-season inflows, predominance of xeric vegetation, etc.
	3b. Hydrologic Connectivity	Rising water has unrestricted access to adjacent areas without levees or other obstructions to the lateral movement of flood waters, if stream present, not entrenched.	Unnatural features such as levees or road grades limit the lateral movement of floodwaters, relative to what is expected for the setting, but limitations exist for <50% of the AA boundary. Restrictions may be intermittent along the margins of the AA, or they may occur only along one bank or shore. If stream present, slightly entrenched.	The lateral movement of flood waters to and from the AA is limited, relative to what is expected for the setting, by unnatural features such as levees or road grades, for 50–90% of the boundary of the AA. Flood flows may exceed the obstructions, but drainage out of the AA is probably obstructed. If stream present, moderately entrenched.	The lateral movement of flood waters is limited, relative to what is expected for the setting, by unnatural features such as levees or road grades, for >90% of the boundary of the AA. If stream present, very entrenched.
	3c. Alteration to Hydroperiod *NON-RIVERINE ONLY*	Hydroperiod is characterized by natural patterns of filling or inundation and drying or drawdowns with no alterations.	Filling and drying patterns deviate slightly from natural conditions due to presence of stressors such as small ditches or diversions, berms or roads at/near grade, pugging, or minor flow additions.	Filling and drying patterns deviate moderately from natural conditions due to presence of stressors such as 1-3ft deep ditches or diversions, two lane roads, roads with culverts adequate for stream flow, moderate pugging, or moderate flow additions.	Filling and drying patterns deviate substantially from natural conditions due to high intensity alterations such as a 4-lane highway, large dikes, > 3ft diversions or ditches capable of lowering water table, large amount of fill, artificial groundwater pumping, or heavy flow additions.
	3d. Upstream Water Retention *RIVERINE ONLY*	<5% of watershed drains to water storage facility.	5–20% of watershed drains to water storage facility.	20–50% of watershed drains to water storage facility.	>50% of watershed drains to water storage facility.

[1] Hydrology metrics are different for Riverine HGM and Non-Riverine HGM wetlands.

HYDROLOGIC CONDITION[1]	*3e. Water Diversions and/or Additions* *RIVERINE ONLY*	No upstream or onsite water diversions or additions present.	Few diversions/additions present or impacts minor relative to contributing watershed size. Minor impact to local hydrology.	Many diversions/additions present or impact moderate relative to contributing watershed size. Major impact to local hydrology.	Diversions/additions very numerous or impacts high relative to contributing watershed size. Local hydrology drastically altered.
	3f. Bank Stability *RIVERINE ONLY*	Most of the channel through the AA is characterized by equilibrium conditions, with little evidence of aggradation or degradation. Streambanks dominated (>90% cover) by stabilizing plant species, including trees, shrubs, herbs.	Most of the channel through the AA is characterized by some aggradation or degradation, none of which is severe, and the channel seems to be approaching an equilibrium form. Streambanks have 70–90% cover of stabilizing plant species.	There is evidence of severe aggradation or degradation of most of the channel through the AA or the channel is artificially hardened through less than half of the AA. Streambanks have 50–70% cover of stabilizing plant species.	The channel is concrete or otherwise artificially hardened through most of the AA. Streambanks have <50% cover of stabilizing plant species.
	3g. Beaver Activity[2] *RIVERINE ONLY*	Active or recent beaver sign present. Beaver currently active within the area.	Only old beaver sign present. No evidence of recent or new beaver activity despite available food resources and habitat. (Score = 3)		No beaver sign present.

[1] Hydrology metrics are different for Riverine HGM and Non-Riverine HGM wetlands.
[2] Only applied to sites with where beaver activity is expected.

PHYSIOCHEMICAL CONDITION	*4a. Water Quality*	No visual evidence of degraded water quality. No visual evidence of turbidity or other pollutants.	Some negative water quality indicators are present, but limited to small and localized areas within the wetland. Water is slightly cloudy, but there is no obvious source of sedimentation or other pollutants.	Water is cloudy or has unnatural oil sheen (natural bacterial sheens break apart upon contact), but the bottom is still visible. Sources of water quality degradation are apparent.	Water is milky and/or muddy or has unnatural oil sheen (natural bacterial sheens break apart upon contact). The bottom is difficult to see and there are obvious sources of water quality degradation.
	4b. Algal Growth	Water is clear with minimal algal growth.	Algal growth is limited to small and localized areas of the wetland. Water may have a greenish tint or cloudiness.	Algal growth occurs in moderate to large patches throughout the AA. Water may have a moderate greenish tint or sheen. Sources of water quality degradation are apparent.	Algal mats are extensive, blocking light to the bottom. Water may have a strong greenish tint and the bottom is difficult to see. There are obvious sources of water quality degradation.
	4c. Substrate / Soil Disturbance	No apparent modifications.	Past modifications, but recovered; OR recent but minor modifications.	Recovering OR recent and moderate modifications.	Recent and severe modifications.

EIA Scoring Formulas:

Non-Riverine HGM Wetlands

Landscape Context Score: $(1a * 0.4) + ([(1c*1d)^{1/2} * (1e + 1f)/2]^{1/2} * 0.6)$

Biotic Condition Score: (2a * 0.2) + ([2b OR 2c[1]] * 0.2) + (2d * 0.4) + (2e[2] * 0.1) + (2f[2] * [0.05 OR 0.1]) + (2g[2] * [0.05 OR 0.1])

Hydrologic Condition Score: (3a * 0.2) + (3b * 0.2) + (3c * 0.6)

Physiochemistry Condition Score: (4a * 0.25) + (4b * 0.25) + (4c * 0.5)

Riverine HGM Wetlands

Landscape Context Score: $(1a * 0.1) + (1b * 0.3) + ([(1c*1d)^{1/2} * (1e + 1f)/2]^{1/2} * 0.6)$

Biotic Condition Score: (2a * 0.2) + ([2b OR 2c[1]] * 0.2) + (2d * 0.4) + (2e[2] * 0.1) + (2f[2] * [0.05 OR 0.1]) + (2g[2] * [0.05 OR 0.1])

Hydrologic Condition Score: (3a * 0.2) + (3b * 0.2) + ($[3d*3e]^{1/2}$ * 0.4) + (3f[3] *[0.1 OR 0.2]) + (3g[3] * 0.1)

Physiochemistry Condition Score: (4a * 0.25) + (4b * 0.25) + (4c * 0.5)

Overall EIA Score

(Landscape Context Score * 0.2) + (Biotic Condition Score * 0.4) + (Hydrologic Condition Score * 0.3) + (Hydrologic Condition Score * 0.1)

[1] Lowest value from 2b or 2c is used.
[2] If 2e is NA, use 0.1 for 2f and 2g weights.
[3] If 3g is NA, use 0.2 for 3f weight.

Overall Score to Rank Conversion:

A = 4.5 – 5.0
B = 3.5 – <4.5
C = 2.5 – <3.5
D = 1.0 – <2.5

APPENDIX E: List of Wetland Sites Sampled in the Rio Grande National Forest

Table E1. Location information for all wetlands sampled on the RGNF.

Site Code	Survey Date	General Location	Management Unit	County	UTM_E	UTM_N	Area (m^2)	Elevation (ft)
A1-001	8/6/2008	North Fork Pole Creek	Rio Grande National Forest	HINSDALE	280607	4189281	984	11,794
A1-002	8/7/2008	Pole Creek Headwaters	Rio Grande National Forest	HINSDALE	286459	4191993	5,091	12,658
A1-003	8/5/2008	Pole Creek	Rio Grande National Forest	HINSDALE	283788	4186078	5,639	11,334
A1-004	8/8/2008	Pole Creek	Rio Grande National Forest	HINSDALE	283518	4184841	19,258	10,975
A1-005	8/7/2008	Pole Creek Headwaters	Rio Grande National Forest	HINSDALE	285724	4191023	16,027	12,275
A1-006	8/7/2008	Pole Creek Headwaters	Rio Grande National Forest	HINSDALE	284194	4191502	1,319	12,116
A1-007	8/5/2008	Middle Fork Pole Creek	Rio Grande National Forest	SAN JUAN	280585	4188393	14,616	11,874
A1-009	8/7/2008	Pole Creek	Rio Grande National Forest	HINSDALE	283125	4188216	7,874	11,602
A1-010	8/6/2008	Middle Fork Pole Creek	Rio Grande National Forest	SAN JUAN	281466	4188682	9,364	11,465
A2-001	7/24/2008	Headwaters of Osier Creek	Rio Grande National Forest	CONEJOS	379660	4099552	5,427	10,403
A2-002	7/22/2008	Rio de los Pinos	Rio Grande National Forest	CONEJOS	374769	4098405	5,014	9,702
A2-003	7/25/2008	Osier Mountain Drainage, Toltec Creek	Rio Grande National Forest	CONEJOS	384318	4097806	4,420	10,031
A2-005	7/23/2008	Los Pinos River	Rio Grande National Forest	CONEJOS	375010	4098748	14,138	9,626
A2-007	7/26/2008	Osier Creek	Rio Grande National Forest	CONEJOS	381224	4099186	4,477	10,025
A2-008	7/23/2008	Dixie Creek	Rio Grande National Forest	CONEJOS	372638	4096501	4,085	9,891
A3-002	7/23/2008	Bennet Creek	Rio Grande National Forest	RIO GRANDE	371188	4149570	8,960	10,917
A3-003	7/22/2008	Bennet Creek	Rio Grande National Forest	RIO GRANDE	371274	4148166	5,730	11,186
A3-005	7/22/2008	Bennet Creek	Rio Grande National Forest	RIO GRANDE	371977	4148217	12,761	11,271
A3-008	7/21/2008	Bennet Creek	Rio Grande National Forest	RIO GRANDE	370991	4148606	6,923	11,039
A3-016	7/23/2008	Bennet Creek	Rio Grande National Forest	RIO GRANDE	371688	4150270	22,631	11,273
A4-001	7/25/2008	Weminuche Creek	Weminuche Wilderness Area	HINSDALE	295376	4173120	15,835	10,609
A4-002	7/24/2008	Weminuche Creek	Weminuche Wilderness Area	HINSDALE	293418	4173446	4,623	11,356
A4-003	7/25/2008	Weminuche Creek	Weminuche Wilderness Area	HINSDALE	296087	4174372	12,727	10,395
A4-005	7/23/2008	Weminuche Creek	Weminuche Wilderness Area	HINSDALE	297322	4175807	24,900	10,246
A4-008	7/23/2008	Weminuche Creek	Weminuche Wilderness Area	HINSDALE	296473	4175104	12,066	10,333
A5-001	8/7/2008	Texas Creek Headwaters	Weminuche Wilderness Area	HINSDALE	310192	4171557	6,607	11,925
A5-002	8/7/2008	Texas Creek Headwaters	Weminuche Wilderness Area	HINSDALE	309552	4171705	1,409	11,853
A5-003	8/8/2008	Bald Mountain	Weminuche Wilderness Area	MINERAL	312613	4173395	8,464	11,831
A5-004	8/5/2008	Ruby Lake	Rio Grande National Forest	MINERAL	311396	4174943	10,237	11,301

Site Code	Survey Date	General Location	Management Unit	County	UTM_E	UTM_N	Area (m^2)	Elevation (ft)
A5-005	8/6/2008	Texas Creek Headwaters	Weminuche Wilderness Area	HINSDALE	309635	4172605	14,604	11,595
A5-007	8/6/2008	Texas Creek Headwaters	Weminuche Wilderness Area	HINSDALE	308719	4172801	4,461	11,921
A5-008	8/7/2008	Texas Creek Headwaters	Weminuche Wilderness Area	MINERAL	310923	4172639	14,623	11,839
A5-010	8/7/2008	Texas Creek Headwaters	Weminuche Wilderness Area	HINSDALE	310077	4170953	8,955	12,136
A5-013	8/6/2008	Texas Creek	Weminuche Wilderness Area	HINSDALE	310249	4174890	16,959	11,065
A6-001	8/11/2008	Lake Fork Conejos River	Rio Grande National Forest	CONEJOS	367647	4130708	1,707	9,537
A6-002	8/10/2008	NE slope of Conejos Peak	Rio Grande National Forest	CONEJOS	366255	4129976	4,366	10,579
A6-004	8/10/2008	NE slope of Conejos Peak	Rio Grande National Forest	CONEJOS	363947	4130198	6,515	11,406
A6-005	8/10/2008	Lake Fork Conejos River	Rio Grande National Forest	CONEJOS	365390	4131879	10,508	9,752
A6-007	8/11/2008	Above Lake Fork Conejos River	Rio Grande National Forest	CONEJOS	363393	4132346	2,597	10,707
A6-008	8/10/2008	NE slope of Conejos Peak	Rio Grande National Forest	CONEJOS	363633	4130515	9,046	11,437
A6-011	8/11/2008	Lake Fork Conejos River	Rio Grande National Forest	CONEJOS	367746	4130156	3,757	9,537
A6-012	8/10/2008	NE slope of Conejos Peak	Rio Grande National Forest	CONEJOS	364872	4130245	3,718	11,349
B1-004	7/1/2008	Above Castor Creek	Rio Grande National Forest	SAGUACHE	378761	4190972	4,869	9,360
B3-003	8/19/2008	Drainage above Old Woman Creek	Rio Grande National Forest	SAGUACHE	372306	4187154	1,268	9,434
B3-007	8/20/2008	Tributary to Old Woman Creek	Rio Grande National Forest	SAGUACHE	371430	4182705	1,888	9,286
B6-001	7/5/2008	Pinorelosa Mountain	Rio Grande National Forest	CONEJOS	378741	4104347	9,456	10,636
B6-002	7/5/2008	Ridge above Conejos Rivers	Rio Grande National Forest	CONEJOS	382509	4110173	2,812	10,117
B6-006	7/5/2008	Pinorelosa Mountain	Rio Grande National Forest	CONEJOS	379992	4105470	7,458	10,399
B6-009	7/6/2008	Ridge above Conejos Rivers	Rio Grande National Forest	CONEJOS	381913	4107699	3,888	9,261
B6-013	7/8/2008	Conejos River	Rio Grande National Forest	CONEJOS	387562	4103642	2,378	8,477
B6-017	7/8/2008	Massey Gulch	Rio Grande National Forest	CONEJOS	386086	4101117	2,135	9,671
WC-004	8/21/2008	Willow Creek	Rio Grande National Forest	SAGUACHE	443103	4204672	12,568	9,774
21a-001	7/20/2010	Sawmill Creek Headwaters	Rio Grande National Forest	RIO GRANDE	359347	4145893	5,023	11,989
21a-009	7/23/2010	Victoria Lake	South San Juan Wilderness Area	CONEJOS	359700	4115253	2,965	11,871
21a-047	7/25/2010	Between Green Lake and Tail Lake	Sangre de Cristo Wilderness Area	SAGUACHE	450804	4200263	3,416	12,338
21a-384	7/25/2010	North Of Cottonwood Lake	Sangre de Cristo Wilderness Area	SAGUACHE	449508	4201260	2,041	12,381
21d-519	7/6/2010	Mill Creek	Rio Grande National Forest	SAGUACHE	382840	4216082	6,923	8,748
21e-937	7/12/2010	Rito Alto Creek	Sangre de Cristo Wilderness Area	SAGUACHE	440666	4216996	5,038	11,063
21g-002	7/21/2010	Between Prospect and Iron Creek	Rio Grande National Forest	CONEJOS	355528	4139901	3,572	11,496
21g-004	7/20/2010	Elephant Mountain	Rio Grande National Forest	RIO GRANDE	362360	4142249	6,666	11,389

Site Code	Survey Date	General Location	Management Unit	County	UTM_E	UTM_N	Area (m^2)	Elevation (ft)
21g-005	8/6/2010	Near Brown Lake SWA	Rio Grande National Forest	HINSDALE	302002	4183376	5,252	9,642
21g-008	8/8/2010	Goose Creek	Weminuche Wilderness Area	MINERAL	334655	4170216	3,990	9,140
21g-011	7/22/2010	East of Alverjones Lake	South San Juan Wilderness Area	CONEJOS	366839	4116770	5,663	11,193
21g-017	7/9/2010	South of Allen Creek	Rio Grande National Forest	SAGUACHE	359075	4207203	1,130	10,352
21g-023	7/21/2010	North of Iron Creek	Rio Grande National Forest	RIO GRANDE	355680	4141092	5,023	11,430
21g-025	7/10/2010	Middle Fork Saguache Creek	Rio Grande National Forest	SAGUACHE	343743	4202734	5,023	10,341
21g-028	7/19/2010	West Fork Pinos Creek	Rio Grande National Forest	RIO GRANDE	363028	4151633	2,649	10,079
21g-029	7/23/2010	South of Victoria Lake	South San Juan Wilderness Area	CONEJOS	363566	4115405	5,010	11,370
21g-030	7/11/2010	Upper Middle Fork Saguache Creek	La Garita Wilderness Area	SAGUACHE	339307	4201104	5,023	11,699
21g-031	8/7/2010	Roaring Fork Floodplain	Weminuche Wilderness Area	MINERAL	332423	4172444	5,023	10,284
21g-032	8/3/2010	Near Rio Grande Reservoir	Weminuche Wilderness Area	HINSDALE	291006	4178448	5,736	9,940
21g-034	8/5/2010	La Garita Mountains	Rio Grande National Forest	SAGUACHE	352816	4194724	3,185	10,896
21h-020	7/7/2010	Mounds Bottom	Rio Grande National Forest	SAGUACHE	360810	4220856	5,023	9,789
21h-055	7/27/2010	Cochatopa Hills	Rio Grande National Forest	SAGUACHE	366018	4233056	5,023	9,912
21h-070	8/10/2010	South Fork Rio Grande River	Rio Grande National Forest	MINERAL	347702	4163045	5,591	8,472
21h-111	7/8/2010	South of Mounds Bottom	Rio Grande National Forest	SAGUACHE	360821	4220061	5,986	9,759
21j-091	7/9/2010	South Fork of Saguache Creek	Rio Grande National Forest	SAGUACHE	354254	4206023	5,023	9,428

Table E2. Classification information for all wetlands sampled on the RGNF.

Site Code	Ecological System	HGM Class	NWI System and Class	NWI Hydrologic Regime	Soil Type
A1-001	Rocky Mountain Alpine-Montane Wet Meadow	Slope	Palustrine Emergent	Saturated	Clay/Loam
A1-002	Rocky Mountain Alpine-Montane Wet Meadow	Slope	Palustrine Emergent	Saturated	Clay/Loam
A1-003	Subalpine-Montane Riparian Shrubland	Slope	Palustrine Scrub-Shrub	Saturated	Clay/Loam
A1-004	Subalpine-Montane Riparian Shrubland	Riverine	Palustrine Scrub-Shrub	Saturated	Histic Epipedon
A1-005	Rocky Mountain Alpine-Montane Wet Meadow	Slope	Palustrine Emergent	Saturated	Histic Epipedon
A1-006	Rocky Mountain Alpine-Montane Wet Meadow	Slope	Palustrine Emergent	Saturated	Clay/Loam
A1-007	Subalpine-Montane Riparian Shrubland	Slope	Palustrine Scrub-Shrub	Saturated	Clay/Loam
A1-009	Subalpine-Montane Riparian Shrubland	Slope	Palustrine Scrub-Shrub	Saturated	Clay/Loam
A1-010	Rocky Mountain Alpine-Montane Wet Meadow	Slope	Palustrine Emergent	Saturated	Clay/Loam
A2-001	Rocky Mountain Subalpine-Montane Fen	Slope	Palustrine Emergent	Saturated	Organic
A2-002	Rocky Mountain Alpine-Montane Wet Meadow	Slope	Palustrine Emergent	Saturated	Histic Epipedon
A2-003	Rocky Mountain Alpine-Montane Wet Meadow	Slope	Palustrine Emergent	Seasonally Flooded	Clay/Loam
A2-005	Rocky Mountain Alpine-Montane Wet Meadow	Riverine	Palustrine Emergent	Seasonally Flooded	Clay/Loam
A2-007	Subalpine-Montane Riparian Shrubland	Riverine	Palustrine Scrub-Shrub	Seasonally Flooded	Clay/Loam
A2-008	Subalpine-Montane Riparian Shrubland	Riverine	Palustrine Scrub-Shrub	Saturated	Clay/Loam
A3-002	Rocky Mountain Alpine-Montane Wet Meadow	Riverine	Palustrine Emergent	Seasonally Flooded	Clay/Loam
A3-003	Subalpine-Montane Riparian Shrubland	Slope	Palustrine Scrub-Shrub	Saturated	Clay/Loam
A3-005	Rocky Mountain Subalpine-Montane Fen	Slope	Palustrine Scrub-Shrub	Saturated	Organic
A3-008	Subalpine-Montane Riparian Shrubland	Slope	Palustrine Scrub-Shrub	Saturated	Clay/Loam
A3-016	Rocky Mountain Subalpine-Montane Fen	Depressional	Palustrine Emergent	Saturated	Organic
A4-001	Subalpine-Montane Riparian Shrubland	Slope	Palustrine Scrub-Shrub	Saturated	Histic Epipedon
A4-002	Rocky Mountain Subalpine-Montane Fen	Slope	Palustrine Scrub-Shrub	Saturated	Organic
A4-003	Subalpine-Montane Riparian Shrubland	Riverine	Palustrine Scrub-Shrub	Saturated	Clay/Loam
A4-005	Subalpine-Montane Riparian Shrubland	Riverine	Palustrine Scrub-Shrub	Saturated	Histic Epipedon
A4-008	Subalpine-Montane Riparian Shrubland	Riverine	Palustrine Scrub-Shrub	Saturated	Clay/Loam
A5-001	Subalpine-Montane Riparian Shrubland	Slope	Palustrine Scrub-Shrub	Saturated	Clay/Loam
A5-002	Rocky Mountain Alpine-Montane Wet Meadow	Slope	Palustrine Emergent	Seasonally Flooded	Clay/Loam
A5-003	Subalpine-Montane Riparian Shrubland	Slope	Palustrine Scrub-Shrub	Seasonally Flooded	Clay/Loam
A5-004	Subalpine-Montane Riparian Shrubland	Riverine	Palustrine Scrub-Shrub	Saturated	Histic Epipedon
A5-005	Rocky Mountain Subalpine-Montane Fen	Slope	Palustrine Scrub-Shrub	Saturated	Organic

Site Code	Ecological System	HGM Class	NWI System and Class	NWI Hydrologic Regime	Soil Type
A5-007	Rocky Mountain Alpine-Montane Wet Meadow	Slope	Palustrine Emergent	Seasonally Flooded	Clay/Loam
A5-008	Rocky Mountain Subalpine-Montane Fen	Slope	Palustrine Emergent	Saturated	Organic
A5-010	Subalpine-Montane Riparian Shrubland	Slope	Palustrine Scrub-Shrub	Saturated	Histic Epipedon
A5-013	Rocky Mountain Alpine-Montane Wet Meadow	Riverine	Palustrine Emergent	Saturated	Clay/Loam
A6-001	Subalpine-Montane Riparian Shrubland	Riverine	Palustrine Scrub-Shrub	Seasonally Flooded	Clay/Loam
A6-002	North American Arid West Emergent Marsh	Depressional	Palustrine Emergent	Semipermanently Flooded	Clay/Loam
A6-004	Subalpine-Montane Riparian Woodland	Slope	Palustrine Forested	Saturated	Clay/Loam
A6-005	Subalpine-Montane Riparian Shrubland	Riverine	Palustrine Scrub-Shrub	Saturated	Histic Epipedon
A6-007	Rocky Mountain Subalpine-Montane Fen	Depressional	Palustrine Emergent	Saturated	Organic
A6-008	Rocky Mountain Subalpine-Montane Fen	Depressional	Palustrine Emergent	Saturated	Organic
A6-011	Subalpine-Montane Riparian Shrubland	Slope	Palustrine Scrub-Shrub	Saturated	Histic Epipedon
A6-012	Rocky Mountain Subalpine-Montane Fen	Depressional	Palustrine Emergent	Saturated	Organic
B1-004	Rocky Mountain Alpine-Montane Wet Meadow	Slope	Palustrine Emergent	Seasonally Flooded	Clay/Loam
B3-003	Rocky Mountain Alpine-Montane Wet Meadow	Slope	Palustrine Emergent	Temporarily Flooded	Clay/Loam
B3-007	Rocky Mountain Alpine-Montane Wet Meadow	Slope	Palustrine Emergent	Saturated	Clay/Loam
B6-001	Rocky Mountain Alpine-Montane Wet Meadow	Slope	Palustrine Emergent	Saturated	Clay/Loam
B6-002	Rocky Mountain Alpine-Montane Wet Meadow	Slope	Palustrine Emergent	Seasonally Flooded	Clay/Loam
B6-006	Rocky Mountain Alpine-Montane Wet Meadow	Slope	Palustrine Emergent	Seasonally Flooded	Clay/Loam
B6-009	Rocky Mountain Alpine-Montane Wet Meadow	Depressional	Palustrine Emergent	Saturated	Histic Epipedon
B6-013	Subalpine-Montane Riparian Shrubland	Riverine	Palustrine Scrub-Shrub	Seasonally Flooded	Clay/Loam
B6-017	Rocky Mountain Alpine-Montane Wet Meadow	Slope	Palustrine Emergent	Seasonally Flooded	Clay/Loam
WC-004	Rocky Mountain Subalpine-Montane Fen	Slope	Palustrine Emergent	Saturated	Organic
21a-001	Subalpine-Montane Riparian Shrubland	Slope	Palustrine Scrub-Shrub	Seasonally Flooded	Clay/Loam
21a-009	Rocky Mountain Alpine-Montane Wet Meadow	Depressional	Palustrine Emergent	Saturated	Histic Epipedon
21a-047	Rocky Mountain Alpine-Montane Wet Meadow	Slope	Palustrine Emergent	Saturated	Clay/Loam
21a-384	Rocky Mountain Alpine-Montane Wet Meadow	Slope	Palustrine Emergent	Seasonally Flooded	Clay/Loam
21d-519	Subalpine-Montane Riparian Shrubland	Riverine	Palustrine Scrub-Shrub	Temporarily Flooded	Clay/Loam
21e-937	Rocky Mountain Subalpine-Montane Fen	Riverine	Palustrine Scrub-Shrub	Saturated	Organic
21g-002	Rocky Mountain Subalpine-Montane Fen	Slope	Palustrine Emergent	Saturated	Organic
21g-004	Rocky Mountain Alpine-Montane Wet Meadow	Slope	Palustrine Emergent	Saturated	Clay/Loam
21g-005	Subalpine-Montane Riparian Shrubland	Riverine	Palustrine Scrub-Shrub	Saturated	Clay/Loam

Site Code	Ecological System	HGM Class	NWI System and Class	NWI Hydrologic Regime	Soil Type
21g-008	Subalpine-Montane Riparian Shrubland	Riverine	Palustrine Scrub-Shrub	Seasonally Flooded	Clay/Loam
21g-011	Rocky Mountain Subalpine-Montane Fen	Slope	Palustrine Emergent	Saturated	Organic
21g-017	Rocky Mountain Alpine-Montane Wet Meadow	Slope	Palustrine Emergent	Temporarily Flooded	Clay/Loam
21g-023	Rocky Mountain Subalpine-Montane Fen	Slope	Palustrine Emergent	Saturated	Organic
21g-025	Subalpine-Montane Riparian Shrubland	Riverine	Palustrine Scrub-Shrub	Seasonally Flooded	Clay/Loam
21g-028	Subalpine-Montane Riparian Shrubland	Riverine	Palustrine Scrub-Shrub	Seasonally Flooded	Clay/Loam
21g-029	Rocky Mountain Subalpine-Montane Fen	Slope	Palustrine Emergent	Saturated	Organic
21g-030	Rocky Mountain Subalpine-Montane Fen	Slope	Palustrine Scrub-Shrub	Saturated	Organic
21g-031	Subalpine-Montane Riparian Shrubland	Riverine	Palustrine Scrub-Shrub	Saturated	Histic Epipedon
21g-032	Subalpine-Montane Riparian Shrubland	Riverine	Palustrine Scrub-Shrub	Saturated	Clay/Loam
21g-034	Subalpine-Montane Riparian Shrubland	Riverine	Palustrine Scrub-Shrub	Saturated	Clay/Loam
21h-020	Rocky Mountain Alpine-Montane Wet Meadow	Slope	Palustrine Emergent	Temporarily Flooded	Clay/Loam
21h-055	Rocky Mountain Alpine-Montane Wet Meadow	Depressional	Palustrine Emergent	Seasonally Flooded	Clay/Loam
21h-070	Subalpine-Montane Riparian Woodland	Riverine	Palustrine Forested	Temporarily Flooded	Clay/Loam
21h-111	Rocky Mountain Subalpine-Montane Fen	Slope	Palustrine Scrub-Shrub	Saturated	Organic
21j-091	Subalpine-Montane Riparian Shrubland	Riverine	Palustrine Scrub-Shrub	Temporarily Flooded	Clay/Loam

Table E3. Survey design information for all wetlands sampled on the RGNF.

Site Code	Data Collection Level	Level IV Ecoregion
A1-001	Level 2	21a: Alpine Zone
A1-002	Level 2	21a: Alpine Zone
A1-003	Level 3	21a: Alpine Zone
A1-004	Level 2	21g: Volcanic Subalpine Forests
A1-005	Level 2	21a: Alpine Zone
A1-006	Level 2	21a: Alpine Zone
A1-007	Level 2	21a: Alpine Zone
A1-009	Level 2	21a: Alpine Zone
A1-010	Level 3	21a: Alpine Zone
A2-001	Level 3	21g: Volcanic Subalpine Forests
A2-002	Level 3	21g: Volcanic Subalpine Forests
A2-003	Level 2	21g: Volcanic Subalpine Forests
A2-005	Level 3	21g: Volcanic Subalpine Forests
A2-007	Level 2	21g: Volcanic Subalpine Forests
A2-008	Level 2	21g: Volcanic Subalpine Forests
A3-002	Level 2	21g: Volcanic Subalpine Forests
A3-003	Level 2	21g: Volcanic Subalpine Forests
A3-005	Level 3	21g: Volcanic Subalpine Forests
A3-008	Level 3	21g: Volcanic Subalpine Forests
A3-016	Level 3	21g: Volcanic Subalpine Forests
A4-001	Level 2	21g: Volcanic Subalpine Forests
A4-002	Level 3	21a: Alpine Zone
A4-003	Level 2	21g: Volcanic Subalpine Forests
A4-005	Level 2	21g: Volcanic Subalpine Forests
A4-008	Level 3	21g: Volcanic Subalpine Forests
A5-001	Level 2	21a: Alpine Zone
A5-002	Level 2	21a: Alpine Zone
A5-003	Level 2	21a: Alpine Zone
A5-004	Level 3	21a: Alpine Zone
A5-005	Level 2	21a: Alpine Zone
A5-007	Level 2	21a: Alpine Zone
A5-008	Level 2	21a: Alpine Zone
A5-010	Level 2	21a: Alpine Zone
A5-013	Level 2	21a: Alpine Zone
A6-001	Level 2	21g: Volcanic Subalpine Forests
A6-002	Level 2	21g: Volcanic Subalpine Forests
A6-004	Level 2	21g: Volcanic Subalpine Forests
A6-005	Level 2	21g: Volcanic Subalpine Forests
A6-007	Level 2	21g: Volcanic Subalpine Forests
A6-008	Level 2	21g: Volcanic Subalpine Forests

Site Code	Data Collection Level	Level IV Ecoregion
A6-011	Level 2	21g: Volcanic Subalpine Forests
A6-012	Level 2	21g: Volcanic Subalpine Forests
B1-004	Level 3	21d: Foothills and Shrublands
B3-003	Level 3	21d: Foothills and Shrublands
B3-007	Level 2	21d: Foothills and Shrublands
B6-001	Level 3	21g: Volcanic Subalpine Forests
B6-002	Level 3	21g: Volcanic Subalpine Forests
B6-006	Level 3	21g: Volcanic Subalpine Forests
B6-009	Level 3	21g: Volcanic Subalpine Forests
B6-013	Level 3	21g: Volcanic Subalpine Forests
B6-017	Level 3	21g: Volcanic Subalpine Forests
WC-004	Level 2	21b: Crystalline Subalpine Forests
21a-001	Level 3	21a: Alpine Zone
21a-009	Level 2	21a: Alpine Zone
21a-047	Level 3	21a: Alpine Zone
21a-384	Level 2	21a: Alpine Zone
21d-519	Level 2	21d: Foothills and Shrublands
21e-937	Level 2	21e: Sedimentary Subalpine Forests
21g-002	Level 3	21g: Volcanic Subalpine Forests
21g-004	Level 2	21g: Volcanic Subalpine Forests
21g-005	Level 3	21g: Volcanic Subalpine Forests
21g-008	Level 3	21g: Volcanic Subalpine Forests
21g-011	Level 2	21g: Volcanic Subalpine Forests
21g-017	Level 2	21g: Volcanic Subalpine Forests
21g-023	Level 2	21g: Volcanic Subalpine Forests
21g-025	Level 2	21g: Volcanic Subalpine Forests
21g-028	Level 2	21g: Volcanic Subalpine Forests
21g-029	Level 2	21g: Volcanic Subalpine Forests
21g-030	Level 2	21g: Volcanic Subalpine Forests
21g-031	Level 2	21g: Volcanic Subalpine Forests
21g-032	Level 2	21g: Volcanic Subalpine Forests
21g-034	Level 2	21g: Volcanic Subalpine Forests
21h-020	Level 3	21h: Volcanic Mid-Elevation Forests
21h-055	Level 2	21h: Volcanic Mid-Elevation Forests
21h-070	Level 2	21h: Volcanic Mid-Elevation Forests
21h-111	Level 2	21h: Volcanic Mid-Elevation Forests
21j-091	Level 2	21j: Grassland Parks

APPENDIX F: EIA Scores for Wetland Sites Sampled in the Rio Grande National Forest

Table F1. EIA category and overall scores for all wetlands sampled on the RGNF.

Site Code	Landscape Score	Landscape Rank	Biotic Score	Biotic Rank	Hydrology Score	Hydrology Rank	Physiochem Score	Physiochem Rank	Final Score	Final Rank
A1-001	5.00	A	4.70	A	5.00	A	5.00	A	4.88	A
A1-002	5.00	A	4.90	A	5.00	A	5.00	A	4.96	A
A1-003	4.68	A	4.90	A	5.00	A	4.50	B	4.85	A
A1-004	4.68	A	4.90	A	4.90	A	5.00	A	4.87	A
A1-005	4.28	B	4.80	A	5.00	A	5.00	A	4.78	A
A1-006	5.00	A	4.20	B	5.00	A	5.00	A	4.68	A
A1-007	5.00	A	4.90	A	5.00	A	5.00	A	4.96	A
A1-009	5.00	A	4.90	A	5.00	A	5.00	A	4.96	A
A1-010	5.00	A	4.90	A	5.00	A	5.00	A	4.96	A
A2-001	3.92	B	4.00	B	3.00	C	3.75	B	3.66	B
A2-002	3.88	B	3.20	C	3.00	C	4.50	B	3.41	C
A2-003	4.28	B	3.20	C	4.00	B	3.50	C	3.69	B
A2-005	3.90	B	3.70	B	3.10	C	4.25	B	3.62	B
A2-007	4.22	B	4.10	B	4.10	B	4.25	B	4.14	B
A2-008	4.68	A	4.60	A	4.20	B	4.25	B	4.46	B
A3-002	3.70	B	4.00	B	3.84	B	3.75	B	3.87	B
A3-003	3.28	C	4.70	A	4.00	B	3.50	C	4.09	B
A3-005	3.88	B	4.90	A	4.00	B	5.00	A	4.44	B
A3-008	1.60	D	4.80	A	4.00	B	4.75	A	3.92	B
A3-016	4.68	A	4.20	B	5.00	A	5.00	A	4.62	A
A4-001	5.00	A	4.90	A	5.00	A	5.00	A	4.96	A
A4-002	5.00	A	4.90	A	5.00	A	5.00	A	4.96	A
A4-003	5.00	A	4.70	A	4.60	A	5.00	A	4.76	A
A4-005	5.00	A	4.80	A	4.90	A	5.00	A	4.89	A
A4-008	5.00	A	4.70	A	5.00	A	5.00	A	4.88	A
A5-001	5.00	A	4.90	A	5.00	A	4.50	B	4.91	A

A5-002	5.00	A	4.60	A	5.00	A	4.50	B	4.79	A
A5-003	5.00	A	4.90	A	5.00	A	5.00	A	4.96	A
A5-004	5.00	A	4.90	A	3.94	B	4.75	A	4.62	A
A5-005	4.68	A	4.90	A	5.00	A	5.00	A	4.90	A
A5-007	5.00	A	4.60	A	5.00	A	4.50	B	4.79	A
A5-008	5.00	A	4.90	A	5.00	A	5.00	A	4.96	A
A5-010	5.00	A	4.80	A	5.00	A	5.00	A	4.92	A
A5-013	5.00	A	4.70	A	4.60	A	4.25	B	4.69	A
A6-001	4.60	A	3.90	B	4.30	B	4.50	B	4.22	B
A6-002	3.28	C	2.80	C	4.00	B	5.00	A	3.48	C
A6-004	3.00	C	3.80	B	3.00	C	4.00	B	3.42	C
A6-005	4.28	B	3.90	B	4.60	A	4.25	B	4.22	B
A6-007	4.28	B	3.80	B	5.00	A	5.00	A	4.38	B
A6-008	3.88	B	4.80	A	4.00	B	4.00	B	4.30	B
A6-011	3.60	B	4.40	B	5.00	A	3.50	C	4.33	B
A6-012	3.00	C	4.80	A	4.00	B	4.50	B	4.17	B
B1-004	5.00	A	3.20	C	5.00	A	5.00	A	4.28	B
B3-003	4.00	B	3.00	C	4.00	B	4.00	B	3.60	B
B3-007	3.60	B	3.20	C	5.00	A	5.00	A	4.00	B
B6-001	4.60	A	4.20	B	5.00	A	5.00	A	4.60	A
B6-002	4.00	B	3.80	B	4.00	B	4.50	B	3.97	B
B6-006	4.00	B	3.20	C	5.00	A	5.00	A	4.08	B
B6-009	5.00	A	2.80	C	4.00	B	4.50	B	3.77	B
B6-013	3.88	B	4.50	B	3.23	C	5.00	A	4.05	B
B6-017	3.92	B	3.60	B	4.00	B	4.00	B	3.82	B
WC-004	5.00	A	3.80	B	5.00	A	4.50	B	4.47	B
21a-001	4.68	A	4.95	A	5.00	A	4.10	B	4.83	A
21a-009	4.85	A	4.80	A	5.00	A	4.50	B	4.84	A
21a-047	4.85	A	4.80	A	5.00	A	4.25	B	4.81	A
21a-384	4.85	A	4.90	A	5.00	A	4.50	B	4.88	A

21d-519	4.85	A	3.75	B	4.39	B	3.00	C	4.09	B
21e-937	4.85	A	4.95	A	5.00	A	4.50	B	4.90	A
21g-002	4.45	B	4.90	A	4.80	A	4.50	B	4.74	A
21g-004	3.57	B	4.80	A	4.00	B	4.50	B	4.28	B
21g-005	4.51	A	3.90	B	4.69	A	4.50	B	4.32	B
21g-008	4.85	A	4.55	A	4.79	A	4.75	A	4.70	A
21g-011	4.85	A	4.60	A	5.00	A	4.25	B	4.73	A
21g-017	3.84	B	3.70	B	3.40	C	3.70	B	3.64	B
21g-023	4.29	B	4.70	A	3.60	B	4.00	B	4.22	B
21g-025	4.85	A	4.60	A	4.79	A	4.75	A	4.72	A
21g-028	4.49	B	5.00	A	4.50	B	5.00	A	4.75	A
21g-029	4.85	A	4.80	A	5.00	A	4.50	B	4.84	A
21g-030	5.00	A	4.95	A	5.00	A	4.25	B	4.91	A
21g-031	4.85	A	4.55	A	4.60	A	5.00	A	4.67	A
21g-032	4.85	A	4.55	A	4.59	A	5.00	A	4.67	A
21g-034	4.85	A	4.90	A	4.60	A	5.00	A	4.81	A
21h-020	4.84	A	3.60	B	5.00	A	4.00	B	4.31	B
21h-055	3.10	C	2.00	D	5.00	A	3.00	C	3.22	C
21h-070	3.98	B	3.55	B	3.39	C	5.00	A	3.73	B
21h-111	5.00	A	4.95	A	5.00	A	4.50	B	4.93	A
21j-091	4.85	A	4.35	B	4.60	A	4.00	B	4.49	B