A Riparian/Wetland Vegetation Community Classification of New Mexico: Pecos River Basin

Final Report

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A typical Rocky Mountain Montane Forested Wetland community growing on terraces in the upper reaches of the Pecos Basin near the town of Pecos, NM.

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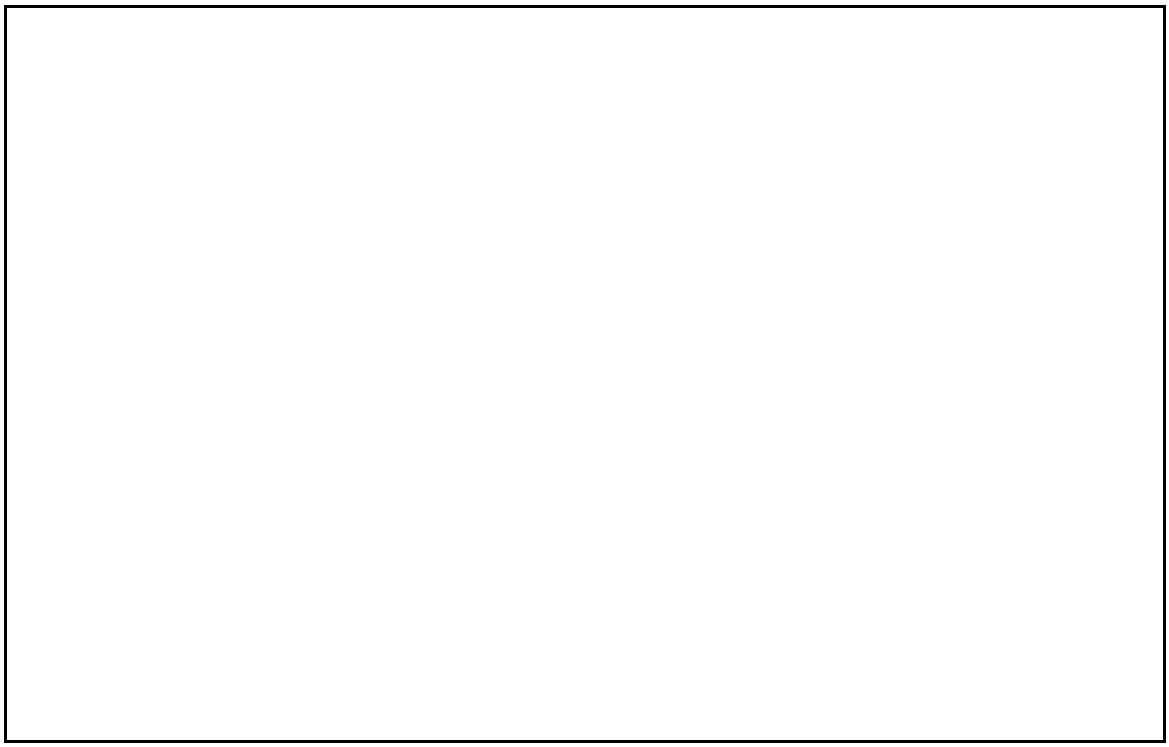

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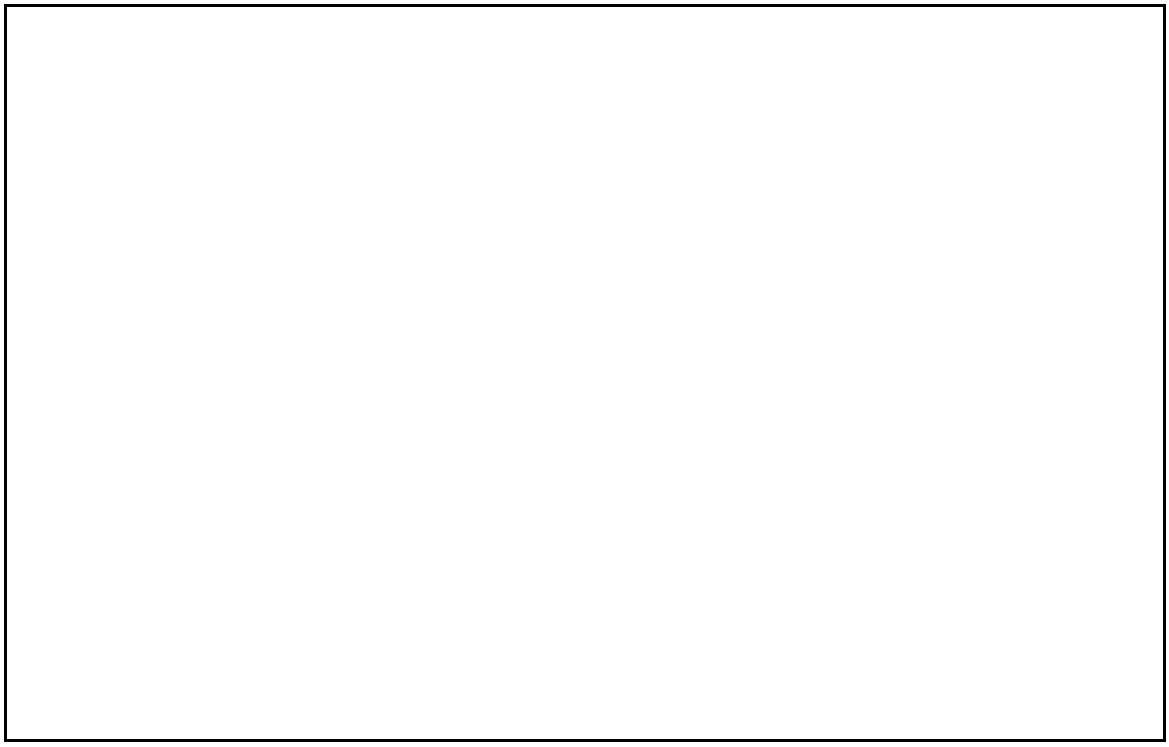

A typical Plains Scrub-Shrub Wetland community growing on side bars in the middle reach of the Pecos Basin near the town of Ft. Sumner, NM.

SUMMARY

Riparian/wetland communities are valuable for maintaining water quality and quantity, stabilizing streambanks and providing flood protection, as well as enhancing habitat for fish and wildlife (EPA 1988). These communities and their associated values are considered highly threatened in New Mexico. The New Mexico Environment Department (NMED) and the federal Environmental Protection Agency (EPA) have initiated the development of a statewide conservation plan for protecting wetlands, as recommended by the EPA's National Wetlands Policy Forum. A fundamental need identified for the plan is a comprehensive and consistent classification of riparian/wetland communities in the state to provide a framework for site inventory and assessment. The classification is preliminary and open to peer review, field testing and revision. New data collected from different basins of the state will be incorporated into the classification system.

In this final report, we present the results of the first year of work on a riparian/wetland vegetation community classification for the Pecos River Basin. A multi-level hierarchical classification system of 42 Community Types among 23 Series is based on a total of 91 riparian/wetland releve plots and 56 cross sections of the river channel and its associated geomorphic features. The classification is structured in accordance with Cowardin's (1979) Classification of Wetlands and Deepwater Habitats of the United States, and UNESCO's international physiognomic vegetation classification system (Driscoll et al. 1984; Mueller-Dombois and Ellenberg 1974). Additionally, Community Characterization Abstracts (CCA's) for each community type are presented. Each abstract contains the following information: the expected basinwide distributions of the community type, a vegetative description, the physical environmental setting, a brief discussion of site progression dynamics based on schematic models, as well as possible management opportunities and a review of documented community types from the region. We have also included a dichotomous key for field identification of the community types and a list of proposed ecologically significant and/or restorable riparian/wetland sites that will be evaluated for possible special management protection.

Also included in this report is an appended volume of data from hydraulic analyses of each cross section, as well as soil profile descriptions and their diagnostic properties, a list of the plant species of the basin and summary tables indicating frequency of species occurrence and average canopy values.

INTRODUCTION

Riparian/wetland areas, while they may occupy only a small portion of a watershed or basin, represent an extremely important ecological component of the overall landscape (Elmore and Beschta 1987). These areas are frequently flooded, or are at least seasonally saturated by a fluctuating water table, and have plant communities, soils, and topography that differ considerably from those of the adjacent uplands (Kittel 1993, Kittel and Lederer 1993). Riparian/wetland communities form a bridge between the riverine aquatic ecosystem and the adjacent uplands, and they are valuable for maintaining water quality and quantity, stabilizing streambanks and providing flood protection, as well as enhancing habitat for fish and wildlife (EPA 1988).

Riparian/wetland communities and their associated values are considered highly threatened in New Mexico. The New Mexico Environment Department (NMED) and the federal Environmental Protection Agency (EPA) have initiated the development of a wetlands protection plan for the state. A fundamental need identified for the plan is a comprehensive and consistent classification of riparian/wetland communities in the state to provide a framework for site inventory and assessment. Earlier riparian/wetland classification work in New Mexico has either been limited in geographic scope (Dick-Peddie et al. 1987; Muldavin, Sims and Johnson 1993a; Muldavin et al. 1993b), too coarse in resolution to meet many protection planning needs (National Wetlands Inventory; Fruit and Rodriguez 1993; SCS 1991), designed for specific ecosystem components (wildlife habitat of Hildebrandt and Ohmart, 1982; Hink and Ohmart 1984; Szaro 1989), or has not been quantitatively assessed (Dick-Peddie 1993). Thus, to meet NMED and EPA needs, the New Mexico Natural Heritage Program (NMNHP) has undertaken the development of a comprehensive riparian/wetlands classification, integrating, where possible, previous work, and expanding upon it with an extensive, detailed sampling effort.

To build the classification, we adopted a watershed approach in which the major basins of the state were identified and delineated for sampling and analysis -- the Pecos, Rio Grande, Gila, San Juan and Canadian river basins. A watershed approach enables us to develop a systematic understanding across the state of the diversity of riparian/wetland communities as they are influenced by basin specific hydrologic, edaphic and climatic environments. The classification is based on direct, quantitative sampling and analysis of actual vegetation that occurs along natural water courses (rivers and creeks) and associated natural bodies of water (i.e. oxbow lakes, reservoir deltas), poorly drained overflow areas, and closed basin wetlands (playas). Where possible we have integrated previous quantitative work directly into the classification framework. The classification system is also designed to be compatible with classifications of adjacent states whose goals are similarly oriented towards developing statewide conservation plans for protecting wetlands, as recommended by the EPA's National Wetlands Policy Forum.

We present below the results of the first year of work for the Pecos River Basin. Products include a preliminary hierarchical classification system for riparian/wetland community types structured in accordance with Cowardin's (1979) Classification of Wetlands and Deepwater Habitats of the United States, and UNESCO's international physiognomic vegetation classification system (Driscoll et al. 1984; Mueller-Dombois and Ellenberg 1974). Additionally, a dichotomous key, community characterization abstracts with successional trends and possible management opportunities for each community type are described. Ecologically significant and/or restorable riparian/wetland sites are also identified and will be evaluated for possible special management protection.

STUDY AREA

The study area is bounded in the northern reaches by the headwaters of the Pecos River in the Sangre de Cristo Mountains of northwestern San Miguel County and in the southern reaches by the town of Malaga of southeastern Eddy County (Figure 1). The mainstem of the Pecos River flows some 500 miles south through eastern New Mexico to Red Bluff Reservoir at the Texas border in Eddy County. The total watershed area is estimated at 15,400,960 acres or 25,450 square miles (Bureau of Reclamation 1979). Elevations within the watershed range from 13,102 ft. at Truchas Peak in the north to 2841 ft. at Red Bluff Reservoir in southeastern Eddy County.

Climatic conditions of the basin vary considerably as a result of the wide range in geography and topography along the course of the Pecos River in New Mexico. Basinwide, moist air generally moves up from the Gulf of Mexico in the spring and summer months while in winter, the main source of moisture is from the Pacific Ocean. The winter months are the driest. Mountainous regions are climatically subhumid and cool to frigid, while the southeastern plains have a semiarid, continental climate with hot summer days followed by cool nights. The upper basin receives moisture both from winter snowstorms which create extensive snowpacks, and from late summer rainstorms which are usually brief and intense. Spring runoff from the snowpack can be significant, with the potential of causing extensive flooding downstream. Snowfall is less important in the lower basin, but summer rains can have a significant impact on short-term stream flow. The lower basin receives most of its moisture from June to August. As in the upper basin, storms are brief and intense. Snowfall ranges from three to eight inches in Eddy County to 18 to 36 inches in San Miguel County. Average annual temperatures vary widely across the basin from a low of 35^0 F at Las Vegas Airport to 79^0 at Carlsbad. Annual extremes have been recorded with a low of -27^0 at Ft. Sumner in January 1963, and a high of 116^0 at Artesia in June 1916 (Houghton 1971 and 1981).

Figure 1. Map showing the general location of the study area. Highlighted are the mainstem of the Pecos River as it flows through New Mexico, and its smaller tributary basins that were sampled.

The mainstem of the Pecos River and its tributaries flow through five ecoregions as defined by Omernik (1987): the Southern Rockies in the Sangre de Cristo Mountains, the Arizona/New Mexico Plateau from Las Vegas to Santa Rosa, the Southwestern Tablelands near Ft. Sumner, the Southern Deserts from the DeBaca and Chaves county lines south to the Texas border, and the Arizona/New Mexico Mountains in the Guadalupe Mountains of southcentral New Mexico. Additionally, there are four regional biomes within these ecoregions, the Rocky Mountain Montane, Plains, Southwest, and Closed Basin. Six main tributaries were included in the study area.

We have subdivided the basin into upper, middle, and lower reaches (Figures 2, 3, and 4). The upper segment is part of the Rocky Mountain Montane Biome and includes Cow Creek and the Gallinas River as main tributaries draining the Sangre de Cristo Mountains (Figure 2). At high elevations, the river flows down through old growth sub-alpine forests of Engelmann spruce and subalpine fir, to mixed coniferous forests of Douglas fir, white fir and ponderosa pine. Blue spruces and alder grow adjacent to the channels (Muldavin 1993a). Within the lower montane reaches narrowleaf cottonwoods and willows become more prevalent. Channel gradients are relatively steep (1-2%) in these upper segments and gradually decrease towards the lower montane. The river is confined by narrow, steep canyons with large boulders and stones armoring the banks. Long runs with occasional deep pools are common and depositional floodplains are narrow. Sinuosity increases in the lower montane reaches with mid- and side-channel bars developing. Reaches with long riffles are more common and runs are shorter. There are no major diversion structures or impoundments associated with montane segments of the basin. Riparian vegetation consists largely of cottonwoods, willows, and boxelders. Pinyon pine-juniper woodlands can be found at 4500-8000 foot elevations in adjacent uplands.

The middle segment passes through the Plains Biome and includes Yeso Creek, which originates in Yeso Hills of western DeBaca County, as the main tributary (Figure 3). Plains-Mesa grasslands, the most extensive grasslands in New Mexico (Dick-Peddie 1993) merge with the pinyon pine-juniper woodlands. Mesquite shrublands may make up a large component of these grasslands. Channel gradients are relatively flat <.5%. Valley confinement is insignificant. The river is wide with bed materials consisting largely of sand covered by thin layers of silt. Sand bars and mudflats are common with low flows and braiding of the channel may occur. Banks are usually steep and bare. Wide floodplains are distinctive with decadent stands of Fremont cottonwoods. Coyote willows, seepwillows, saltcedar and Russian olives also occupy the riparian zone. Russian olives are most common in the Ft. Sumner area where dense stands can be found on banks, and side- and mid- channel bars, often intermixed with saltcedar. The density of saltcedar generally increases in the southern reaches. Impoundments are strongly associated with this segment and heavily influence riparian vegetation patterns.

Figure 2. The Upper Pecos River Basin in New Mexico. Transect locations are indicated along the mainstem, and the Cow Creek and Gallinas River tributaries.

The lower segment of the river passes through the Southwest Biome and includes two important tributaries draining the Sacramento Mountains of Lincoln County, the Rio Ruidoso and Rio Hondo (Figure 4). Additionally, the Black River, which drains out of the Guadalupe Mountains south of Carlsbad Caverns National Park, was included as representative of the southernmost extent of the Basin. Flow into the Pecos is largely intermittent and the major sources of water are from springs. The Rio Ruidoso and Rio Hondo are southwest montane streams. Channel gradients range from .4 -.6% and confinement by the valley is narrow to moderate. Bed materials are cobbly and gravelly. Depositional floodplains are somewhat narrow. Riparian vegetation consists largely of Fremont cottonwoods and Goodding's willows. As the Rio Hondo exits the mountains surface flows become intermittent. The southernmost reaches of the Pecos flow through saltcedar shrublands. Riparian vegetation patterns here have been altered and are largely influenced by human activities, primarily from the construction of large dams. The last major tributary in the study area is the Black River which flows through Chihuahuan Desert scrublands and grasslands where creosotebush, soaptree yucca, desert holly and fluffgrass dominate the upland vegetation. Channel gradients are <.5% and confinement by the valley is moderate. Bed materials are coarse-textured. Riffles are uncommon, and pools are deep and wide. The channel is frequently clogged by naturally forming dams. Depositional floodplains are narrow. Riparian vegetation consists of scattered stands of Fremont cottonwoods and Goodding's willows, Arizona walnut and netleaf hackberry, as well as bulrushes and cattails.

Figure 3. The Middle Pecos River Basin in New Mexico. Transect locations are indicated along the mainstem and Yeso Creek tributary.

Figure 4. The Lower Pecos River Basin in New Mexico. Transect locations are indicated for the mainstem, the Rio Ruidoso and Rio Hondo tributaries, the Black River and Blue Spring tributaries, as well as locations of playa cross sections.

METHODS

To understand the most critical components influencing riparian/wetland vegetation across the Pecos River Basin, vegetation sampling was designed to characterize the communities throughout the study area, and to evaluate their relationship to the hydrological regimes and soils. Vegetation and environmental data, and information on management influences were collected at each sampling site. The physiographic, edaphic, and floristic features of the sampling sites were associated to generate a riparian/wetland community type classification.

Representative Site Selection

A stratified-random approach based on the Austin and Heyligers (1989) gradsect concept was used to distribute sampling sites across the basin, and achieve a representative selection of sites. Stratification of the study area was based on the following variables, which describe much of the variability of streams in the basin:

* riparian vegetation structure and composition;
* elevation;
* hydrologic regime; and
* stream gradient.

These variables generate a well-informed site selection based not only on preliminary vegetation information, but also on the variables to which vegetation responds. Elevation influences floristics through effects on temperature and precipitation. The hydrologic regime (i.e. flood and base flow levels) imposes a strong influence on the riparian/wetland vegetation, while the stream gradient manifests a substantial impact on the hydrologic regime.

The above four variables were assessed using aerial photographic interpretation, National Wetlands Inventory (NWI) maps, Earth Data Analysis Center (EDAC) photo- interpreted water use maps, topographic maps, gauging station records, and field reconnaissance. The use of high-altitude aerial photography and NWI maps differentiate vegetation types (i.e. forested wetlands, herbaceous wetlands, saltcedar woodlands, wet barren flats, and other land-use types (i.e. farmlands). Topographic maps furnish elevations from which stream gradients may be determined. These maps also provide other important features that facilitate determination of site selection, such as landforms, relief, perennial and ephemeral streams, as well as forests and marshes.

The Pecos River and its tributaries were delineated into survey reaches of approximately two to five kilometers and classified according to stream gradient, elevation, and the hydrologic regime. A preliminary sampling pool two to three times larger than the final sample size was developed to account for possible access problems on private and public lands, and on-the-ground unsatisfactory conditions not previously detected by the preliminary assessments. Within each survey reach potential sites for field sampling were identified and categorized by structure,

gross composition, size, and condition. Final sampling site selection was structured to maximize geographic distribution, floristic variation, and stand quality.

Riparian/wetland vegetation that was drastically altered by human activity was not included in this classification. Such areas include dumping grounds, livestock holding sites, crop land, and hay meadows dominated by exotic species. Other significant sites which included exotic species (i.e. saltcedar woodlands) were included.

Environmental Data Collection

Riparian/Wetland Community Data Collection. - Prior to collecting the physical data in the field, landownership information was determined from county tax rolls, BLM land status maps, and interviews with knowledgeable individuals (i.e agency personnel). Following the determination of the final sampling sites, landowners, both public and private, were contacted for permission to access their property.

Field data was collected so as to be compatible with the data formats of the U.S. Forest Service's Terrestrial Ecosystem Survey (USFS 1992), the Bureau of Land Management's Riparian Ecological Site Inventory (NMNHP 1993), and other ongoing community classification projects of the New Mexico Natural Heritage Program. At each candidate sample site, the field team determined if the site met two criteria for sampling: 1) lack of drastic human disturbance such as cultivation, dumping of refuse, clearcut logging and mining; and 2) presence of a relatively homogeneous stand at least twice the area of the sample plot. If the site was deemed acceptable, data was collected for all of the different riparian communities present at that site.

Variables to be estimated or measured at each site include, but are not limited to:

* elevation;
* aspect (stream bearing);
* valley floor width (from topographic maps);
* valley floor gradient;
* channel width and depth;
* drainage basin area above site (from maps);
* hydrologic and geomorphic features (beaver dams, point bars, etc.);
* history of use (from landowner or manager); and
* mapped soil series and phase, where available.

Sample plots were 400 m^2 where possible, and were subjectively located in a reasonably homogeneous portion of each community so as to represent the riparian/wetland communities at the site. The shape of the plot could vary, depending on the orientation of the stand. In some cases, long stringer-type plots were used to account for the inherent narrowness of some riparian zones. The occurrence of a given riparian/wetland vegetation type may also have been less than 400 m^2; in such cases the largest possible area of occurrence was sampled. Data collected from

individual plots included, but was not limited to:

* plant species present;
* canopy cover by species and life-form (trees, shrubs, etc);
* ground cover of bare soil, litter, wood, gravel, rock, bryophyte, and non-vascular plants;
* size-class structure of trees (based on bole diameter 1.5 meters above the ground);
* age-class structure of trees (based on cores extracted);
* soil descriptions (based on one soil pit per plot);
* height above bankfull stage of channel;
* distance from bankfull stage of channel;
* landscape position (point bar, floodplain, old channel, terrace, etc.);
* signs of wildlife or domestic livestock utilization;
* signs of disturbance (flooding, fire, windthrow, logging, etc.);
* successional relationships where trends are observed;
* adjacent upland communities; and
* plot photographs of the stream reach environment featuring individual species, community types, landforms, and/or unique attributes of the stream itself.

All plants not identifiable in the field, particularly of difficult genera such as *Salix, Carex,* and *Juncus* were collected and pressed for later identification. All voucher specimens are archived at the University of New Mexico Herbarium of the Museum of Southwestern Biology.

All plant species were evaluated for their wetland indicator status following five wetland groups as defined in the 1987 Corps of Engineers Wetland Delineation Manual, and as listed in the National List of Plant Species that Occur in Wetlands: Southwest Region (Reed 1988):

* *obligate wetland plants* (OBL) occur almost always (estimated probability >99%) in wetlands, but occasionally are found in nonwetlands (estimated probability <1%);
* *facultative wetland plants* (FACW) usually occur in wetlands (estimated probability 67% to 99%), but occasionally are found in nonwetlands (estimated probability 1% to 33%);
* *facultative plants* (FAC) share an equal likelihood (estimated probability 33% to 67%) of occurring in either wetlands or nonwetlands;
* *facultative upland plants* (FACU) usually occur in nonwetlands (estimated probability 67% to 99%), but occasionally are found in wetlands (estimated probability 1% to <33%);
* *obligate upland plants* (UPL) occur almost always (estimated probability >99%) in nonwetlands.

Additionally, the Facultative Indicator categories are further defined with a positive (+)

or negative (-) sign (i.e., FACW+ or FACW-) to more specifically define the wetland status. A positive sign indicates that a species is more frequently found in wetlands of that category, whereas, a negative sign indicates that a species occurs less frequently in wetlands of that category.

***Hydrologic Data Collection*. -** One of the most important environmental influences on a riparian/wetland community is the flooding environment. To evaluate potential flows at a site, cross sections of the channel and the adjacent floodplain were surveyed using a transit level and stadia rod. The stadia rod measures elevation (relative to the transit level) to the nearest inch. Each cross section extended across the active channel and was measured at every meter. Channel substrate character and significant topographical breaks were noted. Additionally, each cross section included both the vegetation and soil plots. Fluvial landforms (island bars, side bars, and terraces) along the cross section were described. The elevations of current water surface heights, high water marks, location of flood debris, root crown heights for significant riparian species, and bank heights were measured. Stream gradients were also measured with the transit level and stadia rod. The elevations at varying points along the water's edge from upstream to downstream positions were measured and the angle of the slope determined.

Cross section data for the survey of playa lakes was modified such that the transect extended from the edge of the upland slope of the playa lake towards the bottom of the basin to standing water, but not across the entire lake.

***Soils Data Collection*. -** Soil sampling and soil profile descriptions followed guidelines established by the Soil Conservation Service's National Soils Handbook (SCS 1991). At each plot a 1 m^3 soil pit was dug and the following minimum information gathered. Soil horizon designations, horizon depth, and structure, color, texture, calcium carbonate reaction, and any hydric soil redox features (i.e. mottling and gleying). Soil samples from each horizon were collected for laboratory analysis. Salinity (EC) and pH levels for each horizon were determined. Electrical conductivity was measured from a mixed sample of the top 20 cm of soil.

All soils were evaluated for meeting the hydric soil criteria as defined by the National Technical Committee for Hydric Soils (NTCHS) to determine wetland status. Guidelines for determining hydric soil conditions were followed according to the 1987 Corps of Engineers Wetland Delineation Manual.

Data Analysis and Storage

All field data was entered into computer databases for storage and retrieval, and is accessible to all participating agencies. Selected information collected during this project will be entered into The Nature Conservancy's Biological and Conservation Data System (BCD) maintained by the New Mexico Natural Heritage Program at the University of New Mexico, Albuquerque. The New Mexico Natural Heritage Program seeks to continuously update and inventory the biological and ecological features, and biodiversity preservations of New Mexico

utilizing the BCD. This System houses descriptions of plant associations and rare plant species, information on their locations in the state, information on high quality examples of plant communities, and literature relevant to the management and protection of the biodiversity of plant communities and rare species. Information stored in the BCD is available to biologists, land managers, consultants, and any other interested party. However, the New Mexico Natural Heritage Program reserves the right to respect the confidentiality of certain data.

***Hydrologic Analysis*. -** The channel morphology of the Pecos River and its tributaries were classified following Rosgen's (1992) stream classification. Parameters used include:

* channel gradient (measured as energy slope of the water surface);
* sinuosity (ratio of channel length to valley length);
* width/depth ratio (width of bankfull stage divided bankfull depth);
* dominant particle size of bed and bank materials;
* entrenchment of channel and confinement of valley; and
* landform features, soil erodibility, and stability.

Additionally, Rosgen (1992) defines a list of physical characteristics of channels for delineation to stream sub-types. These criteria were used to further define the channel morphology of the Pecos River Basin and included: 1) riparian vegetation; 2) organic debris and/or channel blockages; 3) stream size (width); 4) flow regimen (perennial, ephemeral, subterranean, intermittent channels, streamflow variations and sources; as well as stormflow and snowmelt; 5) depositional features; and 6) meander patterns.

For all cross sections, each point (distance and elevation) was entered into the cross sectional profile analyzer computer program XSPRO (Grant et al. 1992). This produces a profile of the channel and associated landforms. Hydraulic analysis results in estimated flows through the cross section at designated stages and was conducted for each cross section. Modeling of flows required the following parameters: stream cross sectional areas, stream gradients, and a user assigned Manning's "n" channel roughness coefficient for each cross section. Manning's "n" was initially estimated using Barnes (1967). Stream gradients were calculated from field measurements. When these measurements were deemed implausible, stream gradients were determined from 7.5' topographic maps.

Modeled flows were calibrated from stage height measurements for the date of sampling of flows measured from the nearest 1993 USGS stream gauge data. For the cross sections that were located near stream gauges, Manning's "n" and the stream gradient were adjusted until the flows modeled by XSPRO and discharge from the stream gauge directly matched. Most cross sections within the study area, however, were not located near official flow gauging stations. In order to evaluate the flow dynamics at these cross sections, linear extrapolations were made between flow levels of adjacent USGS stream gauges to the point of the cross section.

Once the flows required to flood the site were calculated, flows were also estimated for specific return intervals using the recurrence probabilities calculated at New Mexico stream gauges by Waltemeyer (1986). As with the daily flows, recurrence intervals were only calculated for the sites near gauging stations and then extrapolated to cross sections not located near stream gauging stations. For the cross sections located on smaller tributary basins without stream gauging stations (Yeso Creek, Cow Creek and Box Canyon), recurrence intervals were calculated by determining the drainage basin area and the average elevation of the stream. These two variables were then imputed into Waltmeyer's (1986) equations.

Soils Analysis. - Soil analyses were performed in the field as well as in the laboratory. On-site analysis was determined for each soil horizon and included: soil texture, color, structure, consistency, percent rock fragments, size and abundance of pores and roots, and reaction to $CACO_3$. Lab analysis included pH (for all horizons) and soil conductivity (for the top 20 cm.). A soil paste (at the water saturation point of the sample) was used to make soil conductivity measurements. A 2:1 mixture of 0.01M $CaCl_2$ and the soil sample was used to determine pH. All soils were then classified to the family level according to Soil Taxonomy (Soil Survey Staff 1992).

Vegetation Analysis. - Agglomerative cluster analysis using Euclidean distance and Ward's Method was used as an initial organizational tool to define riparian/wetland community types. The program SYNTAX IV by Podani (1990) was used to generate a dendrogram of hierarchical groupings of plots with similar vegetation associates. Plots were then sorted using synthesis stand tables into final vegetation community type groups following procedures outlined in Mueller-Dombois and Ellenberg (1974). Hydrological, soil and other site characteristics were then correlated to community types. Summary tables were produced which average the species values among all plots within a community type. These summary values provide the quantitative basis for the development of community type descriptions. Full descriptions were developed for each community type which include sections on distribution, vegetation, environmental setting, adjacent vegetation, a discussion of ecological dynamics, and relevant documentation. With this data, plant communities can then be constructed and organized into a vegetation classification scheme.

Classification Scheme

The Community Types are organized in a multi-level hierarchical and open-ended system that allows for expansion, contraction, or transference of community types as additional data is accumulated. The system is based on existing, natural vegetation which is structured as follows:

I. Class -- major physiognomic type and the highest level; second level of the Cowardin (1979) classification, and top level of UNESCO (Driscoll et al. 1984).

II. Zone -- moisture and temperature defined sub-classes; similar to Brown, Lowe and Pace's (1979) Climatic Zone.

III. Regional Biome -- biogeographically related Series Groups; similar to Brown, Lowe and Pase's (1979) Biome.

IV. Series Group -- the dominant plant communities within the same biome, zone, and class related by equivalent sets of morphological, environmental or floristically related series; commonly equivalent to the Cowardin (1979) Sub-class and the UNESCO Formation (Driscoll et al. 1984).

V. Series -- sets of Community Types related by at least a common dominant; equivalent to the Dominance Types of Cowardin (1979) and patterned after Daubenmire (1968).

VI. Community Type -- fundamental repeated assemblages of species; synonymous with plant association.

VII. Phase -- floristic variants of Community Types -- Typic Phase refers to the modal species composition of the Community Type.

The classification has been directly cross-referenced with the UNESCO Physiognomic-Ecological Classification of Plant Formations of the Earth (Mueller-Dombois and Ellenberg 1974; Driscoll et al. 1984) and Cowardin's (1979) Classification of Wetlands and Deepwater Habitats of the United States. The UNESCO system is currently used by Natural Heritage Programs throughout the United States as a basis for regional, national and international comparisons. This hierarchial system uses physiognomy and environmental factors to distinguish vegetation units. The relationship of the UNESCO classification is structured as follows:

UNESCO (1974) Classification System

I,II, . . . Class (physiognomic type: i.e., aquatic plant formations)
A,B, . . . Subclass (reed-swamps of flowing water)
1,2, . . . Group (i.e. temperate vs. tropical)
a,b, . . . Subgroup (i.e., reed-swamps on river banks)

The Cowardin (1979) Classification was adopted by the U.S. Fish and Wildlife Service for use in its National Wetland Inventory. The hierarchical levels of this classification are as follows:

COWARDIN'S (1979) Classification System

I, . . . Persistent-Emergent Wetlands Class (Palustrine System)
A, . . . Persistent Subclass
1, . . . Dominance Type
a, . . . Dominance Type

Essential to a riparian classification is the consideration of natural fluvial disturbances. This classification, as in others (Kittel and Lederer 1993, Kittel 1993, Muldavin et al. 1993a, Hansen et al. 1990, and Padgett et al. 1989), considers riparian vegetation communities to be either relatively stable, or at least to be predictable assemblages that are dependent on the fluvial dynamics of a river system for long-term maintenance and regeneration. This complex process of riparian ecosystem development has been referred to as "site progression" by Leonard et al. (1992) and is a critical process in the maintenance and growth of these communities. Where possible, we have made a preliminary evaluation of dynamic status of each community type in terms of successional or stage of site progression, and have developed general concepts and models of riparian/wetland community dynamics along each major reach.

Determination of Ecologically Significant/Restorable Sites

To aid in the development of a wetlands protection plan for New Mexico, a list of the most current significant and/or restorable sites in the Pecos Basin was developed. The New Mexico Natural Heritage Program is responsible for gathering and updating features of natural biodiversity in New Mexico and has developed a ranking system for significant natural features. Each of these significant natural features (species and community types) is an element of natural diversity, or simply an element. Each element is assigned a global and state rank that indicate its relative rarity on a five-point scale (i.e., 1 = extremely rare vs. 5 = abundant). Elemental occurrences are graded in terms of the quality (size, vigor, etc.) of the population or community

type, the condition (naturalness) of the habitat, the long-term viability (regeneration in different age classes) of the population or community type, and the defensibility (ease or difficulty of protecting) of the occurrence.

Best examples of ecologically significant riparian/wetland areas found in the Pecos River Basin are proposed as those that have high-quality plant communities and are examples of "A" or "B+" ecosystems. They must be in good to excellent condition, be one of the largest or best known examples, occur along hydrologically intact rivers or streams (i.e., without major alteration such as large upstream dams, close proximity to downstream dams, or subject to channelization), show signs of continued existence, such as regeneration, and must be defensible from negative human impacts. These ecologically significant sites are valuable as reference areas for long-term research and comparison with impacted areas.

Ecologically restorable sites are those that may be impacted by human or domestic livestock, but still occur along intact fluvial systems. Their elemental rank may be marginally graded ("C") at the present time, yet may potentially be restored and upgraded to a "B" ranking upon removal of certain detrimental impacts (i.e. heavy grazing pressures, hydrological modifications).

RESULTS

Riparian/Wetland Hydrology

A total of 56 cross sections in the Pecos River Basin were sampled during 1992 and 1993. This includes 34 cross sections of the mainstem (eight from 1992), 15 cross sections of tributary basins, and seven cross sections of closed basin wetlands. The locations of the cross sections are shown in Figures 2, 3, and 4. Each cross section and associated hydraulic analysis is presented in Data Addendum 1. Included is a cross sectional diagram and estimated flows for designated stage heights in the floodplain.

Flows on the Upper Pecos. **-** In the upper Pecos River above the confluence of the Gallinas River, the estimated stream flow equivalent to the magnitude of a two-year flood ranged from 592 cfs to 695 cfs. During the 1993 sample year a flow equivalent to a five-year flood occurred on most of the sample transects averaging 983 cfs. Flooding was mostly due to spring snowmelt and, therefore, high flows were sustained for several days. Evidence of recent flooding was most prominent at Pecos4 and Pecos9 with scouring of bars and the accumulation of large-sized debris. Most cross sections, however, showed little effect from the recent flood. Cross sections below the confluence of the Gallinas River and above Santa Rosa Dam (Pecos14 and Pecos20) are subject to flash floods from summer monsoonal thunderstorms. Pecos14, for example, showed large amounts of debris from a 2000 cfs flood that occurred during one-day in August. On the same day in August, Pecos20, which is located about 15 miles north of Pecos14, had a one day flow of 1320 cfs. These flows are estimated to occur at two-year intervals (Waltemeyer 1986).

Cow Creek and the Gallinas River are two major tributaries of the upper Pecos. Cow Creek remains unregulated except for a few overflow dams. A 100-year flood on Cow Creek may be of the magnitude of 2000 cfs. However, not all flows are unregulated in the upper Pecos watershed. The Gallinas River has been impounded north of Las Vegas at Storrie Lake. Under natural conditions, the upper Gallinas would flood during the spring with two-year flows estimated at 621 cfs and 100 year flows estimated at 10,500 cfs. The lower Gallinas would flood in the spring and summer with two-year flows estimated at 3440 cfs and 100-year flows estimated at 27,000 cfs (Waltemeyer 1986).

Flows on the Middle Pecos. **-** Within the middle segment of the Pecos River, flows are regulated by large reservoirs. Impounded in 1981, Santa Rosa Lake is the largest and most recent of all the reservoirs in the Pecos basin. Except for a few diversion and overflow dams, flow above this reservoir remains relatively natural. Storage in Santa Rosa Lake is allotted for sediment control, flood control, and irrigation. Because of its large size, it is a popular recreational area. Fort Sumner Dam is about 25 miles south of Santa Rosa Dam. Impounded in 1937, it is used for irrigation and recreation. Sediment accumulation in Sumner Lake has reportedly drastically reduced its storage capacity (Bureau of Reclamation 1979).

Even though these dams regulate flows into Eddy County, flooding can still occur along the Pecos due to summer thunderstorms. Flows from local tributaries can make significant contributions to the Pecos. On July 15, 1993, for example, a 940 cfs contribution to the Pecos was recorded. The gauge near Roswell recorded an average flow of 2030 cfs on that date, while the gauge downstream of Fort Sumner Dam recorded an average discharge of 1090 cfs. A flood of 2030 cfs probably occurs every other year (Waltemeyer 1986). Yeso Creek is an important tributary of the middle segment of the Pecos and drains a large area (314 mi^2) west of the Pecos River. Yeso Creek remains unregulated and contributes to the Pecos during heavy summer thunderstorms. Because of its relatively large drainage basin, a 100-year flood on Yeso Creek may be of the magnitude of 13,000 cfs.

In the absence of these reservoirs, flows on the Pecos would be very different. Under unregulated conditions, flows between 3000 cfs and 10,000 cfs would occur approximately every two years (Waltemeyer 1986). Not only would floods be bigger (on the order of 81,700 cfs every 100 years) but they would also have significantly larger sediment loads.

Flows on the Lower Pecos. **-** Flows on the lower Pecos are regulated by three reservoirs. Impounded in 1894, Lake McMillan (located north of Carlsbad) is the oldest reservoir in the Pecos Basin. Sediment accumulation in Lake McMillan has reportedly reduced its storage capacity by 60% (Bureau of Reclamation 1979). Just south of Lake McMillan, is Lake Avalon, which is the smallest of the seven reservoirs found in the Pecos Basin. Below Lake Avalon is Red Bluff Reservoir which is the second largest reservoir on the Pecos. It regulates flows into Texas and is reportedly an important power source. On the Rio Hondo, Two Rivers Reservoir has a larger storage capacity than Fort Sumner Dam, but it stores water only during high flows and is used primarily for flood control and sediment retention. Under these regulated conditions, peak flows such as the 648 cfs for 1993 are representative of current conditions along the lower Pecos. Under natural conditions flows would be considerably greater with yearly flooding events reaching 3000 cfs and 100-year events at 109,000 cfs.

Tributaries on the lower segment of the Pecos include the Rio Hondo (a combination of Rio Bonito and Rio Ruidoso) and the Black River. Near Roswell, the Rio Hondo becomes intermittent and contributes flows to the Pecos during the spring or during heavy summer thunderstorms. Estimated two-year flows for the Rio Hondo are 36 cfs, and 1580 cfs for 100-year flows (Waltemeyer 1986). The Rio Ruidoso and the upper reaches of the Rio Hondo can experience sustained floods during the spring. Two-year flows for this area are estimated to be 234 cfs, and 1780 cfs for 100-year flows (Waltemeyer 1986). The Black River originates in the foothills of the Guadalupe Mountains. Its main source of water is from summer thunderstorms and inputs from Blue Spring. The Black River remains unregulated and is subject to summer flash floods. A 100-year flood on the Black River may reach 13,200 cfs (Waltemeyer 1986).

Effects of Regulated Flows. **-** The effects of regulated flows on riparian ecosystems in the Southwest was investigated by Fenner et.al (1985) and Stromberg et.al (1991). It is

hypothesized that channel entrenchment can occur under sustained low flows resulting in the absence of lateral channel migration. Also, flows released from dams tend to be sediment free. Accumulation of sediment and debris on side bars and on the floodplain during high flows is an important step in riparian succession. In addition, obligate riparian vegetation depends on seasonal flooding. Cottonwood seeds, because of their short viability, depend on the winter/spring flood to germinate. In the absence of these flows, they will not regenerate (Fenner et.al 1985). The lack of high flows and channel entrenchment are evident along the regulated middle and lower segments of the Pecos (see cross sections Pecos13, Pecos15-19, and Pecos21-26 in Data Addendum 1). As will be detailed below under the vegetation descriptions, this has resulted in significant alteration of the extent, character, and condition of the natural riparian/wetland communities along these reaches.

Riparian/Wetland Soils

Soils of the Pecos River Basin develop and are classified according to the environmental influences to which these soils are subjected. Alluvial soils found on bars, terraces and the vast floodplains of the basin are influenced mainly by erosive and depositional forces of the river. These are relatively young soils and are classified as Entisols and Inceptisols. The soils of playas are also subject to periodic inundation by precipitation and upland runoff. An impermeable clay layer prevents infiltration and water is lost by evapotranspiration (Mehlhop et al. 1994). The majority of closed basin soils were classified as Vertisols bordered by Aridisols. Data Addendum 2 provides complete soil profile descriptions for each plot and its community type. Data Addendum 3 summarizes diagnostic properties of soils classified in the Pecos River Basin. It is designed as an aid or quick-reference guide of the soils as they are presented in the riparian/wetland vegetation community descriptions.

The main diagnostic difference between Entisols and Inceptisols is that Inceptisols display some soil development. Flooding occurs infrequently and likely corresponds to 100 year return intervals. Inceptisols are found on the highest terraces. Their development is usually in the form of an ochric surface horizon and/or a cambic sub-surface horizon. The ochric horizon has very little organic material and, therefore, it is light in color. It displays some eluvial (leaching) characteristics. Alternatively, cambic horizons show some physical and chemical alteration. Frost, roots and animal activity mix soil particles and alter the original rock structure. Because Inceptisols have a moderate moisture regime, clays, sesquioxides, and carbonates are often leached out of the horizon. Slight pedogenesis occurs as the result of these alterations, but not because of illuviation (Soil Survey Staff 1988).

The majority of the soils were classified as Entisols. Entisols are newly deposited soils that show little physical alteration from weathering or other chemical and physical processes (Buol et al. 1973). Some Entisols may have an ochric epipedon but because of their young character, they have little or no soil structure and do not form pedogenic horizons (Soil Survey Staff 1988). Entisols are found on the lowest terraces, bars and floodplains, as well as in areas of

active erosion (Soil Survey Staff 1988). Because Entisols have no diagnostic surface and subsurface horizons, there are several different suborders, great groups, and subgroups.

Most of the soils collected on the playas were classified as Vertisols. Development of these soils is influenced by changes in the moisture regime (fluctuating water levels). They are fine-textured soils where shrinking and swelling properties often cause the surface of the soil to undulate (termed gilgai). When the soil dries and shrinks, deep cracks develop and a constant mixing of soil minerals occurs as the fine topsoil falls into the cracks. The deep cracks allow water to infiltrate the soil profile, and the soil remoistens and swells (Soil Survey Staff 1988). Organic matter content of Vertisols is low. Their mineralogy is predominantly montmorillonitic. They are alkaline, thermic, and generally have low salinity levels. Discharge of water is primarily through evapotranspiration. Leaching occurs but is extremely slow due to the high clay content. The primary origin of these soils is believed to be either eolian deposits and/or upland surface runoff (Gile et al. 1981).

Aridisols generally border the playas. They are drier and tend to have higher salinity levels than other soils, unless they are irrigated. They are mineral soils with a xeric moisture regime. The water available for plant growth is low due either to tension, salinity or both. Vegetation is usually sparse and those species that are present are adaptive to xeric and/or saline conditions, such as mesquite (*Prosopis glandulosa*) and saltbush (*Atriplex canescens*). Absorption of water in these soils is slow and most of the precipitation runs off. Pedogenic horizons develop in these soils because they are not exposed to the same disturbances (mainly flooding) as Vertisols and Entisols (Soil Survey Staff 1988).

Riparian/Wetland Vegetation Classification

The classification of vegetation communities of the Pecos River Basin is based on a total of 91 riparian/wetland releve plots from 56 cross sections. We have identified 42 Community Types (CT's) among 23 Series for the basin that fall within a hierarchal stratification of three physiognomic classes, two climatic zones, four regional biomes, and several series groups. Table 1 (page 28) provides an overview of the classification with emphasis on the upper levels of the hierarchy. Detailed descriptions of individual community types are provided in Appendix 1 as Community Characterization Abstracts (CCA's). CCA's provide the essential information necessary for inventorying and evaluation of individual riparian/wetland community occurrences. A diagnostic key of riparian/wetland community types of the Pecos Basin follows the CCA's in Appendix 2. The key is provided for field classification of the community types. Full plant species lists for the Pecos Basin with scientific and common names, and a six-letter acronym code for data collected in 1992, 1993, and for playa lakes are presented in Data Addendum 4. Summary tables presented in Data Addendum 5 provide frequencies of species occurrences and average percent canopy cover values of dominant and other frequently encountered plant species for the designated CT.

***Forested Wetlands*. -** Forested Wetlands of the Pecos Basin are communities dominated by single- or multi-stemmed trees that are generally five meters in height or greater, with closed or open multi-layered canopies. Forested wetlands are further subdivided into the more northern cold temperate Forest with cold to frigid winters, and the southern warm temperate Forest with more mild winters and warmer growing seasons. Within the cold temperate sub-class there are two regional biomes identified, Rocky Mountain Montane Forests and Plains Forests. Within the warm temperate sub-class there is one regional biome identified, the Southwest Forests.

Rocky Mountain Montane Forested Wetlands are found in the Sangre de Cristo, Santa Fe and Sacramento Mountains and are widely distributed in other mountainous regions of the state. These forests are floristically aligned with other wetland forests of the Rocky Mountains stretching from New Mexico to Canada and the boreal regions of the Northern Hemisphere. They can commonly be found along relatively steep gradient channels in the upper reaches of the watershed where the channel is well confined. These wetlands consist of two series groups: needle-leaved evergreen forests of upper elevations (7000-9000 ft.) and broad-leaved deciduous forests of lower elevations (4800-7000 ft.). The Needle-Leaved Evergreen Series Group is represented by the *Picea pungens* (blue spruce) Series composed of two CT's. These forests are found directly adjacent to the active channel. Under less confined conditions, they can occur on depositional bars and terraces. The Broad-Leaved Deciduous Series Group is represented by the *Acer negundo* (boxelder) Series containing two CT's and the *Populus angustifolia* (narrowleaf cottonwood) Series with three CT's. These forests occur most commonly on depositional bars and terraces in moderately confined to unconfined channels with moderate gradients. Canopies are usually closed, multi-layered and diverse. Common tree associates of the *Picea pungens* (blue spruce) Series include *Pseudotsuga menziesii* (Douglas fir) and *Abies concolor* (white fir); shrubs include *Alnus oblongifolia* (New Mexico alder), *Salix irrorata* (bluestem willow), *Cornus stolonifera* (redosier dogwood), *Lonicera involucrata* (bearberry honeysuckle), *Juniperus communis* (dwarf juniper). Common forbs include *Heracleum lanatum* (common cowparsnip), *Aconitum columbianum* (Columbian monkshood) and *Smilacina stellata* (starry false solomonseal); grasses include *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (timothy), *Agrostis stolonifera* (bentgrass) and *Dactylis glomerata* (orchardgrass). Common tree associates of the *Acer negundo* (boxelder) Series and *Populus angustifolia* (narrowleaf cottonwood) Series may include *Populus fremontii* (Fremont cottonwood) and *Pinus ponderosa* (ponderosa pine); shrubs include *Salix exigua* (coyote willow), *Rosa woodsii* (Wood's rose) and *Juniperus scopulorum* (Rocky Mountain juniper). Common forbs include *Equisetum laevigatum* (smooth horsetail), *Clematis ligusticifolia* (western virginsbower) and *Achillea millefolium* (common yarrow); graminoids include *Elymus canadensis* (Canada wildrye), *Festuca pratensis* (meadow fescue) and *Juncus balticus* (Baltic rush).

Plains Forested Wetlands are less diverse and occur in the Southern Great Plains of eastern New Mexico primarily along the middle reach of the Pecos River. They occur at elevations ranging between 3500-4800 feet on bars and terraces of wide floodplains. Floristically, these forests are related to communities further to the east and into the midwest

(although there are some Rocky Mountain elements). In the Pecos, Plains forested wetlands are composed of a single series group, the Broad-Leaved Deciduous Series Group, which is represented by the *Populus fremontii* (Fremont cottonwood) Series. Four CT's have been identified for this series with two significant exotic phases dominated by *Tamarix pentandra* (saltcedar). Canopies are open and multi-layered, but not well developed. Common shrub associates include *Salix amygdaloides* (peachleaf willow), *Salix exigua* (coyote willow), *Baccharis emoryi* (seepwillow) and the exotic *Elaeagnus angustifolia* (Russian olive). Forbs include *Melilotus alba* (sweet clover), *Gaillardia pulchella* (indianblanket), *Equisetum arvense* (field horsetail) and *Evolvulus sericeus* (morning glory). Graminoids are more abundant and include *Sporobolus airoides* (alkali sacaton), *Sporobolus contractus* (spike dropseed), *Sporobolus cryptandrus* (sand dropseed), *Cenchrus incertus* (field sandbur), *Bothriochloa saccharoides* (silver sourgrass) and *Panicum obtusum* (vine mesquite).

Warm temperate Southwest Forested Wetlands occur in the southernmost tributaries of the basin with elevations ranging between 3240-5320 feet. These forests are considered southwestern because they contain regional southwestern endemics and elements from the Sierra Madre Mts. and Chihuahuan Desert of Mexico. They are common to depositional side bars and terraces of moderately confined to unconfined channels of low gradients. These broad-leaved deciduous forests are represented by two series: the *Celtis reticulata* (netleaf hackberry) Series with two CT's and the (*Populus fremontii*) Series with one CT. Canopies may be open or closed with well developed understories. Common tree associates of these forests are *Salix gooddingii* (Goodding's willow) and *Juglans major* (Arizona walnut); shrubs include *Rhus microphylla* (littleleaf sumac), *Chilopsis linearis* (desert willow), *Juglans microcarpa* (river walnut) and *Berberis trifoliolata* (agarito barberry). Common forbs include *Marrubium vulgare* (common hoarhound), *Mirabilis longiflorus* (sweet four o'clock), *Hydrocotyl verticillata* (whorled pennywort) and *Phyla lanceolata* (northern frog fruit).

Scrub-Shrub Wetlands. - Scrub-Shrub Wetlands of the Pecos River Basin are communities dominated by woody and usually multi-stemmed shrubs that are generally less than five meters in height, and commonly characterized by closed canopies, or, if open, are interspersed with individual trees, and perennial or annual graminoids and forbs. As with Forested Wetlands, Scrub-Shrub Wetlands are further subdivided into biogeographical provinces of the Rocky Mountain Montane Shrublands and Closed Basin Shrublands of cold temperate climates, and warm temperate Southwest Shrublands (see Forested Wetlands above).

Rocky Mountain Montane Scrub-Shrub Wetlands, like their forested counterparts, are distributed in mountainous regions of the state. In the Pecos Basin, these wetlands consist of the Broad-Leaved Deciduous Series Group represented by the *Alnus oblongifolia* (New Mexico alder) Series with three CT's and the *Salix exigua* (coyote willow) Series one CT. Some shrubs particularly *Alnus oblongifolia* may reach sub-canopy heights of the tree layer and may on occasion be single-trunked. Canopies are usually closed and multi-layered. These shrublands are well-developed and diverse communities that are commonly located adjacent to the channel, where the channel is confined, or on narrow depositional bars and infilled overflow channels.

Common shrub associates of the *Alnus oblongifolia* (New Mexico alder) Series include *Cornus stolonifera* (redosier dogwood), *Salix irrorata* (bluestem willow), *Symphoricarpos oreophilus* (mountain snowberry), *Prunus virginiana* (common chokecherry) and *Ribes inerme* (whitestem currant). Forbs include *Prunella vulgaris* (common selfheal), *Sidalcea candida* (white checkermallow), *Heracleum lanatum* (common cowparsnip) and occasionally *Dodecatheon pulchellum* (shooting star) and *Habenaria hyperborea* (northern bog orchid); graminoids include *Glyceria striata* (fowl mannagrass), *Calamagrostis canadensis* (Canada reedgrass), *Elymus canadensis* (Canada wildrye), *Carex microptera* (smallwing sedge) and *Juncus balticus* (Baltic rush). Common shrub associates of the *Salix exigua* (coyote willow) Series include *Juniperus scopulorum* (Rocky Mountain juniper) and *Rosa woodsii* (Wood's rose). Occasionally young cottonwood, both *Populus fremontii* (Fremont cottonwood) and *Populus angustifolia* (narrowleaf cottonwood) may be present. Common forbs include *Aster foliaceus* (leafybract aster), *Rudbeckia laciniata* (cutleaf coneflower), while graminoids include *Agropyron repens* (quackgrass), *Poa pratensis* (Kentucky bluegrass) and *Agrostis stolonifera* (carpet bentgrass).

Closed Basin Scrub-Shrub Wetlands occur in the Southern Great Plains of eastern New Mexico in enclosed basins where they occupy the margins of playa lakes. These wetlands consist of the Needle-Leaved Deciduous Series Group represented by the exotic *Tamarix pentandra* (saltcedar) Series with two CT's. They are usually closed canopied and not well developed in other layers. Common forb associates include *Cressa truxillensis* (cressa), *Hoffmanseggia densiflora* (rushpea), *Ratibida tagetes* (prairie coneflower) and *Solanum elaeagnifolium* (silverleaf nightshade). Graminoids include *Buchloe dactyloides* (buffalograss), *Sporobolus airoides* (alkali sacaton), *Distichlis stricta* (inland saltgrass) and *Chloris cucullata* (hooded windmillgrass).

Warm temperate Southwest Scrub-Shrub Wetlands have Madrean/Southwest floristic affinities similar to their forested counterparts, and occur in the southernmost tributaries, as well as in the middle and lower reaches of the mainstem of the Pecos. These wetlands consist of two series groups: the Broad-Leaved Deciduous Series Group represented by the *Baccharis emoryi* (seepwillow) Series with two CT's and the *Salix exigua* (coyote willow) Series with one CT; and the Needle-Leaved Deciduous Series Group dominated by the *Tamarix pentandra* (saltcedar) Series with one CT. These communities develop on depositional side bars and mid-channel bars of low gradient, moderately confined to unconfined channels. Common shrub associates include *Chrysothamnus viscidiflorus* (Douglas rabbitbrush), *Prosopis glandulosa* (honey mesquite) and the exotic *Elaeagnus angustifolia* (Russian olive). Common forbs include *Solidago occidentalis* (western goldenrod), *Ambrosia psilostachya* (western ragweed) and *Sphaeralcea fendleri* (Fendler globemallow) while graminoids include *Muhlenbergia asperifolia* (alkali muhly), *Sporobolus airoides* (alkali sacaton), *Scirpus americanus* (threesquare) and *Elymus canadensis* (Canada wildrye).

Persistent-Emergent Wetlands. **-** Persistent-Emergent Wetlands of the Pecos River Basin are dominated by herbaceous perennials which normally have their basal portions annually, periodically, or continually submerged, and commonly have well developed single-layered canopies. Individual trees or shrubs may occur in these communities. As with the forested and shrubland wetlands, these wetlands are subdivided into biogeographic provinces of the Rocky Mountain Montane Wetlands and Plains Wetlands of cold temperate climates, and warm temperate Southwest Wetlands and Closed Basin Wetlands. The Persistent Series Group is

common to all biomes.

Rocky Mountain Montane Persistent-Emergent Wetlands like their wetland forest and shrubland equivalents are common in the upper reaches of the Pecos Basin, and are widespread in other mountainous regions of the state. These wetlands are represented by four series: the *Phalaris arundinacea* (reed canarygrass) Series of upper elevations with one CT, a *Carex emoryi* (emory sedge) Series of lower elevations with one CT, a *Carex nebrascensis* (Nebraska sedge) Series of lower elevations with one CT, and a *Juncus balticus* (Baltic rush) Series of lower elevations with one CT. These communities occur in backwater channels and wet meadows. Shrubs may occur occasionally and include *Salix irrorata* (bluestem willow) and *Salix exigua* (coyote willow). Common forb associates include *Equisetum arvense* (field horsetail), *Sidalcea neomexicana* (New Mexican checkermallow), *Potentilla anserina* (silverweed cinquefoil) and *Epilobium hornemannii* (Hornemann's willowherb); graminoids include *Glyceria striata* (fowl mannagrass), *Carex rostrata* (beaked sedge), *Carex praegracilis* (fieldclustered sedge), *Juncus tenuis* (poverty rush) and *Juncus saximontanus* (Rocky Mountian rush).

Plains Persistent-Emergent Wetlands like the Plains Forests and Scrub-Shrub Wetlands are distributed along the middle and lower segment of the Pecos River as it flows along the western edge of the Southern Great Plains of eastern New Mexico. These wetlands are represented by the *Distichlis stricta* (inland saltgrass) Series with two CT's and the *Scirpus americanus* (threesquare) Series also with two CT's. These communities occur in partially filled backwater channels, or overflow areas from springs and lakes (commonly alkaline). The exotic *Tamarix pentandra* (saltcedar) may be present. Common forb associates include *Salicornia utahensis* (Utah glasswort), *Limonium limbatum* (plumbago), *Typha latifolia* (common cattail), *Polygonum aviculare* (prostrate knotweed) and *Pluchea purpurascens* (canela); graminoids include *Paspalum distichum* (knotgrass), *Eleocharis macrostachya* (longstem spikerush), *Sorghastrum nutans* (indiangrass) and *Scirpus maritimus* (saltmarsh bulrush).

Warm temperate Southwest Persistent-Emergent Wetlands, like their Forest and Scrub-Shrub Wetland counterparts, have floristic affinities with the Sierra Madre Mts. and Chihuahuan Desert of Mexico. These wetlands are common in the smaller tributaries of the southern portion of the basin where the gradient is low and the channel is more or less unconfined. They are represented by the *Scirpus acutus* (tulegrass) Series with one CT and the *Scirpus olneyi* (olney bulrush) Series with two CT's. Common forb associates include *Typha latifolia* (common cattail), *Flaveria chloraefolia* (clasping flaveria), *Lythrum californicum* (California loosestrife), *Samolus cuneatus* (brookweed), *Berula erecta* (stalky berula) and *Verbena scabra* (sandpaper vervain); graminoids include *Eleocharis macrostachya* (longstem spikerush), *Muhlenbergia asperifolia* (alkali muhly), *Cladium jamaicense* (sawgrass), *Cynodon dactylon* (bermudagrass), *Andropogon glomeratus* (bushy bluestem), *Cyperus uniflorus* (oneflower flatsedge) and *Muhlenbergia rigens* (deergrass).

Warm temperate Closed Basin Persistent-Emergent Wetlands like the closed basin

shrublands are distributed in enclosed basins in the Southern Great Plains of eastern New Mexico. These wetlands are commonly found on the margins of playa lakes or on playa lake beds that are periodically flooded. They are represented by the *Eleocharis macrostachya* (longstem spikerush) Series with four CT's, the *Panicum obtusum* (vine mesquite) Series with one CT and the *Sporobolus airoides* (alkali sacaton) Series with one CT. Common forb associates include *Phyla cuneifolia* (wedgeleaf frog-fruit), *Helianthus ciliaris* (blueweed sunflower), *Sida leprosa* (scurfy mallow) and *Iva axillaris* (poverty sumpweed); graminoids include *Buchloe dactyloides* (buffalograss), *Eragrostis cilianensis* (stinkgrass), *Sporobolus airoides* (alkali sacaton) and *Tridens muticus* (slim tridens).

The following table outlines the preliminary classification of riparian/wetland vegetation communities for the Pecos River Basin. Each level of the classification hierarchy is indicated with cross references to the UNESCO system (Driscoll et al. 1984).

Table 1. A Preliminary Vegetation Classification for New Mexico: Pecos River Basin. The classification is hierarchically arranged from System to Class (Level I) down to Community Type [CT] and Phase following Cowardin's system (1979) with modifications based on NMNHP statewide classification (see text). Scientific names along with common names, and six-letter acronyms of genus and species are also given. Cross references to the UNESCO classification (as presented in Mueller-Dombois and Ellenberg 1974) are bracketed,{}.

PALUSTRINE SYSTEM -- RIPARIAN/WETLAND VEGETATION

I. Forested Wetlands Class (Forests and Woodlands)

II. Cold Temperate Forested Wetlands

III. Rocky Mountain Montane Forested Wetlands

IV. Needle-Leaved Evergreen Series Group
{closed forests, cold temperate, evergreen}

V. *Picea pungens* (blue spruce) Series

1. *Picea pungens/Alnus oblongifolia* CT (blue spruce/New Mexico alder; PICPUN/ALNOBL)
2. *Picea pungens/Poa pratensis* CT (blue spruce/Kentucky bluegrass; PICPUN/POAPRA)

IV. Broad-Leaved Deciduous Series Group
{closed forests, cold temperate, deciduous with evergreens}

V. *Acer negundo* (boxelder) Series

1. *Acer negundo/Salix exigua* CT (boxelder/coyote willow; ACENEG/SALEXI)

V. *Populus angustifolia* (narrowleaf cottonwood) Series

1a. *Populus angustifolia/Alnus oblongifolia* CT (narrowleaf cottonwood/New Mexico alder; POPANG/ALNOBL)
1b. *Populus angustifolia/Alnus oblongifolia* CT (narrowleaf cottonwood/New Mexico alder; POPANG/ALNOBL)
Acer negundo phase (boxelder; ACENEG)
2. *Populus angustifolia/Poa pratensis* CT (narrowleaf cottonwood/Kentucky bluegrass; POPANG/POAPRA)
3. *Populus angustifolia/Salix exigua* CT (narrowleaf cottonwood/coyote willow; POPANG/SALEXI)

III. Plains Forested Wetlands

IV. Broad-Leaved Deciduous Series Group
{woodlands, cold temperate, deciduous with microphyllous shrublands or thickets}

V. *Populus fremontii* (Fremont cottonwood) Series

1. *Populus fremontii*/Sparse CT (Fremont cottonwood/sparse ground cover; POPFRE/SPARSE)
2. *Populus fremontii-Salix amygdaloides* CT (Fremont cottonwood-peachleaf willow; POPFRE-SALAMY)
Tamarix pentandra phase (saltcedar; TAMPEN)
3. *Populus fremontii/Salix exigua* CT (Fremont cottonwood/coyote willow; POPFRE/SALEXI)
4a. *Populus fremontii/Sporobolus airoides* CT (Fremont cottonwood/alkali sacaton; POPFRE/SPOAIR)
4b. *Populus fremontii/Sporobolus airoides* CT (Fremont cottonwood/alkali sacaton; POPFRE/SPOAIR)
Tamarix pentandra phase (saltcedar; TAMPEN)

II. Warm Temperate Forested Wetlands

Table 1. A Preliminary Vegetation Classification for New Mexico: Pecos River Basin (continued).

III. Southwest Forested Wetlands

IV. Broad-Leaved Deciduous Series Group
{closed forests, warm temperate, deciduous}

V. *Celtis reticulata* (netleaf hackberry) Series

1. *Celtis reticulata-Juglans major* CT (netleaf hackberry-Arizona walnut; CELRET-JUGMAJ)
2. *Celtis reticulata-Salix gooddingii* CT (netleaf hackberry-Goodding's willow; CELRET-SALGOO)

V. *Populus fremontii* (Fremont cottonwood) Series

1. *Populus fremontii-Salix gooddingii* CT (Fremont cottonwood-Goodding's willow; POPFRE-SALGOO)

I. Scrub-Shrub Wetlands Class (Shrublands)

II. Cold Temperate Scrub-Shrub Wetlands

III. Rocky Mountain Montane Scrub-Shrub Wetlands

IV. Broad-Leaved Deciduous Series Group
{scrub, cold temperate, deciduous shrublands or thickets}

V. *Alnus oblongifolia* (New Mexico alder) Series

1. *Alnus oblongifolia/Calamagrostis canadensis* CT (New Mexico alder/Canada reedgrass; ALNOBL/CALCAN)
2. *Alnus oblongifolia-Cornus stolonifera* CT (New Mexico alder-redosier dogwood; ALNOBL-CORSTO)
3. *Alnus oblongifolia-Salix irrorata* CT (New Mexico alder-bluestem willow)

V. *Salix exigua* (coyote willow) Series

1. *Salix exigua/Elymus canadensis* CT (coyote willow/Canada ryegrass; SALEXI/ELYCAN)

III. Closed Basin Scrub-Shrub Wetlands

IV. Needle-Leaved Deciduous Series Group
{scrub, cold-deciduous, microphyllous shrublands or thickets}

V. *Tamarix pentandra* (saltcedar) Series

1. *Tamarix pentandra/Buchloe dactyloides* CT (saltcedar/buffalograss; TAMPEN/BUCDAC)
2. *Tamarix pentandra/Sporobolus airoides* CT (saltcedar/alkali sacaton; TAMPEN/SPOAIR)

II. Warm Temperate Scrub-Shrub Wetlands

III. Southwest Scrub-Shrub Wetlands

IV. Broad-Leaved Deciduous Series Group
{scrub, warm temperate, deciduous shrublands or thickets}

V. *Baccharis emoryi* (seepwillow) Series

1. *Baccharis emoryi/Muhlenbergia asperifolia* CT (seepwillow/alkali muhly; BACEMO/MUHRIG)
   Tamarix pentandra phase (saltcedar; TAMPEN)
2. *Baccharis emoryi/Sporobolus airoides* CT (seepwillow/alkali sacaton; BACEMO/SPOAIR)
   Tamarix pentandra phase (saltcedar; TAMPEN)

V. *Salix exigua* (coyote willow) Series

1. *Salix exigua-Baccharis emoryi* CT (coyote willow-seepwillow; SALEXI-BACEMO)

IV. Needle-Leaved Deciduous Series Group

V. *Tamarix pentandra* (saltcedar) Series

1. *Tamarix pentandra*/Sparse CT (saltcedar/sparse ground cover; TAMPEN/SPARSE)

I. Persistent-Emergent Wetlands Class -- Herbaceous Wetlands

II. Cold Temperate Persistent-Emergent Wetlands

III. Rocky Mountain Montane Persistent-Emergent Wetlands

IV. Persistent Series Group
{terrestrial herbaceous communities, sedge swamps or temperate reed-swamps on river banks}

V. *Phalaris arundinacea* (reed canarygrass) Series

1. *Phalaris arundinacea-Glyceria striata* CT (reed canarygrass-fowl mannagrass; PHAARU-GLYSTR)

V. *Carex emoryi* (emory sedge) Series

1. *Carex emoryi/Equisetum arvense* CT (emory sedge/field horsetail; CAREMO/EQUARV)

V. *Carex nebrascensis* (Nebraska sedge) Series

1. *Carex nebrascensis-Carex rostrata* CT (Nebraska sedge-beaked sedge; CARNEB-CARROS)

V. *Juncus balticus* (Baltic rush) Series

1. *Juncus balticus-Carex praegracilis* CT (wire rush-fieldclustered sedge; JUNBAL-CARPRA)

III. Plains Persistent-Emergent Wetlands

IV. Persistent Series Group
{terrestrial herbaceous communities, sedge-rush meadows below treeline}

V. *Distichlis stricta* (inland saltgrass) Series

1. *Distichlis stricta/Salicornia utahensis* CT (inland saltgrass/Utah glasswort; DISSTR/SALUTA)
2. *Distichlis stricta-Scirpus americanus* CT (inland saltgrass-threesquare; DISSTR-SCIAME)
   Tamarix pentandra phase (saltcedar; TAMPEN)

V. *Scirpus americanus* (threesquare) Series

1. *Scirpus americanus-Paspalum distichum* CT (threesquare-knotgrass; SCIAME-PASDIS)
2. *Scirpus americanus/Typha latifolia* CT (threesquare/cattail; SCIAME/TYPLAT)

II. Warm Temperate Persistent-Emergent Wetlands

III. Southwest Persistent-Emergent Wetlands

IV. Persistent Series Group
{terrestrial herbaceous communities, sedge swamps or temperate reed-swamps on river banks}

V. *Scirpus acutus* (tulegrass) Series

1. *Scirpus acutus-Eleocharis macrostachya* CT (tulegrass-longstem spikerush; SCIACU-ELEMAC)

V. *Scirpus olneyi* (bulrush) Series

1. *Scirpus olneyi-Muhlenbergia asperifolia* CT (olney bulrush-alkali muhly; SCIOLN-MUHASP)
2. *Scirpus olneyi/Typha latifolia* CT (olney bulrush/cattail; SCIOLN/TYPLAT)

III. Closed Basin Persistent-Emergent Wetlands

IV. Persistent Series Group
{terrestrial herbaceous vegetation, sedge swamps}

V. *Eleocharis macrostachya* CT (longstem spikerush) Series

1. *Eleocharis macrostachya/Helianthus ciliaris* CT (longstem spikerush/blueweed sunflower; ELEMAC/HELCIL)
2. *Eleocharis macrostachya-Panicum obtusum* CT (longstem spikerush-vine mesquite; ELEMAC-PANOBT)
   Iva axillaris phase (poverty sumpweed; IVAAXI)
3. *Eleocharis macrostachya-Schedonnardus paniculatus* CT (longstem spikerush-tumblegrass; ELEMAC-SCHPAN)
4. *Eleocharis macrostachya/Sida leprosa* CT (longstem spikerush/scurfy sida; ELEMAC/SIDLEP)

V. *Panicum obtusum* (vine mesquite) Series

1. *Panicum obtusum/Helianthus ciliaris* CT (vine mesquite/blueweed sunflower; PANOBT/HELCIL)

V. *Sporobolus airoides* (alkali sacaton) Series

1. *Sporobolus airoides-Buchloe dactyloides* CT (alkali sacaton-buffalograss; SPOAIR-BUCDAC)

Ecologically Significant/Restorable Sites

Best examples of proposed ecologically significant and/or restorable riparian/wetland areas of the Pecos Basin are presented in Appendix 3. There are eleven riparian/wetland areas recommended in this report that are examples of "A" or "B+" ranked occurrences. These sites are primarily distributed in Rocky Mountain Montane segments of the basin, yet there are representative communities from the Plains and Southwest segments that also occur along hydrologically intact reaches of the mainstem or one of its tributaries. These communities show signs of continued existence and are potentially defensible from negative human impacts. Four riparian/wetland areas are recommended as potentially restorable sites. These areas are important community types that still occur on intact segments of the mainstem or smaller tributaries; or show signs of continued existence, but conditions are marginal "C" occurrences due to the presence of certain exotic species, such as *Tamarix pentandra* (saltcedar), *Elaeagnus angustifolia* (Russian olive) or *Cynodon dactylon* (bermudagrass).

DISCUSSION

Vegetation Patterns

The Pecos River flows through four regional riparian/wetland biomes (Rocky Mountain Montane Riparian/Wetlands, Plains Riparian/Wetlands, Southwest Riparian/Wetlands, and Closed Basin Wetlands of the Southern Plains). The upper reach, from its headwaters in the Sangre de Cristo Mountains to Villanueva, is considered primarily montane. Upper segments within the Pecos Wilderness are in near pristine conditions. Lower segments have been altered by agricultural activity leading to fragmentation of the riparian/wetland communities. Still, many of the most significant/restorable sites occur along this reach. The lack of large impoundments and large diversions other than local community irrigation systems (acequias) is probably the most important factor in the maintenance of these sites.

Further downstream the Pecos flows primarily through the Plains Biome of New Mexico. The vast majority of this reach has been altered by human activities, i.e., the construction of dams and subsequent regulated stream flows, the introduction of saltcedar and Russian olives to the system, and the harvesting of riparian trees for fuel, shelter, agriculture and urbanization. According to Dick-Peddie (1993), much of the harvesting of riparian tree species subsided by the beginning of the twentieth century, yet the building of large dams has impeded the rejuvenation of these forests. Additionally, the lowered water tables, the absence of seasonal flooding, and the high palatability of young cottonwood seedlings by livestock and deer have "set a perfect stage for the establishment and expansion of saltcedar." The first sighting of saltcedar in the Pecos River Basin of New Mexico was reported in the Carlsbad area between 1912 and 1914, ten years after the construction of the first dam on the river at Lake McMillan in 1894 (Bureau of Reclamation 1979). Since that time the saltcedar population has virtually exploded throughout the basin. Infestations encompass thousands of acres on the middle and lower reaches of the Pecos River. Large-scale cooperative efforts to actively remove saltcedar, for water salvage

projects, from the floodplains of the Pecos River are on-going and conducted by the Bureau of Reclamation. The results of this project are yet to be determined. Methods of removal have included both mechanical and chemical means, and generally a buffer zone is left on the banks of the river. Clearcut areas in the Artesia region were observed to be replaced by ruderal herbaceous species *Melilotus alba* (white sweetclover) and *Salsola kali* (Russian thistle).

As the river approaches the Texas border, it flows through the Southwest Biome. Much of the river is fed by springs at junctions with major tributaries stemming from the Sacramento Mountains to the west. It is unclear what the original extent of cottonwood riparian/wetland forests was prior to European settlement. Certainly, the forests were probably present, but herbaceous wetlands may have been more extensive. Regardless, the system remains highly altered and the maintenance of native vegetation over exotics remains problematic and a major concern.

Riparian Ecosystem Dynamics

Riparian areas are able to undergo a great deal of change compared to uplands. Inherent to a healthy riparian ecosystem are the sudden and/or extreme physical changes caused by stream dynamics (Leonard et al. 1992). Intact fluvial processes of flooding, sediment deposition, lateral channel migration, and scouring effects on bars and terraces are a natural cyclic process of riparian ecosystem development. This process has been referred to as "site progression" by Leonard et al. (1992) and is a critical process in the maintenance, growth and reproduction of these communities (Muldavin et al. 1993a).

Schematic models of site progression dynamics portray gradual stages of riparian landform development and the successive changes in plant composition due to sediment accumulation, lateral cutting of the channel, or downcutting of the channel over time (Muldavin et al. 1993a). Figures 5 to 8 schematically portray site progression models for generalized riparian communities of Rocky Mountain Montane, Plains (both nonregulated and regulated segments), and Southwest reaches of the Pecos River Basin.

Our first model (Figure 5) portrays the site progression dynamics of typical Rocky Mountain Montane riparian/wetland communities in the Pecos River Basin. The first stage of this model is the development of unconsolidated non-vegetated cobble bars or herbaceous annual river bars formed from channel migration and high sediment flow events. With repeated flooding and deposition, at one and two year intervals, the bars continue to develop. Coarse woody debris dams accelerate the developmental process. Construction of beaver dams may also contribute to the process. Perennial vegetation, particularly obligate riparian species, becomes established. The bars become stabilized in the channel, and soils begin to develop. The New Mexico alder-bluestem willow CT having Typic Fluvaquent soils are characteristic to this first stage of progression. Continued sediment accumulation under higher flows, at 3-25 year intervals, elevates the bars somewhat above the channel and leads to continued development of these river bars. Soils develop further and become aerated. Stratified layers of vegetation

develop, diversity of species increases, reproduction is continuous, and a diversified riparian forest community exists. The blue spruce/New Mexico alder CT with Aeric Fluvaquent soils is representative of this third stage of progression. Additional sediment accumulation ensues along with lateral migration or downcutting of the channel. Terraces build, soils continue to develop and become drier. As a result, species composition changes. Reproduction of obligate riparian tree species ceases, the trees die, and the canopy opens so that meadow grasses and forbs are dominant. The blue spruce/Kentucky bluegrass CT represents this fourth stage of progression. Soils can be either Fluventic Dystrochrepts, Typic Udifluvents, or Oxyaquic Udifluvents. These terraces are rarely flooded (>25 years), but when they are, the force of the flow may be strong enough to scour the bars and terraces, thereby removing the vegetation and returning the site back to the incipient non-vegetated exposed river bar. Flows may be of the magnitude of a 100-year flood and cause some sites to reset in the floodplain and, hence, a re-initiation of the cycle progresses.

	PROGRESSION STAGE	LANDFORM	VEGETATION COMMUNITY	SOIL TYPE	FLOOD RETURN INTERVAL
→ → ↓	1	Exposed River Bar	non-vegetated annual herbs	Riverwash	Yearly
↑	Sediment Accumulation				
→ ↓	2	Stabilized River Bar	alder-bluestem willow	Typic Fluvaquents	1-2 year
↑	Sediment Accumulation				
→ ↓	3	Aggregated River Bar	blue spruce/alder	Aeric Fluvaquents	3-25 year
↑	Sediment Accumulation Lateral Cutting/Downcutting				
↑ ← ↓	4	River Terrace	blue spruce/bluegrass	Fluventic Dystrochrepts Typic Udifluvents Oxyaquic Udifluvents	25-100+ year

Figure 5. Schematic representation of site progression dynamics of Rocky Mountain Montane riparian/wetland communities in the Pecos River Basin.

Regulated stream flows on the mainstem of the Pecos River occur from Santa Rosa Lake to the Texas border. Site progression models become more complex when stream flows are regulated. Base surficial flows and flood return intervals along any given reach are difficult to predict. The riparian ecosystem dynamics are further complicated by agricultural activities (the introduction of cattle, diversion of water, the development of wells), and the introduction of exotics, primarily saltcedar and Russian olives. This is also particularly evident south of Santa Rosa to the Texas border. Two models for the Plains reach of the Pecos River Basin have been developed to account for the potential riparian/wetland community that would exist under nonregulated flows, and the communities that presently exist under regulated flows.

The potential riparian/wetland community that might exist for the Plains reaches of the Pecos River differs markedly in the latter stages of the model for nonregulated flows (Figure 6) than that which exists in its present state with regulated flows (Figure 7). The first stages are similar with the development of exposed unconsolidated river bars that may be non-vegetated, cobbly and sandy, or dominated by herbaceous annuals. Sediments are deposited on a yearly basis during high flows. Continuous deposition and flooding occurs at one- to two- year intervals for nonregulated flows, and two to perhaps five year intervals under regulated flows. Bars take longer to become stabilized as sediments and most large woody debris are removed from the system.

Stage 2 reveals a different set of perennial vegetation community types in these two streams. For nonregulated flows, persistent-emergent vegetation is likely to develop. The threesquare-knotgrass CT with Sulfic Fluvaquent or Aquic Ustipsamment soils might be typical. In contrast, the riparian vegetation under regulated conditions is structurally different and woody species predominate. The coyote willow-seepwillow CT becomes established and the soils that develop here are Oxyaquic Ustipsamments, Typic Psamments, or Typic Psammaquents.

Continued sediment accumulation under higher flows occurs at different rates for the two streams. For regulated flows, longer recurrence intervals may be required (5-50 years) for river bars to become aggregated and elevated above the channel, and soils to become aerated. The channel is less likely to migrate across the floodplain under sustained low flows and downcutting of the channel is accelerated. Scouring of bars is uncommon. As a result, species composition may change dramatically with the introduction of phreatophytic species. Diversity of species decreases dramatically and the reproduction of obligate riparian species diminishes. Added pressure from grazing contributes to these altered conditions. The community type typical of this third stage of progression under regulated flows is the seepwillow/alkali sacaton CT with a saltcedar phase. Soils may be either Oxyaquic Ustifluvents or Typic Fluvaquents. Stands of saltcedar are often so dense that little else is capable of growing and competing. Alternatively, with nonregulated flows continued sediment accumulation under higher flows occurs at three- to 25-year return intervals. The bars are elevated above the channel and continue to develop and stabilize. Sexual reproduction of obligate riparian tree species might be common as the bars are more likely to become scoured and downcutting of the channel is not continuous. This third

stage of progression for nonregulated streams can be exemplified by the coyote willow-seepwillow CT. Soils may be Oxyaquic Ustipsamments, Typic Psamments, or Typic Psammaquents. Reproduction is continuous and a diversified riparian shrubland community exists.

Additional sediment accumulation ensues along with lateral channel migration or downcutting of the channel. Terraces build, soils continue to develop and become drier. Downcutting of the channel under regulated flows is further accelerated by sustained low flows and the terraces become elevated high above the channel. In this fourth stage of site progression the terraces are rarely flooded or may never be flooded. The return interval for regulated flows is difficult to predict and may occur at 50 to 100 or more years. Reproduction of obligate riparian tree species ceases. Small decadent stands may exist and individuals are often widely separated. Species composition is low and exotic species are prevalent, particularly saltcedar. This fourth stage can be represented by the Fremont cottonwood/alkali sacaton CT, saltcedar phase with Oxyaquic Torrifluvent or Typic Ustifluventic soils. Under nonregulated conditions, lateral channel migration continues, but downcutting does not occur to such great extents. Terraces develop and broad floodplains are common. Species composition changes and reproduction of riparian tree species is dependent on scouring floods. The Fremont cottonwood/coyote willow CT best represents this mature riparian Plains community. Soils that develop here may be Typic Ustifluvents, Typic Endoaquents, or Oxyaquic Ustifluvents. Return intervals are more frequent and may occur every 25 to 100 or years. Flows may be of the magnitude to scour and reset some sites back down on the floodplain and re-initiate the site progression process.

PROGRESSION STAGE	LANDFORM	VEGETATION COMMUNITY	SOIL TYPE	FLOOD RETURN INTERVAL
→ → 1	Exposed River Bar	non-vegetated annual herbs	Riverwash	Yearly
↓				
↑ Sediment Accumulation				
← 2	Stabilized River Bar	threesquare-knotgrass	Sulfic Fluvaquents Aquic Ustipsamments	1-2 year
↓				
Sediment Accumulation				
↑				
← 3	Aggregated River Bar Low Floodplain	coyote willow-seepwillow	Oxyaquic Ustipsamments Typic Psamments	3-25 year
↓			Typic Psammaquents	
Sediment Accumulation				
↑ Lateral Cutting/Downcutting				
4	River Terrace Floodplain	Fremont cottonwood/ coyote willow	Typic Ustifluvents Typic Endoaquents	25-100+ year
↑ ← ↓			Oxyaquic Ustifluvents	

Figure 6. Schematic representation of site progression dynamics of Plains riparian/wetland communities in the Pecos River Basin under nonregulated flows.

PROGRESSION STAGE	LANDFORM	VEGETATION COMMUNITY	SOIL TYPE	FLOOD RETURN INTERVAL
→ → 1 ↓	Exposed River Bar	non-vegetated annual herbs	Riverwash	Yearly
↑ Sediment Accumulation				
← 2 ↓	Stabilized River Bar	coyote willow-seepwillow	Oxyaquic Ustipsamments Typic Psamments Typic Psammaquents	2-5 year (?)
↑ Sediment Accumulation				
← 3 ↓	Aggregated River Bar Low Floodplain	seepwillow/ alkali sacaton saltcedar phase	Oxyaquic Ustifluvents Typic Fluvaquents	5-50 year (?)
Sediment Accumulation ↑ Lateral Cutting/Downcutting				
4	Elevated River Terrace	Fremont cottonwood/ alkali sacaton saltcedar phase	Oxyaquic Torrifluvents Typic Ustifluvents	50-100+ year (?)
↑ ← ↓				

Figure 7. Schematic representation of site progression dynamics of Plains riparian/wetland communities in the Pecos River Basin under regulated flows.

Our last model (Figure 8) portrays the site progression dynamics of typical Southwest riparian/wetland vegetation development of the Pecos River Basin. Like the previous models, the first stage of the cycle involves the development of unconsolidated non-vegetated cobble bars or herbaceous annual river bars formed from channel migration and high sediment flow events. These bars are flooded yearly and may be scoured at any time. With further flooding and deposition of sediments and debris, at one- and two-year intervals, the bars continue to develop and stabilize. Perennial vegetation becomes established and the riparian communities can be characterized by the coyote willow-seepwillow CT. Soils that develop here are Oxyaquic Ustipsamments, Typic Psamments, or Typic Psammaquents. Stratification of the forb and graminoid layers is usually well developed and the understory may be lush. A common component of this community type is the ruderal species, bermudagrass. Sediment accumulation continues and the bars become aggregated and slightly elevated above the channel. Higher flows may be required to flood these communities and may recur at three- to 25- year intervals. Stratified layers of vegetation continues to develop and diversify. The netleaf hackberry-Goodding's willow CT is common and exemplifies the riparian forests at this stage of development. Soils are commonly loamy-skeletal Mollic Fluvaquents with gleyed conditions near the surface. Additional sediment accumulation follows and the channel migrates across the floodplain cutting banks or slightly downcutting the channel. Terraces build and soils continue to develop. Like the Rocky Mountain Montane riparian/wetland communities, these terraces are rarely flooded (25-100+ years), but when they are, the force may be of the magnitude to scour the terraces, thereby removing the vegetation and returning the site to riverwash and an exposed river bar. This fourth stage can be typified by the Fremont cottonwood-Goodding's willow CT with Oxyaquic Ustifluvents, Typic Fluvaquents, or Aeric Fluvaquent soils.

Re-initiation of the site progression cycle is crucial for the sexual reproduction of cottonwoods. Without this cycle, cottonwoods are dependent upon asexual suckering for maintenance of a site. Hence, requirements for successful cottonwood regeneration depends on: 1) large scouring floods on a site to first remove herbaceous cover in the year prior to seed dispersal, 2) high spring flows which provide moist, freshly deposited alluvium that coincides with spring seed dispersal, and 3) reduced post-germination flooding to reduce seedling mortality (Muldavin et al. 1993b, Stromberg et al. 1991, Asplund and Gooch 1988, Fenner et al. 1985, and Reichenbacher 1984).

PROGRESSION STAGE	LANDFORM	VEGETATION COMMUNITY	SOIL TYPE	FLOOD RETURN INTERVAL
→ → 1	Exposed River Bar	non-vegetated annual herbs	Riverwash	Yearly
↓				
↑ Sediment Accumulation				
← 2	Stabilized River Bar	coyote willow-seepwillow	Oxyaquic Ustipsamments Typic Psamments Typic Psammaquents	1-2 year
↓				
↑ Sediment Accumulation				
← 3	Aggregated River Bar	netleaf hackberry-Goodding's willow	Mollic Fluvaquents	3-25 year
↓				
Sediment Accumulation ↑ Lateral Cutting/Downcutting				
4	River Terrace	Fremont cottonwood-Goodding's willow	Oxyaquic Ustifluvents Typic Fluvaquents Aeric Fluvaquents	25-100+ year
↑ ← ↓				

Figure 8. Schematic representation of site progression dynamics of Southwest riparian/wetland communities in the Pecos River Basin.

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APPENDIX 1.

PECOS RIVER BASIN RIPARIAN/WETLAND VEGETATION CLASSIFICATION COMMUNITY CHARACTERIZATION ABSTRACTS

Community types are based on dominant or codominant plant species of each canopy stratum derived from constancy and abundance values. A slash separates canopy layers (i.e. tree, shrub, graminoid and forb). A dash indicates codominance within a given canopy layer. In some cases, the dominant community is represented as one layer. Some community types have been described in New Mexico and surrounding regions while others are apparently new dominance types for New Mexico. As additional data is accumulated throughout other major basins of the state some new types may be expanded or rejected.
The distribution of some plant dominants may cross several biomes, particularly the exotic *Tamarix pentandra*.

Each Community Characterization Abstract has six information fields:

1) distribution: the basin-wide distribution of the community with a brief morphological description;
2) vegetation: a description of species composition, dominance and structure;
3) environmental setting: a characterization of channel morphology, classified soils types and additional environmental data;
4) adjacent vegetation: the adjacent upland and riparian/wetland vegetation;
5) discussion: a brief discussion of the community dynamics including successional trends, and/or ecology of the community type where observations or other information was available; and
6) documentation: synonymous and similar community types from regional and state literature comparisons. Synonymous types corresponded in species composition, constancy, average cover, elevation, and physical setting. Types were considered similar when canopy structure, genera, and physical setting were the same, but differed in overall species composition.

PALUSTRINE SYSTEM -- Riparian/Wetland Vegetation

The following descriptors are used to characterize the vegetative cover values in the CCA's:

ABSENT - cannot be found in stand (opp = present);
ACCIDENTAL - individuals very infrequent, occasional, or limited to special microsites;
ABUNDANT - canopy coverage > 25%;
COMMON - canopy coverage > 1% (opp = scarce);
DOMINANT - density or cover is as great as, or greater than, any other species of the same life form (two or more species can be dominant, i.e. codominant);
LUXURIANT - canopy coverage > 50%;
POORLY REPRESENTED - canopy coverage < 5% (opp = well represented);
PRESENT - individuals can be found in the stand (opp = absent);
REGENERATION - understory trees as established seedlings, saplings, or small poles (dbh < 10 in.);
SCARCE - canopy coverage < 1% (opp = common);
WELL REPRESENTED - canopy coverage >5% (opp = poorly represented).

I. Forested Class -- Forests and Woodlands

II. Cold Temperate Forested Wetlands

III. Rocky Mountain Montane Forested Wetlands

IV. Needle-Leaved Evergreen Series Group

Picea pungens (blue spruce) is the dominant species in this group, and occurs along lower slopes and down along the channel edges. Other conifers *Abies concolor* (white fir) and *Pseudotsuga menziesii* (Douglas fir) may be present but either do not persist or are completely out of the floodplain. Common deciduous species present are *Alnus oblongifolia* (New Mexico alder) and several willow shrubs *Salix irrorata* (bluestem willow), *Salix lasiandra* (pacific willow) and *Salix boothii* (Booth willow). These are generally concentrated along the banks adjacent to the active channel. Diversity of species is high in these communities. Channel migration and sediment deposition play a key role in regeneration of these coniferous dominated communities. Accumulation of sediment and debris elevate the bars over time and terraces develop. As the terraces build, soils become drier, tree canopies open and the coniferous species are still able to regenerate while the deciduous species remain closer to the channel. Over time, diversity of obligate riparian species decreases, and understories become predominantly grassy. A common component of these terraces is *Poa pratensis* (Kentucky bluegrass). Hence, the coniferous riparian forests represent some of the most stable plant communities in the riparian zone.

V. *Picea pungens* (blue spruce) Series

1. *Picea pungens/Alnus oblongifolia* CT (blue spruce/New Mexico alder; PICPUN/ALNOBL)

Distribution: This community type is common in the upper montane reaches of the Pecos River within the Santa Fe National Forest (Muldavin et al. 1993a) and is expected to occur elsewhere in San Miguel County and Lincoln Counties.

Vegetation: *Picea pungens* (blue spruce) [FAC], dominates the tree canopy with *Pseudotsuga menziesii* (Douglas fir) commonly well represented. *Alnus oblongifolia* (New Mexico alder) [FACW+], dominates the shrub layer and forms thick bands lining and overhanging the river. *Cornus stolonifera* (Redosier dogwood), *Lonicera involucrata* (bearberry honeysuckle) and several willows *Salix irrorata* (bluestem willow), *Salix lasiandra* (pacific willow) and *Salix boothii* (Booth willow) are present. The forb layer is species rich and abundant in cover. *Heracleum lanatum* (cowparsnip) is common. *Rudbeckia laciniata* (cutleaf coneflower) and *Equisetum arvense* (field horsetail) are always present, while *Aconitum columbianum* (Columbia monkshood) and *Habenaria hyperborea* (northern bog orchid) are present, but scarce.

Environmental Setting: PICPUN/ALNOBL occurs in narrow and confined channels where the development of large bars and floodplains is limited. Aggradation and downcutting continues to occur. The development of small island bars may occur, but is uncommon. The banks are often armored with cobbles and stones. Channel morphology is classified as a Rosgen Type B1. Sinuosity of the channel is limited and the gradient is relatively steep (1- 2%). Adjacent canyon hillslopes are steep. Lower positioned sites may be flooded every four to five years while the older, higher sites are flooded about every 20 years (Muldavin et al. 1993a). Soils are classified as loamy-skeletal Aeric Fluvaquents where the matrix may be upwards of 80% coarse gravels, cobbles and stones. These soils are hydric soils as determined by the 1987 Corps of Engineers Wetlands Delineation Manual. Elevation ranges from 7520-7884 ft.

Adjacent Vegetation: Adjacent north-facing hillslopes are mixed coniferous forests. South-facing hillslopes include ponderosa pine forests and juniper woodlands. Adjacent riparian vegetation includes *Alnus oblongifolia/Cornus stolonifera* shrublands on bars and *Picea pungens/Poa pratensis* communities on terraces.

Discussion: The *Picea pungens/Alnus oblongifolia* CT appears to be a late-progressional stage occurring towards the lower range of mixed coniferous forests and the upper range of *Populus angustifolia* and *Acer negundo* communities. This community is generally located along narrow depositional floodplains, with riparian vegetation developing among boulders and cobbles along the river channel. Stands are usually densely shaded and mesic. Diversity of species is high (50+ species). This type is able to sustain seasonal flooding for short periods and appears to be relatively stable.

Documentation: This description is based on cross sections P3, P4, and Pecos1; and plots

92HK06, 92HK08, and 93PD01. Our type has not been documented elsewhere for New Mexico; however, it is closely related to the *Picea pungens/Alnus tenuifolia*/MG-F documented by Dick-Peddie (1993) that occurs in montane regions of New Mexico. Szaro (1989) reports independent community types in New Mexico of *Picea pungens, Alnus tenuifolia,* and *Alnus oblongifolia,* but contends that these types remain separate. Similar blue spruce/alder types are classified in the White River Basin of Colorado (Kittel 1993), the Yampa and San Miguel/Dolores River Basins of Colorado (Kittel and Lederer 1993). These types are analogous to the type reported by Dick-Peddie (1993), however, in ours *Alnus oblongifolia* replaces *Alnus tenuifolia.*

2. *Picea pungens/Poa pratensis* CT
(blue spruce/Kentucky bluegrass; PICPUN/POAPRA)

Distribution: This community type is common in the upper montane reaches of the Pecos River within the Santa Fe National Forest (Muldavin et al. 1993a) and is expected to occur elsewhere in San Miguel County and Lincoln Counties.

Vegetation: *Poa pratensis* (Kentucky bluegrass) [FACU], dominates the grassy undergrowth of this montane meadow-like community. *Picea pungens* (blue spruce) [FAC], dominates a very open the tree canopy along with an occasional *Pinus ponderosa* (ponderosa pine) or *Pseudotsuga menziesii* (Douglas fir). The species that occur here are adapted to open sun exposures and include *Achillea lanulosa* (yarrow) and *Plantago major* (common plantain). Other common grasses and forbs include *Phleum pratense* (timothy), *Agropyron smithii* (western wheatgrass), *Trifolium repens* (white clover) and *Geranium richardsonii* (Richardson's geranium). Shrubs are scattered and infrequent, but include species common to other riparian communities at this elevation such as *Symphoricarpos oreophilus* (mountain snowberry) and *Ribes inerme* (whitestem currant).

Environmental Setting: PICPUN/POAPRA occurs in moderately confined channels with Rosgen's Type C2 channel morphology (Muldavin et al. 1993a). Sinuosity is limited and the gradient is low (<1%). Adjacent canyon sideslopes are steep. This type occupies the highest depositional bars and terraces. Aggradation is uncommon. The soils are well developed and classified as Oxyaquic Udifluvents and the drier Fluventic Dystrochrepts. Coarse fragments occur deep within the profile and fine-textured loams occupy the surface layers. Flooding is infrequent (>50 years) and the water table is usually well below 100 cm from the surface (Muldavin et al. 1993a). Elevation ranges from 7720-8320 ft.

Adjacent Vegetation: Adjacent north-facing hillslopes are mixed coniferous forests. Ponderosa pine forests and juniper woodlands occupy adjacent south-facing hillslopes. Adjacent riparian vegetation includes *Alnus oblongifolia/Cornus stolonifera* shrubland communities on lower bars.
Discussion: The *Picea pungens/Poa pratensis* CT appears to be a late-progressional stage. Because of its open park-like canopy and close proximity to the stream channel it is often

susceptible to heavy disturbance from human and livestock (Ludwig and Moir 1979, Fitzhugh et al. 1987, and Padgett et al. 1989). Our sites received moderate disturbance from campers and horses. Stands are usually less mesic than sites more proximate to the stream channel. Diversity of species is generally low. In the absence of external disturbances, cover is usually luxuriant.

Documentation: This description is based on cross sections P1, P2 and P7; and plots 92HK07, 92HK11 and 92HK14. PICPUN/POAPRA was first reported in the Sangre de Cristo, San Juan, Sacramento, Mogollon and San Mateo Mountains of New Mexico by Moir and Ludwig (1979). Fitzhugh et al. (1987) also reports this type occurring in the Mogollon Mountains of the Gila National Forest while Dick-Peddie (1993) classifies a similar type as *Picea pungens*/MS/*Poa pratensis* that occurs in a broader sense as a forest vegetation type common to the upper montane coniferous forests of New Mexico, but still usually along stream channels. Padgett et al. (1989) documents a similar community type located on stream terraces in the Utah Plateaus of central Utah and the Abajo Mountains of southwestern Utah, but classifies the type as Conifer/*Poa pratensis.*

IV. Broad-Leaved Deciduous Series Group

This series group is dominated by two series, the *Acer negundo* (boxelder) Series and the *Populus angustifolia* (narrowleaf cottonwood) Series. One CT is classified within the *Acer negundo* Series while three CT's are classified within the *Populus angustifolia* Series. These communities occur primarily on alluvial side bars or on low floodplains adjacent to the channel. Common shrubs in this group may occur in other riparian communities and include *Alnus oblongifolia* (New Mexico alder), *Salix exigua* (coyote willow) and *Rosa woodsii* (woods rose). Likewise, common forbs and grasses include *Rudbeckia laciniata* (cutleaf coneflower), *Equisetum arvense* (field horsetail), *Elymus canadensis* (Canada wildrye) and *Festuca pratensis* (meadow fescue).

V. *Acer negundo* (boxelder) Series

1. *Acer negundo/Salix exigua* CT (boxelder/coyote willow; ACENEG/SALEXI)

Distribution: This community type is common in lower montane reaches of the Pecos River and Cow Creek in San Miguel County and is expected to occur in Lincoln County.

Vegetation: *Acer negundo* (boxelder) [FACW-], dominates the tree canopy. *Salix exigua* (coyote willow) [OBL], dominates the shrub layer and forms dense stands. Other shrubs are common or well represented in the shrub layer and include *Rosa woodsii* (woods rose) and *Prunus virginiana* (common chokecherry); *Salix lutea* (yellow willow) may also be present.

Overall, forbs and graminoids are well represented, but due to high species richness, individual canopy coverages can be scarce. *Clematis ligusticifolia* (western virginsbower), *Parthenocissus inserta* (thicket creeper) and *Rudbeckia laciniata* (cutleaf coneflower) are common forbs. Graminoids present in this community include *Elymus canadensis* (Canada wildrye), *Muhlenbergia asperifolia* (alkali muhly), *Festuca pratensis* (meadow fescue) and *Phleum pratense* (timothy).

Environmental Setting: ACENEG/SALEXI is found on dry terraces or alluvial side bars. It is associated with Rosgen's Type B2 and C1 channel morphologies. Valley confinement is moderate. The channel is moderately entrenched with a stream gradient between 1.2 and 1.5%. Due to lack of vegetation and large cobbles or boulders, channel banks are steep and moderately unstable. Channel material consists of small to medium sized debris that affects less than 10% of the channel, coarse gravels and small to large cobbles. Moderate to well-developed depositional features are common. Hydraulic modeling of flows at this site indicate that 25- to 50-year floods would probably be required to flood this community type. Discharges of 1700 cfs on Cow Creek and 2400 cfs on this reach of the Pecos are the estimated flows required. Soils are classified as coarse-loamy, calcareous, Typic Ustifluvents and Mollic Ustifluvents. Typic Ustifluvents are hydric soils as determined by the 1987 Corps of Engineers Wetlands Delineation Manual. In general, the soils have a mesic or frigid temperature regime. The range of pH for the soils are from 7.61 to 8.03. Electrical conductivity ranges from 0.51 to 1.05 mS. Elevation ranges from 5400 to 6000 ft.

Adjacent Vegetation: Adjacent upland slopes are dominated by pinyon pine-juniper woodlands. Adjacent riparian vegetation is scarce. Exposed river bars are common.

Discussion: The *Acer negundo/Salix exigua* CT appears to be a late-progressional stage. Channel migration and meander movements have cut into these terraces and mature *Acer negundo* are often left nearly adjacent to the channel. *Salix exigua* in these community are often dense and provide excellent coverage.

Documentation: This description is based on cross sections Pecos10, Cow Creek1 and plots 93PD12 and 93PD13 respectively. This specific type has not been reported elsewhere for New Mexico, however, similar communities are documented here and in surrounding states. Dick-Peddie (1993) identifies an *Acer negundo* Series and an *Acer negundo/Alnus tenuifolia*/MG-F community to be widespread in montane regions of New Mexico. *Acer negundo* communities have also been reported by Szaro (1989) to be widely distributed throughout New Mexico and Arizona in mixed deciduous communities with codominants ranging from *Alnus oblongifolia, Salix irrorata, Juglans major, Fraxinus pennsylvanica, Populus fremontii,* and *Populus angustifolia.* In Colorado, *Acer negundo/Betula occidentalis* communities are reported to occur in the Yampa and San Miguel/Dolores River Basins (Kittel and Lederer 1993). Along the White River Basin in Colorado *Acer negundo* occurs sporadically at the series level (Kittel 1993). An *Acer negundo/Prunus virginiana* habitat type is described as a minor type in the Great Plains region of central and eastern Montana (Hansen et al. 1990). It is also reported to occur in seral

stands of *Salix exigua*, *Populus angustifolia*, and *Salix amygdaloides*. In Utah, boxelder occurs as minor and incidental types with *Cornus sericea* in the Wasatch and LaSal Mountains and with *Salix exigua* occurring as a close associate (Padgett et al. 1989).

V. *Populus angustifolia* (narrowleaf cottonwood) Series

1a. *Populus angustifolia/Alnus oblongifolia* CT (narrowleaf cottonwood/New Mexico alder; POPANG/ALNOBL)

Distribution: This is a common community type that occurs on lower montane reaches of the Pecos River in San Miguel County and is expected to occur in Lincoln County.

Vegetation: *Populus angustifolia* (narrowleaf cottonwood) [FACW], dominates this moderately open- to very open-canopied community in the tree layer. The shrub layer is dominated by *Alnus oblongifolia* (New Mexico alder), [FACW+]. *Alnus oblongifolia* typically forms dense thickets along the river banks, often overhangs the banks and is occasionally a sub-canopy tree. *Populus angustifolia* displays some advanced stages of regeneration and are present in the shrub layer. The understory is characteristically shrubby, and *Lonicera involucrata* (bearberry honeysuckle) and *Cornus stolonifera* (redosier dogwood) can be the common dominants. At the lowest reaches of this community *Acer negundo* (boxelder) begins to appear and can be well represented in the tree or shrub layer. Reproduction of *Acer negundo* seems to be successful. The forb layer can be luxuriant and very diverse. Common forbs present include *Rudbeckia laciniata* (cutleaf coneflower), *Heracleum lanatum* (cowparsnip), and *Equisetum arvense* (field horsetail). Common grasses include *Poa pratensis* (Kentucky bluegrass) and *Festuca pratensis* (meadow fescue).

Environmental Setting: POPANG/ALNOBL occurs on low to moderately elevated island bars and side bars associated with Rosgen's Type B2 and C2 channel morphology. The channel is moderately entrenched, moderately confined by the valley, and has a stream gradient between 1.5 and 2.5%. Banks are often well armored. Channel materials consist of large cobbles, small boulders, coarse gravels, and small to medium sized debris that affects less than 10% of the channel. Hydraulic analysis indicates a flooding regime of every three to five years for the lower positioned sites. The flow required for these ranges from 350 cfs to 700 cfs. Higher position sites may be flooded every 20 years. Aggradation of sediments and/or limited downcutting has occurred to elevate the surface significantly above the water table to allow some aeration of the soil. This coincides with the classification of soils as Aeric Fluvaquents and Aeric Endoaquepts, which have hydric conditions at depths greater than 50 cm (Muldavin et al. 1993a). These soils meet the criteria for hydric soils as determined by the 1987 Corps of Engineers Wetland Delineation Manual. The pH ranged from 6.6 to 7.6. Elevation ranges from 7080-7910 ft.
Adjacent Vegetation: Adjacent north-facing hillslopes are steep and are typically mixed coniferous forests. Ponderosa pine forests commonly occupy the south-facing hillslopes. Adjacent riparian vegetation include *Acer negundo/Salix exigua* communities on the terraces.

Discussion: The *Populus angustifolia/Alnus oblongifolia* CT appears to be a late-progressional stage. Stratified layers of vegetation are well developed. This community commonly occurs on lower positioned side bars and overflow channels. Diversity of species is high. These communities are mesic and densely shaded. Beaver activity in these communities is common especially on the cottonwoods.

Documentation: This description is based on cross sections P1, P2, Pecos9 and plots 92HK01, 92HK04, 92HK05, and 93PD18. This community type appears to be common throughout New Mexico. Dick-Peddie (1993) documents an analogous type *Populus angustifolia/Alnus oblongifolia*/MS/MG-F. Szaro (1989) reports independent *Populus angustifolia* and *Alnus oblongifolia* types in New Mexico. Edwards et al. (1987) report of a *Populus angustifolia-Picea pungens/Alnus oblongifolia* type to occur in the Carson National Forest of New Mexico. Analogous types have been reported in surrounding Rocky Mountain states as well. In Colorado, Baker (1989) reports a *Populus angustifolia/Alnus incana* ssp. *tenuifolia* type in the Upper Colorado River Basin. Kittel and Lederer (1993) similarly document this type in the Yampa River Basin. In the San Miguel/Dolores River Basins their type intergrades with *Picea pungens* and *Cornus sericea*. Kittel (1993) also reports a *Populus angustifolia-Picea pungens/Alnus incana* ssp. *tenuifolia-Cornus sericea* type for the White River Basin in Colorado. Our stands had no *Picea pungens* or *Cornus sericea* present. In our stands *Alnus oblongifolia* replaces *Alnus incana* ssp. *tenuifolia*. Our type may be ecologically similar to the *Populus angustifolia/Betula occidentalis* type defined by Padgett et al. (1989) in Utah with *Betula occidentalis* replacing *Alnus oblongifolia*.

1b. *Populus angustifolia/Alnus oblongifolia* CT (narrowleaf cottonwood/New Mexico alder; POPANG/ALNOBL)

Acer negundo phase (boxelder; ACENEG)

Distribution: This phase of the community type occurs in lower montane reaches of the Pecos River in San Miguel County and is probably not widespread throughout New Mexico. This type may occur in Lincoln County.

Vegetation: *Populus angustifolia* (narrowleaf cottonwood) [FACW], dominates this closed-canopied community in the tree and shrub layer. *Acer negundo* (boxelder) [FACW-], is well represented in the tree and shrub layers. *Alnus oblongifolia* (New Mexico alder) [FACW+], dominates this community in the shrub layer and sometimes extends up into the tree sub-canopy. It forms dense thickets lining the banks of the channel. This community is species rich with all stratum well represented. Common shrubs include *Cornus stolonifera* (redosier dogwood) and *Lonicera involucrata* (bearberry honeysuckle). *Heracleum lanatum* (cowparsnip) *Rudbeckia*

laciniata (cutleaf coneflower) and *Solidago canadensis* (Canada goldenrod) commonly occur in the forb layer. Common grasses include *Dactylis glomerata* (orchardgrass) and *Phleum pratense* (timothy) while *Glyceria striata* (fowl mannagrass) and *Elymus canadensis* (Canada wildrye) are present.

Environmental Setting: This phase occurs within the floodplain and along overflow channels. It is associated with Rosgen's Type B2 channel morphology. The channel is moderately entrenched and moderately confined by the valley. Channel materials consist of large cobbles, small boulders, and coarse gravels. Depositional features include a large cobble bar. These communities may be flooded every five years due to their low position in the floodplain. The flow required to flood this community is estimated to be 850 cfs. The water table lies within 100 cm of the soil surface. Soils are classified as coarse-loamy over sandy-skeletal, calcareous, Oxyaquic Udifluvents with a frigid temperature regime. Conductivity is low (0.6 mS). The pH ranges from 7.34 to 7.5. Elevation is 7080 ft.

Adjacent Vegetation: Adjacent north-facing hillslopes are steep and are commonlly occupied by mixed coniferous forests. Ponderosa pine forests typically occupy south-facing hillslopes. Adjacent riparian vegetation include *Acer negundo/Salix exigua* communities on terraces and *Populus angustifolia/Alnus oblongifolia* shrublands on side bars.

Discussion: This phase of the community appears to be a mid- to late-progressional stage of the narrowleaf cottonwood/New Mexico alder CT. These sites are densely shaded, mesic, and species rich. *Acer negundo* reaches the upper limits of its range in this typic phase, intergrading with cottonwood and alder in the tree and shrub layers. Its occurrence may be due to an elevational overlap.

The taxonomic status of *Acer negundo* has been debated amongst ecologists in surrounding states. It is suggested that along some drainages in Colorado an eastern race of *Acer negundo* ssp. *violaceum* may have been introduced by homesteaders for railroad ties, etc. (Kittel 1993). Weber (1987) classifies a native western race *Negundo aceroides* ssp. *interius* which has branchlets covered with short hairs and is common to gulches and streamsides at low elevations in Colorado. Weber's eastern race, classified as *Negundo aceroides* ssp. *violaceum*, has smooth, pale, glaucous twigs and was introduced as a shade tree. In New Mexico our species is thought to be that of the native western race as well. Martin and Hutchins (1980) refer to two varieties in New Mexico: *Acer negundo* var. *interius* as the native, having more or less glabrous twigs, and *Acer negundo* var. *texanum* that has permanently puberulent twigs and is introduced. Szaro (1989) reports a wide distribution of *Acer negundo* in the understory of many of his stands, but makes no reference to varietal differences or races.

Documentation: This description is based on cross section Pecos9 and plot 93PD11. No other type of this specific kind has been reported elsewhere in New Mexico or surrounding states. Most classifications report independent *Populus angustifolia, Acer negundo,* and *Alnus oblongifolia* (or similar species) community types. Similar types have been defined with

boxelder occurring in mixed communities with narrowleaf cottonwood and New Mexico alder. Dick-Peddie (1993) reports of an elevational overlap of species in montane riparian tree-dominated communities in New Mexico with these species capable of being codominants. Our type may be ecologically similar to *Populus angustifolia-Acer negundo/Cornus sericea* reported to occur in Colorado (Kittel and Lederer 1993), and the *Populus angustifolia/Cornus sericea* type in Utah (Padgett et al. 1989) with *Alnus oblongifolia* replacing *Cornus sericea*. In this last community *Acer negundo* is reported to be an occasional codominant.

2. *Populus angustifolia/Poa pratensis* CT (narrowleaf cottonwood/Kentucky bluegrass; POPANG/POAPRA)

Distribution: This community type occurs along the lower montane reaches of the Pecos River in San Miguel County and may occur in Lincoln County.

Vegetation: *Populus angustifolia* (narrowleaf cottonwood) [FACW], dominates this closed-canopied to moderately open and mature community in the tree layer. Trees are similar in age and regeneration is absent. These communities are well shaded and species diversity is relatively low. The understory is predominantly grassy. *Poa pratensis* (Kentucky bluegrass) [FACU], dominates this layer. *Festuca pratensis* (meadow fescue) and *Phleum pratense* (timothy) are common. The shrub and forb layers have few species. *Rosa woodsii* (woods rose) is common while *Prunus virginiana* (common chokecherry) and *Ribes inerme* (whitestem currant) are present. *Clematis ligusticifolia* (western virginsbower) and *Geranium atropurpurea* (purple geranium) are present.

Environmental Setting: POPANG/POAPRA occurs on older, high elevation island and side bars. It is associated with the Rosgen's Type B2 channel morphology. The channel is moderately entrenched and moderately confined by the valley. Channel material consists of large cobbles, small boulders, coarse gravels, and small to medium sized debris that affects less than 10% of the channel. Hydraulic analysis indicates that this community may be flooded every 25 years with an estimated flow of 2200 cfs to inundate this community. Alluvial terraces are coarse textured, relatively stable and adjacent to steep upland slopes. Soils are classified as a sandy-skeletal Mollic Udifluvents having a frigid temperature regime and moderate moisture regime. These soils meet the criteria for hydric soils as determined by the 1987 Corps of Engineers Wetlands Delineation Manual. Conductivity is low (0.48 mS). The pH ranges from 6.53 to 7.14 throughout the matrix. Elevation is 7320 ft.

Adjacent Vegetation: Adjacent canyon hillslopes are south-facing and occupied by ponderosa pine forests. Adjacent riparian vegetation includes a *Carex nebrascensis-Carex rostrata* wetland.

Discussion: The *Populus angustifolia/Poa pratensis* CT appears to be a late-progressional stage. Tree canopies are open. Diversity of species is generally low. Aggradation of sediments and flood debris contributes to lateral channel migration. A wetland adjacent to this community

appears to be located in an abandoned channel that became isolated with the migration of the channel. This community is reported as a disturbance induced type in other states (Utah and Montana).

The taxonomic status of *Poa pratensis* in New Mexico and the Rocky Mountain region has been debated. Allred (1993) in New Mexico recognizes two different races of *Poa pratensis*: a *pratensis* phase, which is introduced and common throughout North America, and an *agassizensis* phase that is the native race and occurs less commonly. Weber (1987) classifies these races into two different species in Colorado. His *Poa pratensis* in Colorado is adventive and widely distributed, and always occurs in wet sites under natural conditions, whereas, *Poa agassizensis* is the native, western counterpart of *Poa pratensis* and is common to dry open forests.

Documentation: This description is based on cross section Pecos7 and plot 93PD09. This type may be ecologically similar to our upper montane *Picea pungens/Poa pratensis* which occupies older, infrequently flooded terraces. Our type is similar to Dick-Peddie's (1993) *Populus angustifolia*/MS/MG-F which occurs in montane riparian regions of New Mexico. Our type is analogous to the type described by Padgett and others (1989) which is widespread in Utah, and Hansen and others (1990) of Montana.

3. *Populus angustifolia/Salix exigua* CT
(narrowleaf cottonwood/coyote willow; POPANG/SALEXI)

Distribution: This community type is common to lower montane reaches of the Pecos River and the Gallinas River in San Miguel County and is expected to occur in Lincoln County.

Vegetation: *Populus angustifolia* (narrowleaf cottonwood) [FACW], dominates the tree canopy in this type with other important riparian tree species commonly present including *Populus fremontii* (Fremont cottonwood) and *Acer negundo* (boxelder). *Salix exigua* (coyote willow) [OBL], dominates the shrub layer and is well represented to luxuriant. Other shrubs that are well represented include *Salix irrorata* (bluestem willow), *Rosa woodsii* (woods rose) and *Prunus virginiana* (common chokecherry). The herbaceous layer is diverse and luxuriant. Several species of *Juncus* are present and include *Juncus bufonius* (toad rush), *Juncus tenuis* (poverty rush), *Juncus balticus* (Baltic rush), *Juncus torreyi* (Torrey rush) and *Juncus saximontanus* (Rocky Mountain rush). Other graminoids present include *Carex aquatilis* (water sedge), *Scirpus americanus* (threesquare), *Muhlenbergia asperifolia* (alkali muhly) and *Eleocharis macrostachya* (longstem spikerush). The predominant grasses, however, are *Agrostis stolonifera* (carpet bentgrass) and *Agrostis alba* (redtop).

Environmental Setting: POPANG/SALEXI occurs on low to moderate elevation side bars or on broad floodplains. It is associated with Rosgen's Type B2 and C4 channel morphologies. In

the B2 Type classification, the channel is moderately entrenched and moderately confined by the valley. The stream gradient varies little (1.1% to 1.2%). Channel materials consist of large cobbles, small boulders, coarse gravels, and small to medium sized debris. Adjacent alluvial terraces are relatively stable with steep upland slopes nearby. Banks are commonly stabilized by vegetation. In the C4 stream type, the channel is moderately entrenched but only slightly confined by the valley. Channel materials consist of sand and small gravels. Alluvial bars are low and banks are relatively stable. Hydraulic analysis indicates that this community may be flooded every five to ten years. On the Pecos, a flow of 1300 cfs would likely inundate the community, while on the Gallinas a flow of only 500 cfs would be required. Soils are classified as nonacid, sandy-skeletal Oxyaquic Udifluvents, and nonacid coarse-loamy over sandy-skeletal Aeric Fluvaquents. Temperature regime is frigid while the moisture regime is moderate. Conductivity varies from 0.52 to 4.96 mS. The pH ranges from 7.19 to 7.65. Elevation ranges from 6540-7080 ft.

Adjacent Vegetation: Adjacent upland vegetation on hillslopes include ponderosa pine forests and juniper woodlands. Terraces adjacent to the floodplain are commonly used for pasture.

Discussion: The *Populus angustifolia/Salix exigua* CT appears to be late/advanced-progressional stage of a mature cottonwood forest. Accumulation of debris from beaver activity can affect the flow in secondary channels providing possible sites for establishment.

Documentation: This description is based on cross sections Pecos9 and Gallinas3; and plots 93PD19, 93PD23, 93PD24 respectively. This type is analogous to other classified types in New Mexico and Colorado (Baker 1984, Kittel and Lederer 1993, and Kittel 1993). Muldavin et al. (1993b) reports this type to occur on the Upper Rio Grande River Basin of New Mexico, and Dick-Peddie (1993) classifies a *Populus angustifolia/Salix exigua*/MG-F as being common to montane riparian regions of New Mexico. The Colorado types are widespread and analogous to our types.

III. Plains Forested Wetlands

IV. Broad-Leaved Deciduous Series Group

Intact fluvial processes are essential for the establishment, growth, maintenance, and long-term survival of these forests. The majority of these forests occur on the mainstem of the Pecos River where water flows are regulated. The durability of this series group is threatened by additional impacts from grazing and encroachment from exotic species. In southeastern New Mexico, this series group is dominated by the *Populus fremontii* (Fremont cottonwood) Series which occurs on floodplain bars and terraces. Many of the stands consist of mature individuals in open canopied stands. Regeneration is largely due to asexual cloning. Sexual reproduction occurs infrequently. Terraces are often situated well above the active channel where surficial fluvial processes are no longer active.

V. *Populus fremontii* (broadleaf cottonwood) Series

1. *Populus fremontii*/Sparse CT
(Fremont cottonwood/sparse ground cover; POPFRE/SPARSE)

Distribution: This community type is of limited extent and occurs on the middle reaches of the Pecos River in Guadalupe County and may occur elsewhere from DeBaca to Eddy County.

Vegetation: *Populus fremontii* (narrowleaf cottonwood) [FACW], dominates the tree layer providing a closed-canopy shady site. Regeneration of cottonwood is not evident. *Juniperus monosperma* (oneseeded juniper) is well represented in the shrub layer or as a sub-canopy tree along with the exotic *Elaeagnus angustifolia* (Russian olive). Vegetative ground cover is sparse and mostly herbaceous. Graminoids and forbs present include *Cyperus uniflorus* (oneflower flatsedge), *Muhlenbergia asperifolia* (alkali muhly), *Mentha arvensis* (field mint) and *Melilotus alba* (white sweetclover).

Environmental Setting: POPFRE/SPARSE occurs on moderate elevation bars or terraces positioned out of the floodplain. It is associated with Rosgen's Type C3 channel morphology. The channel is moderately entrenched and slightly confined by the valley. Stream gradient is between 0.5 and 1%. Channel materials consist of a mixture of silt, sand, fine gravels, and small cobbles. Bars and terraces appear to be moderately stable. Debris from flooding is common. Hydraulic analysis indicates that flooding occurs at 10- to 25- year intervals. Soils are classified as calcareous Oxyaquic Ustipsamments with a mesic temperature regime. These soils are predominantly sandy soils with aquic conditions occurring above 85 cm. Conductivity is 0.40 mS and the pH ranges from 7.87 to 8.01. Elevation is 5200 ft.

Adjacent Vegetation: Adjacent upland slopes are sparsely vegetated with mesquite shrubland communities.

Discussion: This mature community of *Populus fremontii* occupies a narrow band on floodplains that are commonly delimited by downcutting of the river channel and farmed terraces. The sparse ground cover may be attributed to previous scouring floods that carryied large debris and heavy bedloads. There is some potential for sexual reproduction of cottonwoods, but, shading may limit the success. The lack of regeneration may also be due to herbivory.

Documentation: This description is based on cross section Pecos20 and plot 93PD43. This type corresponds with the type documented by Muldavin et al. (1993b) for the Upper Rio Grande. No other synonymous types have been reported elsewhere for New Mexico. A similar community type was identified by Hansen and others (1990) for Central and Eastern Montana. Generally, Fremont cottonwood types in New Mexico have been broadly classified to the series level (Dick-Peddie 1993).

2. *Populus fremontii-Salix amygdaloides* CT
(Fremont cottonwood-peachleaf willow; POPFRE-SALAMY)

***Tamarix pentandra* phase**
(saltcedar; TAMPEN)

Distribution: This exotic dominated phase of the typic community occurs occasionally along the middle reaches of the Pecos River north of Santa Rosa Lake in Guadalupe County and may occur in DeBaca and Chaves Counties.

Vegetation: *Populus fremontii* (Fremont cottonwood) [FACW], dominates the tree layer providing an open to moderately open canopy. *Salix amygdaloides* (peachleaf willow) [FACW], is dominant and well represented in the shrub layer. Regeneration of *Salix amygdaloides* is common. The shrub layer consists of several potentially dominating species. In this phase *Tamarix pentandra* (saltcedar), [no wetland indicator status available] is well represented and can codominate the shrub layer. *Salix exigua* (coyote willow) is common. Young *Populus fremontii* regeneration is common. Herbaceous ground cover is sparse and low in diversity.

Environmental Setting: This phase occurs on moderately positioned side bars and is associated with a Rosgen's Type C4 channel morphology. The channel is moderately entrenched and slightly confined by the valley with a relatively flat stream gradient between 0.1 and 0.5%. Channel materials consist of a sand/silt bed. Banks are moderately stabilized by woody vegetation. Hydraulic analysis indicates that this site may be flooded every five years and commonly there is evidence of recent flooding in the form of thick layers of large debris. Soil are classified as coarse-loamy over very fine calcareous Oxyaquic Ustifluvents. These are floodplain soils that have a mesic temperature regime, a moderate moisture regime, and aquic conditions above 100 cm. Conductivity is 2.32 mS. The pH ranges from 7.65 to 7.87. Elevation is 4740 ft.

Adjacent Vegetation: Adjacent upland vegetation is predominantly pinyon pine/juniper woodlands. Adjacent riparian vegetation includes *Baccharis emoryi/Salix exigua* communities on bars and *Tamarix pentandra* lining the banks.

Discussion: This is an exotic encroachment phase of the *Populus fremontii/Salix amygdaloides* CT and appears to be a mid-progressional stage community. Regeneration of *Populus fremontii* and *Salix amygdaloides* is common. Mature individuals of both species were noted on adjacent bars. Although *Tamarix pentandra* has gained a foothold in other adjacent communities, it is represented here by younger shrubs that are not yet well established. *Tamarix pentandra* in this association represents an exotic phase of the CT common to the middle and lower reaches of the Pecos.

Documentation: This description is based on cross section Pecos14 and plot 93PD29. No other classifications of New Mexico or surrounding states have identified this community type. Generally, these dominants have been described as independent community types in New Mexico. Dick-Peddie (1993) documents the following types for New Mexico that may be related to ours: *Populus fremontii*/MS/MG-F, *Salix amygdaloides*/MS/MG-F, and Saltcedar Series, *Tamarix* spp. (towards Cottonwood Associations). In Colorado, a Plains cottonwood/peachleaf willow (*Populus deltoides* ssp. *monilifera/Salix amygdaloides*) type has been documented by Baker (1984).

3. *Populus fremontii/Salix exigua* CT
(Fremont cottonwood/coyote willow; POPFRE/SALEXI)

Distribution: This community type occurs frequently on the middle reaches of the Pecos River and in an unnamed tributary in the Las Vegas National Wildlife Refuge. It occurs from San Miguel to Chaves County.

Vegetation: This community is characterized by mature individuals of *Populus fremontii* (Fremont cottonwood) [FACW], dominating the tree layer. The canopy is typically open and the trees can be widely spaced. *Salix exigua* (coyote willow) [OBL], forms dense thickets and dominates the shrub layer. Other willows, *Salix amygdaloides* (peachleaf willow) and *Salix gooddingii* (Goodding's willow), and shrub forms of *Acer negundo* (boxelder) and *Elaeagnus angustifolia* (Russian olive) may also be well represented. The herbaceous layer is diverse. In wetter zones some forbs and graminoids may be well represented. *Berula erecta* (stalky berula), *Solidago canadensis* (Canada goldenrod) and *Melilotus alba* (white sweetclover) are well represented. *Scirpus americanus* (threesquare), *Scirpus acutus* (tulegrass) and *Muhlenbergia asperifolia* (alkali muhly) are common graminoids.

Environmental Setting: POPFRE/SALEXI occurs on stable bars at mid elevations in the floodplain and develops on recently deposited alluvium. This community is associated with Rosgen's Types B2, C1, and C3 channel morphologies. In the C morphology types, the channel is moderately entrenched and slightly to moderately confined by the valley. Channel materials consist of sand, coarse gravels, small cobbles, and large debris. Moderately developed depositional features are common. In the B2 channel morphology type, the channel is moderately entrenched and moderately confined by the valley. Terraces and banks are stable. Steep canyon walls border the floodplain. Hydraulic modeling indicates that these communities are inundated at 25-year intervals. Soils are classified as calcareous, sandy-skeletal Typic Ustifluvents; calcareous, coarse-loamy over sandy-skeletal Oxyaquic Ustifluvents, and calcareous, fine-loamy over sandy-skeletal Typic Endoaquents. Ustifluvents are floodplain soils that have a mesic temperature regime and a moderate moisture regime. Oxyaquic Ustifluvents have aquic conditions above a depth of 100 cm. Typic Endoaquents have aquic conditions between 40-50 cm from the soil surface. Typic Ustifluvents and Typic Endoaquents are hydric

soils as determined by the 1987 Corps of Engineers Wetland Delineation Manual. Conductivity ranges from 0.56 to 2.10 mS. The range of pH is between 7.52 to 7.83. Elevation ranges from 5860-6320 ft.

Adjacent Vegetation: Adjacent upland vegetation varies from the northern reaches to the southern and can include pinyon pine/juniper woodlands with ponderosa pine and Gambel's oak, or mesquite shrublands and alkali sacaton grasslands. Adjacent riparian vegetation can include saltcedar, seepwillows, and mudflats pioneered by cattails, spikerushes and threesquare.

Discussion: The *Populus fremontii/Salix exigua* CT is considered a mid-progressional stage and is an important plains riparian forest community. Signs of beaver herbivory were observed on the cottonwoods. The distribution of cottonwoods may be threatened by manmade impoundments (dams, irrigation channels, and levees). Below the dams, entrenchment of the channel increases and channel evulsion is restrained. Flood flows which are required for the growth, maintenance, and reproduction of this community are restricted below Santa Rosa Lake and Ft. Sumner Dam. *Tamarix* spp. may be limiting the distribution of this type. In the middle reaches (primarily in the Ft. Sumner region) *Elaeagnus angustifolia* is also encroaching and positioned on the banks directly adjacent to *Tamarix* spp.

Documentation: This description is based on cross sections Pecos11, Pecos12, and Box Canyon1; and plots 93PD15, 93PD17, 93PD26 respectively. Our type corresponds with Dick-Peddie's (1993) *Populus fremontii/Salix exigua/*MG-F and the *Populus fremontii/Salix exigua* community type reported in the Santa Fe National Forest (Miller et al. 1993).

4a. *Populus fremontii/Sporobolus airoides* CT (Fremont cottonwood/alkali sacaton; POPFRE/SPOAIR)

Distribution: This community type occurs along the middle reaches of the Pecos River in DeBaca and Chaves Counties. However, the extent of its distribution within these counties is limited.

Vegetation: *Populus fremontii* (Fremont cottonwood) [FACW], dominates an open tree canopy. Shrubs, including *Baccharis emoryi* (seepwillow) and *Chrysothamnus viscidiflorus* (Douglas rabbitbrush) may be present. The exotic *Tamarix pentandra* (saltcedar) is usually present, while *Juniperus monosperma* (oneseeded juniper) is uncommon. The understory is characteristically grassy and dominated by *Sporobolus airoides* (alkali sacaton) [FAC], a common bottomland grass of this region. *Bothriochloa saccharoides* (silver sourgrass) can also occur and be well represented.

Environmental Setting: POPFRE/SPOAIR occurs on high elevation terraces and is rarely flooded. It is associated with Rosgen's Type C3 and C4 channel morphologies. The channel is moderately entrenched and slightly confined by the valley with relatively flat stream gradients ranging from 0.1 to 1%. Channel materials consist of a sand or gravel bed mixed with small

cobbles and silt. Hydraulic analysis indicates that flows along the Pecos of up to 30,000 cfs to would be required to inundate these floodplains due to increased channel entrenchment and decreased channel evulsion. Under unregulated flows, these sites would be flooded every 25 to 50 years. Soils are classified as coarse-loamy, mixed calcareous Typic Ustifluvents; very fine, mixed, mesic, and calcareous Mollic Ustifluvents; and sandy Aquic Ustipsamments. The Mollic Ustifluvents commonly have an organic layer to a depth of 15 cm. Aquic conditions can occur within 100 cm of the soil surface. Typic Ustifluvents and Aquic Ustipsamments are hydric soils as determined by the 1987 Corps of Engineers Wetlands Delineation Manual. Conductivity ranged from 1.23 to 8.7 mS. The range of pH is from 7.63 to 8.28. Elevation ranges from 3540-4580 ft.

Adjacent Vegetation: Adjacent upland vegetation commonly associated with this type include mesquite shrublands and plains-mesa grasslands. Adjacent riparian vegetation includes *Salix exigua-Baccharis emoryi* communities on bars, *Tamarix pentandra*/Sparse communities on banks and mudflats pioneered by *Scirpus americanus/Typha latifolia* communities.

Discussion: The *Populus fremontii/Sporobolus airoides* CT is considered to be a late/advanced-progressional stage community where tree canopies are open, and individual trees are widely spaced. These sites typically occur on elevated, extensive floodplains of the middle reaches of the Pecos River Basin.

Documentation: This description is based on cross sections Pecos13, Pecos17, Pecos18 and plots 93PD27, 93PD35, 93PD40 respectively. The generally described types of Dick-Peddie (1993) (*Populus fremontii* association, *Sporobolus airoides* swales) and Szaro's (1989) *Populus fremontii* community type may include this CT.

4b. *Populus fremontii/Sporobolus airoides* CT (Fremont cottonwood/alkali sacaton; POPFRE/SPOAIR)

Tamarix pentandra phase (saltcedar; TAMPEN)

Distribution: This exotic dominated phase of the typic community is widely distributed along similar floodplains and terraces of the Pecos River Basin in DeBaca and Chaves Counties.

Vegetation: This phase is characterized by *Tamarix pentandra* (saltcedar) [no wetland indicator status], as the exotic shrub dominant. It forms dense thickets which effectively shade out the understory vegetation although *Populus fremontii* (Fremont cottonwood) [FACW], and *Sporobolus airoides* (alkali sacaton) [FAC], are always present, but not well represented. Species diversity is poor and sparse in cover.

Environmental Setting: This phase occurs on middle to high elevation terraces. It is associated with Rosgen's Type C3 and C4 channel morphology. The channel is moderately entrenched and slightly confined by the valley, with a relatively flat stream gradient between 0.15 and 0.35%. Channel materials consist of a sand/gravel bed mixed with small cobbles and silt. Hydraulic analysis indicates that under unregulated conditions this phase would be inundated every 25-50 years with discharges between 30,000 and 50,000 cfs. Soils are commonly classified as calcareous Oxyaquic Torrifluvents and Typic Ustifluvents. Particle size classes vary from sandy to coarse-loamy. Aquic conditions occur within 100 cm below the soil surface. Conductivity ranges from 0.4 to 2.2 mS. Typic Ustifluvents are hydric soils as determined by the 1987 Corps of Engineers Wetlands Delineation Manual. The pH ranges from 7.66 to 8.28. Elevation ranges from 3680-4480 ft.

Adjacent Vegetation: Adjacent upland vegetation commonly associated with this type include mesquite shrublands and plains-mesa grasslands. Adjacent riparian vegetation includes *Salix exigua-Baccharis emoryi* communities on bars, *Tamarix pentandra*/Sparse communities on banks and mudflats pioneered by *Scirpus americanus/Typha latifolia* communities.

Discussion: This is an exotic encroachment phase of the *Populus fremontii/Sporobolus airoides* community that has developed with the construction of reservoirs and impoundment of the river. Normal flow regimes no longer exist below these dams. Flows are regulated and entrenchment of the channel probably occurs at higher than normal rates. These conditions may be favoring *Tamarix pentandra*.

Documentation: This description is based on cross sections Pecos15, Pecos16, Pecos19, and Pecos24; and plots 93PD30, 93PD32, 93PD41, 93PD52 respectively. No other types described elsewhere in New Mexico or surrounding regions directly correspond to this typic phase. Dick-Peddie (1993) classifies a *Tamarix pentandra* Series and qualifies it as moving toward Cottonwood Associations.

II. Warm Temperate Forested Wetlands

III. Southwest Forested Wetlands

IV. Broad-Leaved Deciduous Series Group

The *Celtis reticulata* (netleaf hackberry) and *Populus fremontii* (Fremont cottonwood) series in this group can be expected to occur where surface flows are perennial, periodic spring flooding occurs and streams are not stabilized by storage reservoirs. There are two community types classified in the *Celtis reticulata* Series and one community type in the *Populus fremontii* Series.

V. *Celtis reticulata* (netleaf hackberry) Series

1. *Celtis reticulata-Juglans major* CT
(netleaf hackberry-Arizona walnut; CELRET-JUGMAJ)

Distribution: The distribution of this type is limited to smaller tributaries of the lower segment of the Pecos River in Eddy County. It is known to occur at Blue Spring, a tributary of the Black River.

Vegetation: Two codominants of this community are *Celtis reticulata* (netleaf hackberry) [FACU] and *Juglans major* (Arizona walnut) [FACW-]. Commonly, these trees grow adjacent to the banks, often overtopping and shading the channel. The understory is well developed in all other layers of this distinctively mesic site. *Rhus copallina* (flameleaf sumac) is well represented in the shrub layer along with *Berberis trifoliolata* (agarito barberry) and *Vitis arizonica* (canyon grape). The herbaceous layer is distinctively mesic and well developed. Some plant species are more commonly associated with marshy ground and have limited distributions in New Mexico. These forbs are well represented and include *Hydrocotyl verticillata* (whorled pennywort) and *Flaveria chloraefolia* (clasping flaveria). Other forbs present include *Berula erecta* (stalky berula), *Phyla lanceolata* (northern frog fruit) and *Clematis drummondii* (Drummond clematis). Common grass associates are the non-native *Cynodon dactylon* (bermudagrass) and *Polypogon monspeliensis* (rabbitfoot grass).

Environmental Setting: CELRET-JUGMAJ occurs on low floodplains. This spring fed channel is moderately entrenched and slightly confined by the valley. It corresponds with Rosgen's Type C4 channel morphology. Channel materials are commonly sandy or a fine gravel bed. Soils are hydric and saturated to the surface. Inundation probably occurs throughout the year. Evidence of anoxic (gleying) conditions are present at the surface. Elevation is 3240 ft.

Adjacent Vegetation: Adjacent upland vegetation commonly associated with this type includes creosotebush shrublands common of the Chihuahuan Desert Scrub. Adjacent riparian vegetation consists of *Scirpus acutus/Eleocharis macrostachya* wetlands and *Populus fremontii/Salix gooddingii* communities on floodplains of the Black River.

Discussion: The *Celtis reticulata-Juglans major* CT appears to be a stable late-progressional stage community. Tree canopies are closed and the site is densely shaded. Diversity of species is high in these mesic communities. The occurrence of this type is sporadic. Lush stands are uncommon and do not occur on the mainstem of the Pecos.

Documentation: This description is based on plot 93PD67. Minckley and Brown (1982) report these species to occur in "interior riparian deciduous mixed broadleaf forests and woodlands" with *Populus fremontii* and *Salix gooddingii*. Classifications of New Mexico and Arizona (Szaro 1989) describe similar community types with these species occurring. The Arizona walnut in our type was previously thought not to exist east of the Rio Grande (Dick-Peddie 1993), however

along the Black River, *Juglans major* was found to occur (though sporadic) with little walnut (*Juglans microcarpa*).

2. *Celtis reticulata-Salix gooddingii* CT
(netleaf hackberry-Goodding's willow; CELRET-SALGOO)

Distribution: The distribution of this type is limited to smaller tributaries of the lower segment of the Pecos River in Eddy County. It is known to occur sporadically along the Black River, a tributary of the Pecos River.

Vegetation: *Celtis reticulata* (netleaf hackberry) [FACU], and *Salix gooddingii* (Goodding's willow) [OBL], characteristically share an equal dominance as small trees and frequently occur adjacent to the river banks. A dense shrub understory of *Baccharis emoryi* (seepwillow) or *Baccharis glutinosa* (groundsel-tree) typify undisturbed occurrences. *Rhus copallina* is usually present on the periphery of the community and positioned almost out of the floodplain. Graminoids in the stand are luxuriant while forbs scarce. *Cynodon dactylon* (bermudagrass), an exotic grass is abundant and commonly dominates the graminoid layer in these communities.

Environmental Setting: CELRET-SALGOO occurs on floodplain bars and terraces of the channel. It is associated with Rosgen's Type C4 channel morphology. The channel is moderately entrenched and slightly confined by the valley with a flat gradient of 0.15%. Large flows probably do not commonly occur. Banks are well vegetated and stabilized. The floodplain is narrow and confined to within two meters of the active channel. Due to the low gradient of the stream, a flow of approximately 90 cfs would likely occur with heavy summer thunderstorms. Such a flow is expected to occur at approximately five year intervals. Soils are classified as loamy-skeletal Mollic Fluvaquents with a thermic temperature regime and a calcareous matrix. Saturation and a reduced matrix occur up to 40 cm below the surface. The upper 40 cm contains more gravels and cobbles than the gleyed horizon. These soils are hydric soils as determined by the 1987 Corps of Engineers Wetlands Delineation Manual. Conductivity is 2.96 mS. The pH range is 7.49 to 7.62. Elevation is 3660 ft.

Adjacent Vegetation: Adjacent upland vegetation commonly associated with this type include creosotebush shrublands common of the Chihuahuan Desert Scrub. Adjacent riparian vegetation consists of *Scirpus acutus/Eleocharis macrostachya* wetlands and *Populus fremontii/Salix gooddingii* communities on floodplains of the Black River.

Discussion: The *Celtis reticulata-Salix gooddingii* CT appears to be a late/advanced-progressional stage community. It occurs along a tributary of the Pecos, the Black River, which has an uncommon morphology. The river is slowly moving and is often ponded. Ponding occurs primarily due to colonization of the large tussock-forming exotic sawgrass (*Cladium jamaicense*) across the channel. This species, preferring riparian areas with calcareous soils,

occurs in tropical and warm temperate regions of the world and is thought to originate in Australia (Correll and Correll 1975). In some reaches the channel consists entirely of persistent-emergent vegetation.

Documentation: This description is based on cross section Black River1 and plot 93PD57. This community type has not been previously described in New Mexico. Dick-Peddie (1993) classifies a *Celtis reticulata*/MS/S association. We regard our type to be analogous. Szaro (1989) classifies a *Salix gooddingii* community type in New Mexico and Arizona, reporting *Celtis reticulata* as being a commonly associated understory shrub or small tree. Minckley and Brown (1982) report these species to occur in "interior riparian deciduous mixed broadleaf forests and woodlands" with Fremont cottonwoods and Goodding's willows.

V. ***Populus fremontii*** **Series**

1. ***Populus fremontii-Salix gooddingii*** **CT**
(Fremont cottonwood-Goodding's willow; POPFRE-SALGOO)

Distribution: This type was found to occur on three tributaries of the Lower Pecos River Basin, Rio Ruidoso, Rio Hondo, and the Black River in Lincoln and Eddy Counties.

Vegetation: *Populus fremontii* (Fremont cottonwood) [FACW], dominates the overstory with *Salix gooddingii* (Goodding's willow) [OBL], codominating as a subcanopy tree. *Salix gooddingii* is typically positioned adjacent to the river banks and often overhangs the banks. Other trees may be present and include *Acer negundo* (boxelder) and *Juglans major* (Arizona walnut). *Populus fremontii* and *Salix gooddingii* may also be present in the shrub layer in advanced stages of regeneration. Other shrubs can include *Salix exigua* (coyote willow), *Baccharis glutinosa* (groundsel-tree) and *Robinia neomexicana* (New Mexico locust), as well as the exotics *Tamarix pentandra* (saltcedar) and *Elaeagnus angustifolia* (Russian olive). The herbaceous understory is distinctively mesic and often graminoid-dominated. *Muhlenbergia rigens* (deergrass) can be abundant. *Muhlenbergia asperifolia* (alkali muhly), *Cladium jamaicense* (sawgrass), *Juncus balticus* (Baltic rush) and the exotic *Cynodon dactylon* (bermudagrass) are often well represented.

Environmental Setting: POPFRE-SALGOO occurs on mid-elevation, well developed side bars. It is associated with Rosgen's Type C3 channel morphology. Channel entrenchment is moderate, while valley confinement is slight, with stream gradients between 0.5 and 1%. Channel materials are commonly sand, coarse gravels and small cobbles. Multiple terraces or low vegetated bars are common features. Hydraulic analysis indicates a flow of approximately 1900 cfs would scour some lower positioned sites at five-year intervals, while 50-350 cfs would likely flood the sites every two to five years. Soils are classified as calcareous Aeric Fluvaquents, Oxyaquic Ustifluvents, and Typic Fluvaquents. Particle

classes range from sandy-skeletal to coarse-loamy. Aquic conditions can occur between 100-40 cm of the soil surface. Aeric Fluvaquents and Typic Fluvaquents are hydric soils as determined by the 1987 Corps of Engineers Wetland Delineation Manual. Conductivity ranges from 0.64 to 9.02 mS. The pH ranges from 7.65 to 8.09. Elevation ranges from 3240-5320 ft.

Adjacent Vegetation: Adjacent upland vegetation commonly associated with this type include creosotebush shrublands common of Chihuahuan Desert Scrub. Adjacent riparian vegetation consists of *Scirpus acutus/Eleocharis macrostachya* wetlands and *Populus fremontii/Salix gooddingii* communities on floodplains of the Black River.

Discussion: The *Populus fremontii-Salix gooddingii* CT is considered a late/advanced-progressional stage community. Tree canopies are moderately open and individuals are widely spaced. *Muhlenbergia rigens* is a large tussock-forming grass distributed sporadically on the Black River. As it occurs it commonly forms dense stands along riparian woodland streambanks which effectively stabilizes them from erosion. The equally large tussock-forming exotic sedge, sawgrass (*Cladium jamaicense)* is an abundant associate. Lateral channel migration may be undercutting some banks on the Rio Hondo.

Documentation: This description is based on cross sections Rio Ruidoso1, Rio Hondo1, Black River2, and Black River3; and plots 93PD53, 93PD54, 93PD55, 93PD62, 93PD65 and 93PD66 respectively. The *Populus fremontii-Salix gooddingii* plant association is well documented in California, Arizona, and New Mexico. Holland and Roye (1988) refer to this type as a "Great Valley Cottonwood Riparian Forest Subtheme" occurring in California. In Arizona, it has been documented by Stromberg et al. (1991), Szaro (1989), Reichenbacher (1984), and Laurenzi et al. (1983). In New Mexico, Szaro (1989) and Dick-Peddie (1993) both describe the widespread distribution of this type in riparian forests. *Populus fremontii* and *Salix gooddingii* are both considered obligate riparian species that often occur as codominants on the Gila and San Francisco Rivers in western New Mexico (Dick-Peddie et al. 1987).

I. Scrub-Shrub Wetlands Class -- Shrublands

II. Cold Temperate Scrub-Shrub Wetlands

III. Rocky Mountain Montane Scrub-Shrub Wetlands

IV. Broad-Leaved Deciduous Series Group

Upper montane riparian deciduous shrublands of the Pecos River Basin are dominated by *Alnus oblongifolia* (New Mexico alder). Generally, reaches which support this Series are narrow and confined with well armored banks. *Alnus oblongifolia* communities are generally positioned directly adjacent to the channel, and are adapted to periodic flooding. They may require more aerated groundwater that flows through the coarse-textured subsurface soils (Kittel and Lederer 1993, Padgett et al. 1989).

V. *Alnus oblongifolia* (New Mexico alder) Series

1. *Alnus oblongifolia/Calamagrostis canadensis* CT (New Mexico alder/Canada reedgrass; ALNOBL/CALCAN)

Distribution: This type is known from the upper reaches of the Gallinas River in San Miguel County where it grow along small, low-gradient channels. It may occur in upper elevations of Lincoln County.

Vegetation: *Alnus oblongifolia* (New Mexico alder) [FACW+], occurs as the overstory dominant in the shrub layer of this CT. The understory is characteristically luxuriant and species rich. *Calamagrostis canadensis* (Canada reedgrass) [OBL], is abundant in the graminoid layer and is the understory dominant. Other common shrubs include *Salix irrorata* (bluestem willow) and *Rubus strigosus* (blackberry). Other graminoids include several sedge species, *Carex stipata* (owlfruit sedge), *Carex geophila* (peanut sedge) and *Carex festivella* (ovalhead sedge). *Glyceria striata* (fowl mannagrass) can be abundant. Forbs are numerous, yet some individual cover values may be low. *Veratrum californicum* (California falsehellebore) is common, while *Solidago canadensis* (Canada goldenrod), *Heracleum lanatum* (common cowparsnip) and *Equisetum arvense* (field horsetail) are well represented.

Environmental Setting: ALNOBL/CALCAN occurs on well developed side bars and is associated with Rosgen's Type B2 channel morphology where the channel is moderately entrenched and moderately confined by the valley, with a stream gradient between 1.5 and 2.5%. Banks tend to be stabilized by vegetation, cobbles and small boulders. Hydraulic analysis indicates a flood recurrence interval of approximately every five to ten years to scour the site. Soils are classified as acidic, coarse-loamy Mollic Endoaquents, and nonacid fine-loamy over sandy skeletal Mollic Endoaquents. These soils are hydric soils as determined by the 1987 Corps of Engineers Wetlands Delineation Manual. Conductivity ranges from 0.3 to 0.4 mS. The pH ranges from 4.28 to 5.35. Elevation is approximately 8600 ft.

Adjacent Vegetation: Adjacent hillslopes are steep occupied by mixed coniferous forests. Adjacent riparian vegetation includes *Picea pungens/Alnus oblongifolia* adjacent to the channel and *Picea pungens/Poa pratensis* on terraces.

Discussion: The *Alnus oblongifolia/Calamagrostis canadensis* CT appears to be a mid-progressional stage riparian shrubland that occurs towards the lower range of mixed coniferous forests. Narrow depositional floodplains are common. Diversity of species is high. Stands are usually mesic and receive additional water inputs from immediate upland runoff.

Documentation: This description is based on 1993 cross section Gallinas1 and plots 93PD20 and 93PD21. This type has not specifically been documented elsewhere in New Mexico, but is closely related to others in New Mexico and surrounding states. In New Mexico, Dick-Peddie (1993) reports an *Alnus oblongifolia*/MS/MG-F to occur in upper montane regions while Szaro (1989) reports an *Alnus oblongifolia* vegetation type to be distributed mostly in southeastern New Mexico, north central New Mexico and widely spread in Arizona. His type can occur in

mixed communities and independently with mesic understories. Kittel and Lederer (1993) document an analogous type *Alnus incana* ssp. *tenuifolia*/mesic forb in Colorado. Similarly, Padgett et al. (1989) report an *Alnus incana*/mesic graminoid as a minor type occurring in Idaho and Utah.

2. *Alnus oblongifolia-Cornus stolonifera* CT (New Mexico alder-redosier dogwood; ALNOBL-CORSTO)

Distribution: This community type occurs in the upper reaches of the Pecos River in San Miguel County and may occur in upper elevations of Lincoln County.

Vegetation: This community is dominated by shrub forms of *Alnus oblongifolia* (New Mexico alder) [FACW+], and *Cornus stolonifera* (redosier dogwood) [FACW]. Other shrubs can be common as well, and include *Lonicera involucrata* (bearberry honeysuckle), *Rosa woodsii* (woods rose) and *Rubus strigosus* (blackberry). A sparse canopy of *Picea pungens* (blue spruce) or *Abies concolor* (white fir) may be present, but the community is distinctively shrubby. A rich and luxuriant understory is commonly dominated by forbs and few graminoids. *Thalictrum fendleri* (Fendler meadowrue), *Heracleum lanatum* (common cowparsnip), *Geranium richardsonii* (Richardson's geranium) and *Equisetum arvense* (field horsetail) are all common forbs. *Phleum pratense* (timothy), *Calamagrostis canadensis* (Canada reedgrass) and *Carex rostrata* (beaked sedge) are present.

Environmental Setting: ALNOBL-CORSTO occurs on well developed side bars and is associated with Rosgen's Type B2 channel morphology where the stream channel is moderately entrenched and well confined by the valley. Banks are armored by large cobbles and boulders. Stream gradient is between 1.5 and 2.5%. High flows may have little or no impact in the alteration of the channel bed and bank material. Little or no depositional floodplain develops, although small and narrow sand bars may exist. Hydraulic modeling of these cross sections indicates that this community is at least partially flooded every year and perhaps completely flooded every two years, which is reflected by the hydric character of the soils. On the upper Pecos River relatively small flows between 120 to 650 cfs would likely inundate this site. Soils are classified as loamy skeletal Typic Fluvaquents with mixed mineralogy and a frigid temperature regime. Aquic conditions occur between 40 and 50 cm and cobbles and stones make up 60% or more of the soil profile. These soils are hydric soils as determined by the 1987 Corps of Engineers Wetlands Delineation Manual. The pH ranges from 6.4 to 7.2. Elevation ranges from 7720-8200 ft.

Adjacent Vegetation: Adjacent hillslopes are steep and occupied by mixed-coniferous forests. Adjacent riparian vegetation includes *Picea pungens/Alnus oblongifolia* adjacent to the channel and *Picea pungens/Poa pratensis* on terraces.

Discussion: The *Alnus oblongifolia-Cornus stolonifera* CT appears to be a mid- to late-progressional stage community. Evidence of oxygen poor, reduced conditions at lower depths of the soil profile is a function of the close proximity and fluctuation of the water table and the wetted perimeter of the stream channel (Muldavin et al. 1993a). Soils at this site are not well developed due to frequent scouring of the channel and skeletal structure. The vegetation that is capable of occupying these sites is adapted to frequent flooding and stem breakage. The flooding regime may maintain the shrubby aspect of the community as willows and alders resprout on a continuous basis from the root crown. Under less frequent destructive flooding, an overstory tree canopy may develop.

Documentation: This description is based on cross sections P2, P5; and plots 92HK03 and 92HK10. This community type has not previously been documented elsewhere in New Mexico, however, analogous types exist with similar species compositions yet are ordinarily described in a broader sense as an alder/mixed deciduous vegetation type (Szaro 1989 and Dick-Peddie 1993). In the surrounding Rocky Mountain region (Colorado and Utah), this type is nearly equivalent to types described by Kittel and Lederer (1993), and Padgett et al. (1989), however, in their types *Alnus oblongifolia* is replaced by *Alnus incana* ssp. *tenuifolia*.

3. *Alnus oblongifolia-Salix irrorata* CT
(New Mexico alder-bluestem willow; ALNOBL-SALIRR)

Distribution: This community type occurs on the upper reaches of the Pecos River in San Miguel County and may occur in upper elevations of Lincoln County.

Vegetation: This community is dominated by shrub forms of *Alnus oblongifolia* (New Mexico alder) [FACW+], and *Salix irrorata* (bluestem willow) [FACW+]. Additionally, several other willows, *Salix lutea* (yellow willow), *Salix subcoerulea* (blue willow), *Salix bebbiana* (Bebb willow), and *Salix lasiandra* (pacific willow) are commonly present, as well as *Cornus stolonifera* (redosier dogwood) and *Lonicera involucrata* (bearberry honeysuckle). Young shrub form reproduction of *Populus angustifolia* (narrowleaf cottonwood) may also be present. The understory is distinctively mesic, luxuriant, and species rich. Sedges, commonly *Carex microptera* (smallwing sedge), *Carex occidentalis* (western sedge), *Carex geophila* (peanut sedge), *Carex stipata* (owlfruit sedge); and rushes, *Juncus saximontanus* (Rocky Mountain rush) and *Juncus balticus* (Baltic rush) are well represented. Grasses are well represented and include *Phalaris arundinacea* (reed canarygrass), *Deschampsia caespitosa* (tufted hairgrass) and *Glyceria striata* (fowl mannagrass). Forbs present include *Equisetum arvense* (field horsetail), *Rudbeckia laciniata* (cutleaf coneflower) and *Smilacina stellata* (starry false solomonseal).

Environmental Setting: ALNOBL-SALIRR occurs on young depositional island or side bars associated with Rosgen's Type B2 and C channel morphology. There may be some

entrenchment and confinement of the stream channel, but aggradation of sediments still occurs leading to stabilization of the mid-channel and side bars. Hydraulic modeling of these cross sections indicates that the lowest bars are flooded repeatedly during the year while the return interval for flooding of the older more aggregated sites may be every other year. On the upper Pecos flows between 120-500 cfs will flood these sites. Soils are commonly loamy-skeletal or sandy-skeletal Typic Fluvaquents, Typic Endoaquents and Aquic Dystrochrepts. Occasionally, Aeric Fluvaquents can be associated with this community type, which occur under somewhat drier conditions and can have sandy or loamy surface horizons overlaying a cobbly matrix of the original channel bottom. The water table may be within at least 50 cm of the surface sometime during the year. Evidence of prolonged reduced conditions (gley) are present. These soils are hydric soils as determined by the 1987 Corps of Engineers Wetlands Delineation Manual. Conductivity is 0.40 mS. The pH range is 6.6 to 7.0. Elevations of this community type range from 7520-8320 ft.

Adjacent Vegetation: Adjacent canyon hillslopes are steep with mixed-coniferous forests. Adjacent riparian vegetation includes *Picea pungens/Alnus oblongifolia* shrublands on narrow side bars.

Discussion: The *Alnus oblongifolia-Salix irrorata* CT appears to be a mid-progressional stage riparian shrubland. Debris from flooding combined with vegetation enhances sediment aggradation and leads to stabilization of the bars.

Documentation: This description is based on cross sections P1, P6, P7, P8, and Pecos2; and plots 92HK02, 92HK09, 92HK12, 92HK13, 93PD02 respectively. Classifications in New Mexico and surrounding Rocky Mountain region states have not reported this community type, however, Kittel and Lederer (1993) describe other alder-willow types which may be ecologically similar to ours. In New Mexico and Arizona, Szaro (1989) documents a closely related *Salix irrorata*/mixed deciduous community type.

IV. Broad-Leaved Deciduous Series Group

Lower montane riparian, deciduous shrublands of the Pecos River Basin consist of one series, the *Salix exigua* (coyote willow) Series. These communities are tolerant of flooding and are one of the first pioneering shrubland community types to become established on freshly deposited coarse-textured alluvium, and hence they are effective streambank stabilizers of the lower montane reaches.

V. *Salix exigua* (coyote willow) Series

1. *Salix exigua/Elymus canadensis* CT
(coyote willow/Canada ryegrass; SALEXI/ELYCAN)

Distribution: This community type often occurs in lower montane reaches of the Pecos River in San Miguel County.

Vegetation: *Salix exigua* (coyote willow) [OBL], dominates this shrubby community. Shrubby and young forms of riparian trees *Populus angustifolia* (narrowleaf cottonwood), *Populus fremontii* (Fremont cottonwood) and *Acer negundo* (boxelder) may occasionally be present. Occurrences of *Alnus oblongifolia* (New Mexico alder) are accidental. The understory is predominantly graminoid, but mesic forbs are also well represented. *Elymus canadensis* (Canada wildrye) [FAC], occurs in all stands and dominates the graminoid layer. Other important graminoid associates are *Juncus bufonius* (toad rush), *Juncus tenuis* (poverty rush), *Juncus balticus* (Baltic rush), *Juncus saximontanus* (Rocky Mountain rush), *Phalaris arundinacea* (reed canarygrass), *Festuca pratensis* (meadow fescue) and *Agrostis stolonifera* (carpet bentgrass) as well as *Carex geophila* (peanut sedge). Common forb species present include *Solidago canadensis* (Canada goldenrod), *Rudbeckia laciniata* (cutleaf coneflower) and *Prunella vulgaris* (common selfheal), *Equisetum arvense* (field horsetail) and *Conium maculatum* (poison hemlock).

Environmental Setting: SALEXI/ELYCAN occurs on cobble bars, sand islands and low floodplains, and is associated with Rosgen's Type C1 channel morphology where the channel is moderately entrenched and confined by a narrow valley with stream gradients ranging between 1.2 and 1.5%. Channel materials consist of a cobble bed with mixtures of coarse gravel, sand, as well as a mixture of small to large flood debris that can affect up to 10% of the channel area. Banks are stabilized by woody vegetation and by armoring of the channel bed with cobbles and boulders. Hydraulic modeling indicates that recurrence intervals of flooding events occurs between five to 25 years depending on the positions of side bars and terraces relative to the channel. Some terraces are higher than others where downcutting of the river is most distinctive. In general, flows on the upper Pecos between 1200 and 2500 cfs would likely flood these sites. Soils are classified as Oxyaquic Ustifluvents, Typic Ustifluvents and Aeric Fluvaquents. All have a mesic temperature regime and are calcareous. The soils are skeletal in the lower portions of the matrix and are predominantly saturated for some time during the year. Typic Ustifluvents and Aeric Fluvaquents are hydric soils as determined by the 1987 Corps of Engineers Wetlands Delineation Manual. Conductivity ranges from 0.21 to 0.84 mS. The range of pH is from 7.51 to 7.91. Elevation ranges from 5860-6660 ft.

Adjacent Vegetation: Adjacent upland hillslopes commonly are steep bluffs topped with pinyon pine/juniper woodlands. Adjacent riparian vegetation include *Acer negundo/Salix exigua* communities on higher terraces.

Discussion: The *Salix exigua/Elymus canadensis* CT appears to be an early- to mid-progressional stage shrubland community type. It is typically tolerant of frequent flooding events and occurs on recently deposited alluvium. This CT is an important bank stabilizer and adapted to a wide-ranging set of environmental conditions. It is likely to occur throughout New Mexico at mid-range elevations intergrading between montane and plains regions. Adjacent

depositional floodplains are commonly being used for agriculture or pasture.

Documentation: This description is based on cross sections Pecos4, Pecos5, Pecos8, Pecos10, and Pecos11; and plots 93PD04, 93PD05, 93PD07, 93PD14, 93PD16 respectively. This type has not been previously reported in New Mexico and surrounding Rocky Mountain region states. Most classifications refer to a similar but more broadly defined *Salix exigua*/mesic graminoid type (Kittel and Lederer 1993, and Padgett et al. 1989), or simply a *Salix exigua* community type (Szaro 1989 and Hansen et al. 1990). Muldavin et al. (1993b) identifies a *Salix exigua/Agrostis alba* community type in the Upper Rio Grande Watershed of New Mexico.

III. Closed Basin Scrub-Shrub Wetlands

The closed basin shrublands of the Pecos Basin consist of one series group, the needle-leaved deciduous series group. This series group is known to occur in southeastern New Mexico. Soils are fine-textured and the hydrology is such that water levels fluctuate seasonally and may be ponded for much of the year.

IV. Needle-Leaved Deciduous Series Group

The closed basin needle-leaved deciduous series group of the Pecos Basin is represented by the exotic *Tamarix pentandra* (saltcedar) Series. Communities of the series may commonly be induced by disturbances such as grazing and impoundments, and they become relatively stable and maintained in the landscape.

V. *Tamarix pentandra* (saltcedar) Series

1. *Tamarix pentandra/Buchloe dactyloides* CT (saltcedar/buffalograss; TAMPEN/BUCDAC)

Distribution: This exotic CT is known to occur at North Ballard Hill in Chaves County and along the margins of other playa lakes in southeastern New Mexico.

Vegetation: *Tamarix pentandra* (saltcedar) [no wetland indicator status available], is well represented and dominates the shrub layer in this community type. *Buchloe dactyloides* (buffalograss) [FACU], is luxuriant and codominates this community type in the graminoid layer. *Panicum obtusum* (vine mesquite), is usually present. Other herbaceous species present here include *Helianthus ciliaris* (blueweed sunflower), and the exotic *Solanum elaeagnifolium* (silverleaf nightshade).

Environmental Setting: TAMPEN/BUCDAC occurs along the shoreline of small ephemeral playa lakes and probably occurs along other playa lakes in southeastern New Mexico. Soils are classified as Typic Haplotorrerts with a clayey profile. These soils are alkaline, calcareous, and hydric soils as determined by the 1987 Corps of Engineers Wetlands

Delineation Manual. Electrical conductivity is low; 2.85 mS. Elevation is 3590 ft with a flat to gently undulating topography.

Adjacent Vegetation: Bordering the playa are *Prosopis glandulosa/Sporobolus airoides* desert shrublands and *Buchloe dactyloides/Bouteloua gracilis* grasslands.

Discussion: The *Tamarix pentandra/Buchloe dactyloides* CT is an exotic-dominated wetland community, transitional to grasslands, and may be grazing induced. This type is represented by a shrub-dominated community with a graminoid underlayer located towards the interior of the playa. The moisture regime is such that a sustainable population of the exotic saltcedar thrives. Diversity of species is low but overall plant cover is high. The wettest and lowest areas tend to be colonized by *Panicum obtusum* and *Helianthus ciliaris*.

Documentation: This description is based on cross section Playa5 and plot 93NR07. The herbaceous species composition of this type may be similar to the buffalograss-dominated playas of Kiowa National Grasslands, New Mexico (Hoagland 1994).

2. *Tamarix pentandra/Sporobolus airoides* CT
(saltcedar/alkali sacaton; TAMPEN/SPOAIR)

Distribution: This exotic type, known to occur along the shoreline of Salt Lake, is located in Chaves County and probably occurs along other playa lakes of southeastern New Mexico.
Vegetation: This type is shrub-dominated by the exotic *Tamarix pentandra* (saltcedar) [no wetland indicator status available]. The stands are well established but regeneration is scarce. *Sporobolus airoides* (alkali sacaton) [FAC], is also abundant and dominates in the graminoid layer. Overall, diversity of species is low. Herbaceous species are commonly graminoids. *Distichlis stricta* (inland saltgrass), *Chloris cucullata* (hooded windmillgrass) and *Chloris verticillata* (tumble windmillgrass) are well represented. Common forbs include *Cressa truxillensis* (common cressa) and the ruderal *Solanum elaeagnifolium* (silverleaf nightshade).

Environmental Setting: TAMPEN/SPOAIR occurs along the shoreline of ephemeral playa lakes. Soils are classified as Aquic Camborthids with coarse-loamy textured horizons over a clayey horizon. These soils are fully base-saturated and calcareous. Electrical conductivity is very high; 12.03 mS. These soils are hydric soils as determined by the 1987 Corps of Engineers Wetlands Delineation Manual. Elevation is approximately 4050 ft.

Adjacent Vegetation: Bordering the playa are *Prosopis glandulosa/Sporobolus airoides* desert shrublands.

Discussion: The *Tamarix pentandra/Sporobolus airoides* CT is an exotic-dominated wetland community that may transitional to grasslands and may be grazing induced.

Documentation: This description is based on cross section Playa2 and plot 93NR04. This community type has not been reported elsewhere for New Mexico.

II. Warm Temperate Scrub-Shrub Wetlands

III. Southwest Scrub-Shrub Wetlands

IV. Broad-Leaved Deciduous Series Group

Two series have been identified for this group the *Baccharis emoryi* (seepwillow) Series and the *Salix exigua* (coyote willow) Series. These communities tend to be more structurally diverse than the Needle-Leaved Deciduous Series Group, however it is likely that these communities are gradating or progressing towards that disturbance induced group.

V. *Baccharis emoryi* (seepwillow) Series

1. *Baccharis emoryi/Muhlenbergia asperifolia* CT (seepwillow/alkali muhly; BACEMO/MUHASP)

Tamarix pentandra phase (saltcedar; TAMPEN)

Distribution: This exotic phase of the community type is common to the middle and lower segments of the Pecos River in DeBaca and Chaves Counties.

Vegetation: The shrub *Baccharis emoryi* (seepwillow) [FACW], forms in dense stands and characterizes the CT. *Tamarix pentandra* (saltcedar) [no wetland indicator status available], is abundant as either a codominant or sub-dominant and defines the phase. *Salix exigua* (coyote willow) may be present in some stands but is not dominant. The understory is dominated by mesic graminoids. *Muhlenbergia asperifolia* (alkali muhly) [FACW], is common in all stands and dominates the graminoid layer. Other grasses may be common and abundant, and include *Distichlis stricta* (inland saltgrass), *Bothriochloa saccharoides* (silver sourgrass) and *Juncus balticus* (Baltic rush). Forbs are sparse. Present are *Solidago occidentalis* (western goldenrod), *Aster ericoides* (heath aster), *Psilostrophe tagetina* (woolly paperflower), and young *Populus fremontii* (Fremont cottonwood) regeneration.

Environmental Setting: This phase occurs on moist, low-lying alluvial soils along the middle reaches of the Pecos River where flows are regulated from large dams. It is associated with Rosgen's Type C3 and C4 channel morphologies where the channel is moderately entrenched and slightly confined by the valley with a relatively flat gradient ranging between 0.1 and 1%. Banks can be severely downcut and unstable as result of the lack of vegetation or accumulation of flood debris. Channel materials consist of a gravel, sand/silt bed; and small to medium debris.

Hydraulic analysis indicates a flow of 2100 cfs to likely inundate this community along the Pecos at two- to five- year intervals. Soils are commonly fine, over sandy Aquic Torrifluvents, and coarse loamy over sandy-skeletal Oxyaquic Ustifluvents. The temperature regime varies from mesic to thermic. Carbonates were also present. Aquic conditions occurred at 125 cm. Aquic Torrifluvents are considered hydric soils according to the 1987 Corps of Engineers Wetlands Delineation Manual. Conductivity ranges from 2.82 to 9.80 mS. The pH ranges from 7.76 to 8.08. Elevations range from 3680-4480 ft.

Adjacent Vegetation: Adjacent upland vegetation commonly associated with this type include mesquite and plains-mesa grasslands. Adjacent riparian vegetation can include *Tamarix pentandra*/Sparse communities on floodplains and banks, *Salix exigua/Baccharis emoryi* communities on side bars, and mudflats pioneered by *Scirpus americanus/Typha latifolia* communities.

Discussion: The *Tamarix pentandra* phase of the *Baccharis emoryi/Muhlenbergia asperifolia* typic community appears to be an early- to mid-progressional community. The habit of *Baccharis emoryi* is much like that of *Salix exigua* (coyote willow). Often both species, which are native, will occur in the same stands. *Muhlenbergia asperifolia* has a rhizomatous habit and is a common, native riparian grass associate of this region. It prefers moist or wet conditions, and alkaline soils. This native typic community is threatened by the encroachment of the phreatophytic saltcedar which grows in similar habitats and is probably the most problematic exotic plant occurring in New Mexico (Bureau of Reclamation 1979).

Documentation: This description is based on cross sections Pecos15, Pecos18 and plots 93PD31 and 93PD39. This specific type has not been reported elsewhere for New Mexico. An independent *Muhlenbergia asperifolia* community type has been described tentatively to occur in the Yampa River Basin in Colorado (Kittel and Lederer 1993). Saltcedar disclimax community types have been classified previously in New Mexico by Hildebrandt and Ohmart (1982), Szaro (1989), and Dick-Peddie (1993). Muldavin et al. (1993b) reports a closely related *Salix exigua/Tamarix pentandra* community type for the upper Rio Grande Basin.

2. *Baccharis emoryi/Sporobolus airoides* CT
(seepwillow/alkali sacaton; BACEMO/SPOAIR)

***Tamarix pentandra* phase**
(saltcedar; TAMPEN)

Distribution: This exotic phase of the community is distributed on floodplains of the middle and lower Pecos River and along Yeso Creek, a tributary of the middle segment of the Pecos River. It is known to occur in DeBaca and Chaves Counties.

Vegetation: This CT is characterized by dense stands of *Baccharis emoryi* (seepwillow) [FACW]; with a grassy undergrowth dominated by *Sporobolus airoides* (alkali sacaton) [FAC]. *Tamarix pentandra* (saltcedar) [no wetland indicator status available], is abundant and represents an exotic phase of the CT. *Elaeagnus angustifolia* (Russian olive) can be present in the shrub layer. Relict *Populus fremontii* (Fremont cottonwood) may be present. *Salix exigua* (coyote willow), *Salix taxifolia* (yewleaf willow) and *Chrysothamnus viscidiflorus* (Douglas rabbitbrush) are notable shrubs present in some stands. Common graminoids include *Distichlis stricta* (inland saltgrass), *Muhlenbergia asperifolia* (alkali muhly) and *Bothriochloa saccharoides* (silver sourgrass). Common forbs include *Ambrosia psilostachya* (western ragweed) which may be abundant, and *Melilotus alba* (white sweetclover) which is commonly present.

Environmental Setting: The exotic phase of this typic community occurs on high elevation side bars, island bars, or on older terraces that are out of the active floodplain. It is associated with Rosgen's Type C4 and C6 channel morphologies where the channel is moderately entrenched and slightly confined by the valley. Gradients are relatively flat, between 0.1 and 0.5%. Banks can be downcut and unstable due to a lack of vegetation or accumulation of flood debris. Channel materials consist of a sandy/clay bed and fine gravels. Debris of all sizes affect less than 10% of the channel. In moderately positioned sites, inundation is likely to occur along the middle and lower Pecos every five to ten years, with unregulated flows of 3200 to 6500 cfs. The higher positioned sites would be flooded every 25 to 50 years at flows of approximately 13,000 to 35,000 cfs. The soils of this community are diverse. Oxyaquic Ustifluvents that are very fine, sandy and calcareous, predominate. Other soils include sandy Typic Fluvaquents and coarse-loamy, thermic Aeric Fluvaquents. Typic Fluvaquents and Aeric Fluvaquents are considered hydric soils according to the 1987 Corps of Engineers Wetlands Delineation Manual. Conductivity ranges from 0.56 to 7.56 mS. The pH ranges between 7.71 to 8.45. Elevation ranges from 3290-3980 ft.

Adjacent Vegetation: Adjacent upland vegetation commonly associated with this type includes mesquite and plains-mesa grasslands. Adjacent riparian vegetation can include *Tamarix pentandra*/Sparse communities on floodplains and banks, *Salix exigua/Baccharis emoryi* communities on side bars, and mudflats pioneered by *Scirpus americanus/Typha latifolia* communities.

Discussion: The exotic *Tamarix pentandra* phase of the *Baccharis emoryi/Sporobolus airoides* typic community appears to be a mid- to late-progressional stage community. Some occurrences along the Pecos River contain very dense stands of saltcedar where little else is growing in the understory. In these areas there are large-scale projects aimed at removing saltcedar (Bureau of Reclamation 1979). The community occurs downstream from Santa Rosa Lake where flows are

regulated by large dams. Entrenchment of the channel can be severe.

Documentation: This description is based on cross sections Pecos21, Pecos22, Pecos23, and Yeso Creek1; and plots 93PD45, 93PD46, 93PD47, 93PD49, 93PD50, 93PD60 respectively. Despite the widespread occurrence of this community, this specific type has not previously been reported for New Mexico. Generally, *Sporobolus airoides* is considered to be an extensive bottomland species occurring in swales (Dick-Peddie 1993). Generalized *Tamarix pentandra* plant associations have been classified as disclimax types in New Mexico by Hildebrandt and Ohmart (1982), Szaro (1989), and Dick-Peddie (1993).

V. *Salix exigua* (coyote willow) Series

1. *Salix exigua-Baccharis emoryi* CT (coyote willow-seepwillow; SALEXI-BACEMO)

Distribution: This native community type is a common type distributed along the middle and lower segments of the Pecos River. It is known to occur in DeBaca and Chaves Counties.

Vegetation: This type is characteristically shrubby and dominated by *Salix exigua* (coyote willow) [OBL], and *Baccharis emoryi* (seepwillow) [FACW]. *Populus fremontii* (Fremont cottonwood) trees may be present as juveniles. Other shrubs that may be present include *Chrysothamnus viscidiflorus* (Douglas rabbitbrush), *Gutierrezia sarothrae* (broom snakeweed) with the occasional exotics, *Tamarix pentandra* (saltcedar) and *Elaeagnus angustifolia* (Russian olive). The understory is typically graminoid and represented by *Muhlenbergia asperifolia* (alkali muhly), *Juncus balticus* (Baltic rush) and *Scirpus americanus* (threesquare). Forbs are not well represented and low in diversity. Commonly present are *Ambrosia artemisiifolia* (common ragweed) and *Helianthus petiolaris* (prairie sunflower).

Environmental Setting: SALEXI-BACEMO occurs on high elevation side bars, island bars, or on older terraces that are out of the active floodplain. It is associated with Rosgen's Type C4 channel morphology where the channel is moderately entrenched and slightly confined by the valley with a relatively flat stream gradient between 0.1 and 0.5%. Channel materials consist of a sand/silt bed, fine gravels, and a small amount of flood debris. Banks are stabilized by the woody vegetation. Hydraulic analysis indicates that relatively small floods between 850 to 4500 cfs on the lower Pecos would most likely flood these sites corresponding to an average recurrence interval of five years. Soils are classified as Oxyaquic Torrifluvents, Oxyaquic Psamments, and Typic Psamments. All have mixed mineralogy and thermic temperature regimes, and are calcareous. Medium sand-sized particles predominate although some clay films occur. The water table is typically within 150 cm of the soil surface. Conductivity ranges from 0.7 mS to 3.86 mS. The pH ranges from 7.74 and 8.03. Elevation ranges from 3540-3940 ft.

Adjacent Vegetation: Adjacent upland vegetation commonly associated with this type includes mesquite and plains-mesa grasslands. Adjacent riparian vegetation can include *Tamarix pentandra*/Sparse communities on floodplains and banks, *Salix exigua/Baccharis emoryi*

communities on side bars, and mudflats pioneered by *Scirpus americanus/Typha latifolia* communities.

Discussion: The *Salix exigua/Baccharis emoryi* CT appears to be a early- to mid-progressional stage shrubland community. Cottonwood regeneration is favorable along the banks and may be due to a frequently wetted perimeter. Along the southernmost reaches *Baccharis emoryi* would may be replaced with *Baccharis glutinosa* (groundsel-tree) in this type.

Documentation: This description is based on cross sections Pecos16, Pecos17, Pecos24; and plots 93PD33, 93PD34, 93PD36, 93PD51 respectively. Classifications of New Mexico and surrounding regions (Colorado, Arizona, Utah, Idaho, and Montana) report a non-definitive coyote willow/mesic graminoid type or independent coyote willow plant associations. We found this plant association to be common and likely to occur in other similar basins.

IV. Needle-Leaved Deciduous Series Group

Needle-leaved deciduous shrublands are represented by the exotic *Tamarix pentandra* (saltcedar) Series. These communities are simple assemblages of plant species where diversity of species is extremely low. They are disturbance-induced communities that often form broad stands along the floodplains of the Pecos.

V. *Tamarix pentandra* (saltcedar) Series

1. *Tamarix pentandra*/Sparse CT (saltcedar/sparse ground cover; TAMPEN/SPARSE)

Distribution: This community is distributed widely across floodplains of the middle and lower segments of the Pecos River in DeBaca, Chaves and Eddy Counties. It is particularly extensive from Artesia south to the Texas border.

Vegetation: The exotic shrub *Tamarix pentandra* (saltcedar) [no wetland indicator status available], dominates this community forming closed canopied, dense stands along the banks and across the floodplain. The closely related *Tamarix gallica* (French tamarisk) is also common. Herbaceous cover is distinctively scarce and low in diversity. *Melilotus alba* (white sweetclover), *Salsola kali* (Russian thistle) and *Solanum elaeagnifolium* (silverleaf nightshade) are common forbs. *Sporobolus airoides* (alkali sacaton) and *Setaria leucopila* (tall bristlegrass) are the only native graminoids present (<5% cover).

Environmental Setting: TAMPEN/SPARSE occurs on high elevation side bars and terraces that are out of the active floodplain. It is associated with Rosgen's Type C6 channel morphology where the channel is deeply entrenched and slightly confined by the valley with very low stream

gradients of approximately 0.1%. No armoring of the channel occurs. Channel materials consist of a sand bed with a mixture of silt. Banks are unstable and downcutting is severe. Channel evulsion is usually absent, and the river channel commonly resembles a canal. Soils are classified as very fine, calcareous Typic Torrifluvents. Conductivity is 1.68 mS. The pH ranges from 7.71 to 7.78. Site elevation is 3290 feet.

Adjacent Vegetation: Adjacent upland vegetation commonly associated with this type include mesquite and plains-mesa grasslands. Adjacent native riparian vegetation is scarce or absent.

Discussion: The *Tamarix pentandra*/sparse CT is considered a late-progressional stage disclimax community. This type occurs most prolifically in the region around Dexter and Artesia, downstream from two major water impoundments of the mainstem of the Pecos River: Santa Rosa Lake and Ft. Sumner Dam. Unregulated flows no longer exist.

Documentation: This description is based on cross section Pecos25 and plot 93PD56. *Tamarix pentandra* plant associations have been classified as a disclimax type in New Mexico by Hildebrandt and Ohmart (1982), Szaro (1989), and Dick-Peddie (1993).

I. Persistent-Emergent Wetlands Class -- Herbaceous Wetlands

II. Cold Temperate Persistent-Emergent Wetlands

III. Rocky Mountain Montane Persistent-Emergent Wetlands

IV. Persistent Series Group

Herbaceous montane riparian/wetlands are dominated by perennial species of graminoids and forbs, and occupy sites that are either perennially saturated or ponded. Communities are either grassy (*Phalaris arundinacea*) or sedge (*Carex emoryi, Carex nebrascensis* and *Juncus balticus*) dominated and are found on the mainstem of the Pecos and on smaller upper tributary basins.

V. *Phalaris arundinacea* (reed canarygrass) Series

1. *Phalaris arundinacea-Glyceria striata* CT (reed canarygrass-fowl mannagrass; PHAARU-GLYSTR)

Distribution: This community occurs along the Gallinas River in San Miguel County and may occur in upper elevations of Lincoln County.

Vegetation: The grassy *Phalaris arundinacea* (reed canarygrass) [OBL], and *Glyceria striata* (fowl mannagrass) [OBL], codominate this herbaceous wetland. *Alnus oblongifolia* (New Mexico alder), *Salix exigua* (coyote willow) and *Salix lutea* (yellow willow) shrubs typically can occur but are positioned along the margins. The herbaceous layer is luxuriant and species rich. Other well represented graminoids are *Carex stipata* (owlfruit sedge), *Carex hystricina* (bottlebrush sedge) and *Juncus saximontanus* (Rocky Mountain rush). *Heracleum lanatum* (common cowparsnip), *Rudbeckia laciniata* (cutleaf coneflower) and *Agrimonia striata* (roadside agrimony) are well represented forbs while *Habenaria hyperborea* (northern bog orchid) and *Prunella vulgaris* (common selfheal) may be common.

Environmental Setting: PHAARU-GLYSTR occurs in upper montane wetlands and is associated with Rosgen's Type B6 channel morphology where the channel is deeply entrenched, but slightly confined by the valley. The stream gradient is between 1.5 and 4%. Channel materials consist of emergent vegetation and a sand/gravel bed. The development of this community is associated with the construction of beaver dams. The stream gradient is reduced and the water table is elevated. This creates an environment of saturated soils that will support primarily species tolerant of an anaerobic environment. Soil are classified as an acid, fine-loamy, Mollic Endoaquents with a mixed mineralogy and a frigid temperature regime. These soils are considered hydric soils as determined by the 1987 Corps of Engineers Wetlands Delineation Manual. Conductivity was 0.42 mS. The pH is slightly acidic, ranging between 4.51 and 5.34. Elevation is 7480 ft.

Adjacent Vegetation: Adjacent upland hillslopes are steep and include *Picea pungens* forests. Adjacent riparian vegetation consists of *Picea pungens/Alnus oblongifolia* forests on narrow floodplains.

Discussion: The *Phalaris arundinacea-Glyceria striata* CT is an early-progressional stage herbaceous wetland community. Felling of trees and shrubs by beavers and the construction of dams may significantly help maintain this wetland. *Phalaris arundinacea*, native to North America, typically forms dense, nearly monotypic stands. This species is highly rhizomatous and spreads rapidly. Reportedly this plant species is an effective stream stabilizer, yet it can also be a strong competitor with other riparian/wetland species (Hansen et al. 1990). Padgett et al. (1989) relate that while it can stabilize eroding streambanks, in slow-moving channels, such as irrigation ditches it can also choke off water flows. Reed canarygrass does not appear to pose a problem in New Mexico.

Documentation: This description is based on cross section Gallinas2 and plot 93PD22. *Phalaris arundinacea* is classified as a habitat type in Montana (Hansen et al. 1990). In Utah, Padgett and others (1989) categorize this as a miscellaneous unclassified graminoid dominated community.

V. *Carex emoryi* (emory sedge) Series

1. *Carex emoryi/Equisetum arvense* CT (emory sedge/field horsetail; CAREMO/EQUARV)

Distribution: This community type occurs infrequently on the upper reaches of the Pecos River in San Miguel County and may occur in upper elevations of Lincoln County.

Vegetation: The rhizomatous sedge *Carex emoryi* (emory sedge) [OBL], is luxuriant and dominates the graminoid layer. *Equisetum arvense* (field horsetail) [FACW-], dominates the forb layer of this predominantly herbaceous community. Some shrubs can occur such as *Salix exigua* (coyote willow), *Rosa woodsii* (woods rose), *Salix lutea* (yellow willow), but they do not dominate the community. Other graminoids are also well represented and include *Phalaris arundinacea* (reed canarygrass), *Eleocharis macrostachya* (longstem spikerush) and *Elymus canadensis* (Canada wildrye).

Environmental Setting: CAREMO/EQUARV occupies narrow, low-lying bars delimited by the river channel and by steep upland bluffs, and is associated with Rosgen's Type C1 channel morphology. The channel is moderately entrenched and moderately confined by the valley with a stream gradient between 1.2 and 1.5%. Canyon sideslopes are steep. Channel materials consist of a cobble and gravel bed with small boulders. Banks are stable due to vegetation and accumulation of flood debris. Due to the low position of this community relative to the channel, a flow of 800 cfs on this segment of the Pecos would scour this community at two- to five-year intervals. Inundation may occur yearly during spring flows.
Soils are classified as coarse-loamy over sandy-skeletal Oxyaquic Ustifluvents with a mesic temperature regime. They are commonly calcareous. The water table was at 100 cm. Conductivity is 1.14 mS. The pH ranges between 7.66 to 7.70. Elevation is 6300 ft.

Adjacent Vegetation: Adjacent upland vegetation consists of pinyon pine/juniper woodlands. Adjacent riparian vegetation includes scattered individuals of *Populus fremontii* (Fremont cottonwood) and *Populus x acuminata* (lanceleaf cottonwood).

Discussion: The *Carex emoryi/Equisetum arvense* CT is an early-progressional stage herbaceous riparian/wetland community of mid-elevations. Occupying a narrow strand along the channel, this lush site is often broken up by large boulders fallen from upland rockfalls. Banks appear to be well stabilized by the herbaceous cover. The strand of vegetation is often not more than three meters wide, and the community is prone to frequent inundation. Cover is excellent, yet diversity of species is low.

Documentation: This description is based on cross section Pecos6 and plot 93PD06. This type has not previously been reported for New Mexico or surrounding regions. Classifications of New Mexico and surrounding regions have not reported this type but often report similar sedge dominance types.

V. *Carex nebrascensis* (Nebraska sedge) Series

1. *Carex nebrascensis-Carex rostrata* CT
(Nebraska sedge-beaked sedge; CARNEB-CARROS)

Distribution: This community type is distributed sporadically in the lower montane reaches of the Pecos River in San Miguel County and may occur in Lincoln County.

Vegetation: The *Carex nebrascensis* (Nebraska sedge) [OBL], and *Carex rostrata* (beaked sedge) [OBL], codominate a dense herbaceous layer that occurs in discontinuous patches within this wetland. The shrubs *Salix exigua* (coyote willow), *Salix lasiandra* (pacific willow) and *Salix lutea* (yellow willow) may occupy a marginal zone. Other graminoids are also well represented and include *Carex praegracilis* (fieldclustered sedge), *Juncus balticus* (Baltic rush) and *Eleocharis macrostachya* (longstem spikerush). *Glyceria striata* (fowl mannagrass) may be common. Mesic forbs are well represented and include *Epilobium hornemannii* (Hornemann's willowherb), *Sisyrinchium montanum* (Colorado blue-eyed grass), and *Sidalcea neomexicana* (New Mexico checkermallow).

Environmental Setting: CARNEB-CARROS occurs where the water table is near or at the surface, either near the active channel, or adjacent to abandoned or overflow channels, or below man-made lakes and ponds. Smaller channels often dissect the wetlands. Subsurface flows and ancillary seeps may maintain these communities along with overflows from the channel that may periodically inundate some sites. Where this community occurs in lower positioned back channels, it is probably flooded at one- to two-year intervals. A flow of 350 cfs would completely inundate the site. Soils are hydric (1987 Corps of Engineers Wetlands Delineation Manual) having a mixed mineralogy and a frigid temperature regime, and are classified as loamy over coarse silty over sandy-skeletal Endoaquents with aquic conditions occurring between 30 and 50 cm. Conductivity is 0.86 mS. The pH ranges from 6.91 to 7.67. Elevation ranges from 7000-7320 ft.

Adjacent Vegetation: Adjacent north-facing hillslopes are mixed coniferous forests. Ponderosa pine forests occupy adjacent south-facing hillslopes. Adjacent riparian/wetland vegetation consists of *Populus angustifolia/Poa pratensis* communities on terraces and an artificially maintained *Typha latifolia* marsh.

Discussion: The *Carex nebraskensis-Carex rostrata* CT is an early-progressional stage herbaceous wetland community of mid-elevations. Communities are either naturally spring fed or artificially maintained wetlands, and were characteristically some of the wettest sites encountered on the mainstem of the upper Pecos River. Both dominant sedges are highly rhizomatous. *Carex nebrascensis* has been reported to be an excellent streambank stabilizer and able to withstand heavy grazing pressures, while *Carex rostrata* may be able to withstand more saturated, anaerobic conditions (Padgett et al. 1989, Hansen et al. 1990, and Kittel and Lederer 1993).

Documentation: This description is based on cross sections Pecos3, Pecos7; and plots 93PD03 and 93PD08. This specific community type has not been described for New Mexico or surrounding regions. Individual dominance types for *Carex nebraskensis* and *Carex rostrata* have been identified in Colorado (Baker 1984, Kittel 1993, Kittel and Lederer 1993), Utah and Idaho (Padgett et al. 1989), and Montana (Hansen et al. 1990). However, our type characteristically occurs in mixed stands of *Carex nebraskensis* and *Carex rostrata*, with relative abundance shifting in space and time. During wetter years *Carex rostrata* may show an increase, while during drier years *Carex nebraskensis* may increase.

V. *Juncus balticus* (Baltic rush) Series

1. *Juncus balticus-Carex praegracilis* CT (Baltic rush-fieldclustered sedge; JUNBAL-CARPRA)

Distribution: This community occurs in Box Canyon at Las Vegas National Wildlife Refuge in San Miguel County and may occur in Lincoln County.

Vegetation: *Juncus balticus* (Baltic rush) [OBL], can dominate this herbaceous wetland meadow with *Carex praegracilis* (fieldclustered sedge) [FACW+]. *Juncus balticus* arises singly from creeping rootstocks; whereas *Carex praegracilis* spreads rhizomatously and more often forms clumps. *Vitis arizonica* (canyon grape) and *Juniperus monosperma* (oneseeded juniper) represent the shrub layer and are typically found towards the drier margins. *Agropyron trachycaulum* (slender wheatgrass) and *Muhlenbergia asperifolia* are common grasses. The exotic grass *Agrostis alba* (redtop) can be abundant. Forbs present can include *Equisetum laevigatum* (smooth horsetail), *Marrubium vulgare* (common horehound) and *Melilotus alba* (white sweetclover). *Berula erecta* (stalky berula) forms spongy mats in and about the main channel.

Environmental Setting: JUNBAL-CARPRA occurs where the water table is near or at the surface, adjacent to the active channel. The primary channel is slow moving and often branches into smaller secondary channels. Scouring floods are unlikely except by monsoonal rainstorm events. Soils are commonly nonacid, coarse-loamy Mollic Endoaquents having a mixed mineralogy and a frigid temperature regime. Soils showed hydric conditions within 40-50 cm. of the surface. Mottling of the soils is indicative of a fluctuating water table. These soils are considered hydric according to the 1987 Corps of Engineers Wetlands Delineation Manual. Conductivity is 4.35 mS. The pH is 7.33. Elevation is 6320 ft.

Adjacent Vegetation: Adjacent upland hillslopes are steep and dry occupied by ponderosa pines forests. Adjacent riparian vegetation includes *Acer negundo/Salix exigua* communities on side bars.

Discussion: The *Juncus balticus-Carex praegracilis* CT is an early-progressional stage community or it may be a grazing-induced disclimax. Past management practices have allowed grazing in this small canyon. The canyon is now fenced off and being allowed to recover. Site progression may be towards a coyote willow/sedge-dominated community. The occurrence of cottonwoods here may be accidental and regeneration is likely to occur only by cloning.

Documentation: This description is based on cross section Box Canyon1 and plot 93PD25. Our type is analogous to the *Juncus balticus/Carex aurea* PNC described by Muldavin et al. (1993b) in the upper Rio Grande Basin of New Mexico. It is also closely related to the grazing induced types described in other states. Kittel and Lederer (1993) describe a *Juncus balticus* plant association like ours in the Yampa River Basin of Colorado. Padgett et al. (1989) in Utah and Idaho, and Hansen et al. (1990) in Montana classify similar types. All authors regard *Juncus balticus* plant associations to be grazing-induced disclimaxes where *Juncus balticus* replaces the sedges (*Carex nebrascensis* or *Carex rostrata*).

III. Plains Persistent-Emergent Wetlands

IV. Persistent Series Group

Plains persistent wetland communities are either grassy (*Distichlis stricta*) or sedge-dominated (*Eleocharis macrostachya*) and occupy sites that are either perennially saturated or ponded on the mainstem of the Pecos or on smaller upper tributary basins.

V. *Distichlis stricta* (inland saltgrass) Series

1. *Distichlis stricta/Salicornia utahensis* CT (inland saltgrass/Utah glasswort; DISSTR/SALUTA)

Distribution: This community is distributed on highly saline floodplains. It is known from an overflow wetland from Lea Lake southeast of Roswell in Chaves County and may occur in Eddy County.

Vegetation: The grass *Distichlis stricta* (inland saltgrass) [FACW], and the forb *Salicornia utahensis* (Utah glasswort) [FACW], codominate this wetland with each forming distinct zones. Diversity of species is poor. The exotic shrub *Tamarix pentandra* (saltcedar) can be present, but it is not well established. *Limonium limbatum* (plumbago), a saline wetland forb species, is the only other species present.

Environmental Setting: Electrical conductivity ranges between 15.33 and 37.20 mS. Soils are hydric (1987 Corps of Engineers Wetlands Delineation Manual) and classified as calcareous, very-fine Typic Endoaquents with a mixed mineralogy and a thermic temperature regime. The water table is high (within one meter of the surface) and fluctuates regularly, which is reflected as a reduced matrix (gley) 40 cm below the surface. The pH ranges from 7.94 to 8.17. Elevation

is 3440 ft.

Adjacent Vegetation: Adjacent vegetation included pinyon pine/juniper woodlands and alkali sacaton bottomlands.

Discussion: The *Distichlis stricta/Salicornia utahensis* CT is considered an early-progressional stage community. This type is able to tolerate highly saline conditions and low to moderate alkalinities. Species diversity is low. Perpetually saline conditions may be too harsh for other species.

Documentation: This description is based on cross section Overflow Wetland1 and plots 93PD37, 93PD38 respectively. This type may also occur at Bitter Lake National Wildlife Refuge (Peterson and Rasmussen 1986). Most classifications report of individual dominance types which may be similar to ours. In Colorado, a *Salicornia rubra* salt meadow is documented by Baker (1984), and a *Distichlis spicata* plant association is reported by Kittel and Lederer (1993). In Montana, Hansen and others (1990) classify a *Distichlis spicata* habitat type and a *Salicornia rubra* community type.

2. *Distichlis stricta-Scirpus americanus* CT
(inland saltgrass-threesquare; DISSTR-SCIAME)

***Tamarix pentandra* phase**
(saltcedar; TAMPEN)

Distribution: The exotic phase of this community type is distributed along the middle reaches of the Pecos River in DeBaca and Chaves Counties.

Vegetation: The graminoids *Distichlis stricta* (inland saltgrass) [FACW], and *Scirpus americanus* (threesquare) [OBL], share dominance along the margins of this wetland while the exotic shrub *Tamarix pentandra* (saltcedar) [no wetland indicator status available], occupies a zone through the middle of the channel. Other species present are typically graminoid and include *Muhlenbergia asperifolia* (alkali muhly), *Scirpus maritimus* (saltmarsh bulrush) and the exotic *Phragmites australis* (common reed). Forbs are sparse and may include *Polygonum aviculare* (prostrate knotweed).

Environmental Setting: The exotic TAMPEN phase of DISSTR-SCIAME occurs in abandoned channels and is associated with standing water and high salinity. This community corresponds with Rosgen's Type C4 channel morphology where the channel is moderately entrenched and slightly confined by the valley with gradients between 0.1 and 0.5%. Soils are hydric (1987 Corps of Engineers Wetlands Delineation Manual) and classified as calcareous, sandy-skeletal Typic Fluvaquents and very fine Aeric Fluvaquents. The water table is high and

aquic conditions occur at 60 cm. The temperature regime can be either mesic or thermic. Conductivity ranges from 4.44 to 16.32 mS. The pH ranges between 7.81 to 8.14. Elevation ranges from 2930-3820 ft.

Adjacent Vegetation: Adjacent upland vegetation include mesquite shrublands and alkali sacaton bottomlands. Adjacent riparian vegetation include *Salix exigua/Baccharis emoryi* shrubland communities on side bars, and mudflats pioneered by *Scirpus americanus/Typha latifolia* communities.

Discussion: The exotic *Tamarix pentandra* phase of the *Distichlis stricta-Scirpus americanus* typic community is considered to be an early-progressional stage community that is disturbance induced. This type occurs in overflow channels where soil alkalinities are high. It occurs below Santa Rosa Lake and Ft. Sumner Dam where natural fluvial processes have been disrupted. Saltcedar competes strongly with native species. Overall species diversity is low.

Documentation: This description is based on cross sections Pecos22, Pecos26 and plots 93PD48, 93PD63 respectively. Individual dominance types have been classified in nearby states. In Colorado, Baker (1984) classifies a *Distichlis spicata* var. *stricta* salt meadow, and a *Scirpus americanus* wetland. Similarly, Kittel and Lederer (1993) describe these types as occurring in the Yampa River Basin of northwestern Colorado. In Montana, Hansen and others (1990) classified a *Distichlis spicata* habitat type.

V. *Scirpus americanus* (threesquare) Series

1. *Scirpus americanus-Paspalum distichum* CT (threesquare-knotgrass; SCIAME-PASDIS)

Distribution: This herbaceous wetland community is common on the middle and lower segment of the Pecos River in DeBaca and Chaves Counties.

Vegetation: The graminoids *Scirpus americanus* (threesquare) [OBL], and *Paspalum distichum* (knotgrass) [OBL], codominate this community type. The forb *Equisetum arvense* (field horsetail) can be well represented. Other forbs present include *Rorippa sinuata* (spreading yellow watercress) and *Polygonum persicaria* (spottedthumb knotweed). Young *Populus fremontii* (Fremont cottonwood) seedling establishment is often present on the wetted perimeter of these communities, as is *Tamarix pentandra* (saltcedar).

Environmental Setting: SCIAME-PASDIS occurs adjacent to mudflats on low elevation side bars or mid-channel bars. This riparian/wetland community is associated with Rosgen's Type C3 channel morphology. The channel is moderately entrenched and moderately confined by the valley with a stream gradient between 0.5 and 1.0%. Banks are stabilized by vegetative cover and the accumulation of flood debris. Adjacent terraces are highly elevated and downcut with bare, unstable banks. Channel materials consist of a sand/gravel bed with small cobbles. Due to the low position in the floodplain, hydraulic analysis indicates a flow of 700 to 1400 cfs to be

required to inundate this community at two- to five-year intervals. Soils are hydric (1987 Corps of Engineers Wetlands Delineation Manual) and calcareous, and are classified as coarse-loamy Sulphic Fluvaquents and Aquic Ustipsamments with a mesic temperature regime. The water table occurs within the first 85 cm. Conductivity ranges from 0.40 to 2.04 mS. The pH is 7.39 to 7.89. Elevation ranges from 4580-5200 ft.

Adjacent Vegetation: Adjacent upland vegetation consists of mesquite shrublands. Adjacent riparian vegetation includes *Salix exigua-Baccharis emoryi* communities on bars and *Populus fremontii*/sparse communities on terraces.

Discussion: The *Scirpus americanus-Paspalum distichum* CT appears to be an early-progressional stage of recently deposited alluvial sites that are frequently or intermittently inundated. This type may also occur on margins of abandoned channels, and sites are generally non-alkaline and nonsaline. Hence, the community type is usually not associated with closed basin wetlands. *Paspalum distichum*, a native perennial, is described by Allred (1993) as "weedy along ditchbanks, and in slow moving water and sloughs." Alternatively, Correll and Correll (1975) reports this species as occurring in habitats similar to ours, (i.e., colonizing mudflats along streambanks) yet they decline to comment on its weediness. *Paspalum distichum* is also reported to be a common graminoid associate on the Hassayampa River in Arizona (Stromberg et al. 1991).

Documentation: This description is based on cross sections Pecos13, Pecos20 and plots 93PD28, 93PD44 respectively. Individual *Scirpus americanus* dominance type plant associations have been classified in Colorado by Baker (1984), and Kittel and Lederer (1993) in the Yampa River Basin. Our type may be grazing-induced, but grazing effects need further investigation.

2. *Scirpus americanus/Typha latifolia* CT
(threesquare/common cattail; SCIAME/TYPLAT)

Distribution: This community is common on the middle and lower reaches of the Pecos River and on Yeso Creek in DeBaca, Chaves and Eddy Counties.

Vegetation: The graminoid *Scirpus americanus* (threesquare) [OBL], and the forb *Typha latifolia* (common cattail) [OBL], share dominance in this low diversity herbaceous wetland. Young *Populus fremontii* (Fremont cottonwood) seedling establishment may be present in these communities on the wetted perimeters. Shrubs are scarce. *Baccharis emoryi* (seepwillow) may be present. Encroachment occurs by the exotic shrub *Tamarix pentandra* (saltcedar). Other graminoids present include *Paspalum distichum* (knotgrass), *Polypogon monspeliensis* (rabbitfoot grass) and *Muhlenbergia asperifolia* (alkali muhly).

Environmental Setting: SCIAME/TYPLAT occurs on mudflats, and side bars or mid-channel bars. This community is associated with Rosgen's Type C3 and C5 channel morphologies where the channel is moderately entrenched and slightly confined by the valley with a stream gradient between 0.1-1.0%. Channel materials consist of coarse gravels, sand and small cobbles. Large debris can occur. Soils are hydric (1987 Corps of Engineers Wetlands Delineation Manual) and commonly sandy-skeletal, calcareous Typic Fluvaquents with a mesic temperature regime. Conductivity varies from 5.40 to 6.80 mS. The pH ranges from 7.85 to 8.12. Elevation ranges from 3980-4470 ft.

Adjacent Vegetation: Adjacent upland vegetation includes mesquite shrublands and alkali sacaton bottomlands. Adjacent riparian vegetation includes *Salix exigua-Baccharis emoryi* communities on bars and *Populus fremontii*/sparse communities on terraces.

Discussion: The *Scirpus americanus/Typha latifolia* CT is an early-progressional stage community colonizing on mudflats or recently aggradated low-lying bars. Low flows are characteristically associated with this community type. Species diversity is usually low. These communities may be good for cottonwood establishment because they are frequently inundated and soils are hydric. Cattails were routinely encountered on the middle and lower reaches of the Pecos River where they are rooted in the mud at the edge of the channel. They are common associates in many stands of other communities, and are reportedly one of the most ubiquitous lowland wetland species in the western United States (Padgett et al. 1989).

Documentation: This description is based on cross sections Pecos19 and Yeso Creek1; and plots 93PD42, 93PD61 respectively. This type is probably equivalent to the bulrush/cattail marsh bordering playas at Bitter Lake National Wildlife Refuge reported by Peterson and Rasmussen (1986). Individual *Scirpus americanus* dominance types have been classified in Colorado by Baker (1984), and Kittel and Lederer (1993) in the Yampa River Basin. Cattail marshes have been classified in Utah and Idaho (Padgett et al. 1989) and Montana (Hansen et al.

1990). Our type may also be ecologically similar to the *Scirpus validus/Typha latifolia* wetland described by Baker (1984) in Colorado.

II. Warm Temperate Persistent-Emergent Wetlands

III. Southwest Persistent-Emergent Wetlands

IV. Persistent Series Group

Major elements of this series group are dominated by the *Scirpus acutus* (tulegrass) Series and the *Scirpus olneyi* (olney bulrush) Series. One community type is classified in the *Scirpus acutus* Series while two community types are classified in the *Scirpus olneyi* Series. These communities are simple assemblages and commonly form extensive stands that may clog the flow of water.

V. *Scirpus acutus* (tulegrass) Series

1. *Scirpus acutus-Eleocharis macrostachya* CT (tulegrass-longstem spikerush; SCIACU-ELEMAC)

Distribution: This herbaceous wetland community is known to occur in the Blue Spring tributary of the Black River in Eddy County.

Vegetation: The graminoids *Scirpus acutus* (tulegrass) [OBL], and *Eleocharis macrostachya* (longstem spikerush) [OBL], codominate this wetland and overall herbaceous cover is luxuriant. Diversity of species is high. Associated graminoid species include *Muhlenbergia asperifolia* (alkali muhly), *Paspalum distichum* (knotgrass) and the exotics *Cladium jamaicense* (sawgrass) and *Cynodon dactylon* (bermudagrass). Associated forbs are obligate riparian species and include *Typha latifolia* (common cattail), *Lythrum californicum* (California loosestrife) and *Berula erecta* (stalky berula). Additionally, *Flaveria chloraefolia* (clasping flaveria) [FACW] is present.

Environmental Setting: SCIACU-ELEMAC occurs on floodplains of the channel. The community is associated with Rosgen's Type C6 channel morphology where the channel is deeply entrenched and slightly confined by the valley with a relatively flat gradient, 0.5% or less. Channel materials consist of aquatic plants and a sand bed. Banks are stabilized by vegetation. Soils are hydric and saturated to the surface by overbank flooding and subsurface flow or underground seeps. Elevation is 3300 ft.

Adjacent Vegetation: Adjacent upland vegetation includes creosotebush, acacia, and soaptree yucca shrublands characteristic of the Chihuahuan Desert Scrub. Adjacent riparian vegetation includes *Scirpus olneyi/Typha latifolia* communities.

Discussion: The *Scirpus acutus-Eleocharis macrostachya* CT appears to be an early-

progressional stage community. The community is probably perennially saturated. The average width of the marsh is 100 ft. Domestic livestock use is minimal.

Documentation: This description is based on cross section Blue Spring1 and plot 93PD64. Our type may be ecologically similar to the *Scirpus americanus-Eleocharis macrostachya* PNC as classified by Muldavin et al. (1993b) along river banks of the upper Rio Grande.

V. *Scirpus olneyi* (bulrush) Series

1. *Scirpus olneyi-Muhlenbergia asperifolia* CT (olney bulrush-alkali muhly; SCIOLN-MUHASP)

Distribution: This community type is distributed sporadically in the lower segment of the Pecos Basin and is known to occur along segments of the Black River in Eddy County.

Vegetation: This herbaceous wetland is dominated by the graminoid *Scirpus olneyi* (olney bulrush) [OBL], which is abundant in the central region of the wetland. The grass *Muhlenbergia asperifolia* (alkali muhly) [FACW], occupies the margins. Other species are scarce or absent.

Environmental Setting: SCIOLN-MUHASP occurs in the active channel or on the margins of the channel if flows are strong enough to prevent establishment of the wetland. This community is associated with Rosgen's Type C4 channel morphology where the spring-fed channel is moderately entrenched and slightly confined by the valley. Stream gradients are exceedingly low, between 0.1 and 0.5%. In areas where the channel is clear of vegetation, channel materials consist of sands and fine gravels. The channel is fed by a spring. Soils are hydric and saturated to the surface. Wet conditions are maintained by slow-moving subsurface flow. Elevation is 3660 ft.

Adjacent Vegetation: Adjacent upland vegetation includes creosotebush, acacia, and soaptree yucca shrublands characteristic of Chihuahuan Desert Scrub. Adjacent riparian vegetation includes *Celtis reticulata-Salix gooddingii* communities on terraces and *Salix exigua-Baccharis emoryi* on bars.

Discussion: The *Scirpus olneyi-Muhlenbergia asperifolia* CT is an early-progressional stage community. This community is found in active, slow-moving channels with standing water. It occurs in wet alkaline soils, and salt and freshwater wetlands from California to eastern Texas. The distribution of *Scirpus olneyi* has been reported as being rare and scattered (Correll and Johnston 1979, Correll and Correll 1975) from southeastern Texas to Arizona; to being widespread throughout temperate North America (Kearney and Peebles 1960, Munz 1975, and Martin and Hutchins 1980). Nevertheless, the species is believed by all these authors to originate in the West Indies or South America.

Documentation: This description is based on cross section Black River1 and plot 93PD58. This association has not been previously identified in New Mexico or surrounding regions. Other *Muhlenbergia asperifolia* dominance types have been described in Colorado by Baker (1984), and Kittel and Lederer (1993).

2. *Scirpus olneyi/Typha latifolia* CT
(olney bulrush/common cattail; SCIOLN/TYPLAT)

Distribution: This community type is distributed sporadically in the Pecos Basin, and is known to occur on the Black River in Eddy County.
Vegetation: The graminoid *Scirpus olneyi* (olney bulrush) [OBL], and the forb *Typha latifolia* (common cattail) [OBL], codominate this herbaceous wetland. *Populus fremontii* (Fremont cottonwood) is well represented on the margins of the wetland as individual trees and young saplings. Species diversity is characteristically low. Other graminoids present include *Juncus bufonius* (toad rush), *Juncus tenuis* (poverty rush) and the exotic *Cynodon dactylon* (bermudagrass). Forbs are scarce yet represented by *Desmanthus illinoensis* (Illinois bundleflower).

Environmental Setting: SCIOLN/TYPLAT occurs on the margins of backwater channels where ponding is commonly due to subsurface flow and a high water table. Soils are hydric and saturated to the surface. Adjacent soils are hydric and show evidence of having a reduced matrix (gleying). Adjacent banks are steep and unstable and vegetatively sparse. Elevation is 3660 ft.

Adjacent Vegetation: Adjacent upland vegetation includes creosotebush, acacia, and soaptree yucca shrublands characteristic of Chihuahuan Desert Scrub. Adjacent riparian vegetation include *Celtis reticulata-Salix gooddingii* communities on terraces and *Salix exigua-Baccharis emoryi* on bars.

Discussion: The *Scirpus olneyi/Typha latifolia* CT is considered to be an early-progressional stage community. Ponding of water adjacent to the active channel may result from an ancillary seep, as well as impermeable clay soils. Adjacent landforms are steep and unstable. Regeneration of cottonwoods adjacent to the marsh appears to be sexual and successful. Regeneration should remain successful in the absence of grazers. This community is probably inundated throughout the year.

Documentation: This description is based on cross section Black River1 and plot 93PD59. This type has not been reported elsewhere for New Mexico. Cattail marshes have been identified in Utah and Idaho (Padgett et al. 1989) and Montana (Hansen et al. 1990). Our type may be ecologically similar to the *Scirpus validus/Typha latifolia* wetland described by Baker (1984) in Colorado.

III. Closed Basin Persistent-Emergent Wetlands

Closed basin wetlands are dependent upon a specific moisture regime. They are internally drained basins. Sources of water are by direct precipitation or runoff from surrounding upland slopes. All water remains in the basin except that which is lost due to evapotranspiration. Soils are fine-textured and water may be ponded for much of the year or for only several weeks during the year. Plant populations may fluctuate corresponding to water levels during dry and wet seasons. Playas are typically herbaceous-dominated communities and are unique habitats for plants and animals that may be restricted in their overall distribution. Playas are important as well for migratory waterfowl and shorebirds, and terrestrial wildlife needing a source of water. These closed basin wetlands may also support a richer and denser vegetative cover than the surrounding region (Mehlhop et al. 1994).

IV. Persistent Series Group

Closed basin herbaceous wetlands of the Pecos River Basin consist of one series group, the persistent series group, of which there are three series: the *Eleocharis macrostachya* (longstem spikerush) Series, the *Panicum obtusum* (vine mesquite) Series, and the *Sporobolus airoides* (alkali sacaton) Series.

V. *Eleocharis macrostachya* (longstem spikerush) Series

1. *Eleocharis macrostachya/Helianthus ciliaris* CT (longstem spikerush/blueweed sunflower; ELEMAC/HELCIL)

Distribution: This community is known to occur at Cocklebur Lakes East in Chaves County, and probably occurs in other ephemeral playa lakes of southeastern New Mexico.

Vegetation: *Eleocharis macrostachya* (longstem spikerush) [OBL], is abundant and dominates the graminoid layer while *Helianthus ciliaris* (blueweed sunflower) [FAC], is luxuriant and dominates the forb layer. Overall species diversity is low. *Sida leprosa* (scurfy mallow) and *Phyla cuneifolia* (wedgeleaf frog-fruit) are present. Other graminoids present include *Buchloe dactyloides* (buffalograss) and *Panicum obtusum* (vine mesquite).

Environmental Setting: ELEMAC/HELCIL represents an intermediate zone in the moisture regime of playa lakes. Soils are hydric (1987 Corps of Engineers Wetlands Delineation Manual) Typic Haplotorrerts with a clayey profile. They are frequently flooded, alkaline and calcareous. Conductivity is 2.48 mS. Elevation is approximately 3600 ft.

Adjacent Vegetation: Bordering the basin are mesquite/alkali sacaton shrublands.

Discussion: The *Eleocharis macrostachya/Helianthus ciliaris* CT is an early-successional wetland community associated with moist clayey soils. It is able to tolerate some inundation, yet prefers somewhat drier conditions.

Documentation: This description is based on cross section Playa1 and plots 93NR01, 93NR02,

93NR03 respectively. This community type is likely to occur elsewhere in the Southern Great Plains.

2. *Eleocharis macrostachya-Panicum obtusum* CT
(longstem spikerush-vine mesquite; ELEMAC-PANOBT)

***Iva axillaris* phase**
(poverty sumpweed; IVAAXI)

Distribution: This community is known to occur at Curlew Lake in Chaves County.

Vegetation: The forb *Iva axillaris* (poverty sumpweed) [FAC], is luxuriant and dominates the forb layer. It is equally likely to occur in wetlands or nonwetlands. *Eleocharis macrostachya* (longstem spikerush) [OBL], and *Panicum obtusum* (vine mesquite) [FAC] are abundant and codominate the graminoid layer. Species diversity is low. Other species are scarce and include *Cuscuta cuspidata* (field dodder), *Hoffmanseggia densiflora* (rushpea) and *Sida leprosa* (scurfy mallow).

Environmental Setting: Soils are hydric (1987 Corps of Engineers Wetland Delineation Manual) Typic Haplotorrert with a clayey profile. These soils are frequently flooded, alkaline and calcareous. Conductivity is 7.88 mS. Elevation is approximately 4025 ft.

Adjacent Vegetation: Bordering the basin are mesquite/alkali sacaton shrublands.

Discussion: The *Iva axillaris* phase of the *Eleocharis macrostachya-Panicum obtusum* typic community is an early-successional wetland community associated with moist clayey soils. The phase may be transitional from moister conditions where water is ponded to the drier alkaline conditions of the upslope. Diversity of species is low. Species composition may fluctuate during drier and wetter seasons. *Iva axillaris* likely increases during the dry season. Disturbance from cattle grazing is moderate. The potential for pollution and degradation of habitat from waste oil or brine is high due to the close proximity of two oil wells at this playa lake.

Documentation: This description is based on cross section Playa3 and plot 93NR05. Species composition may be similar to playa lakes of Kiowa National Grasslands, New Mexico (Hoagland 1994). Studies in NW Colorado (Baker 1984, and Kittel and Lederer 1993) recognize *Iva axillaris* as a community type in a transitional phase. Its dominance could be attributed to disturbance, alkaline soil conditions, and a drier than normal monsoonal season. No other dominance types of *Iva axillaris* have been reported in New Mexico. Correll and Johnston (1979) describe this species as being in and about playas of the Texas Panhandle.

3. *Eleocharis macrostachya-Schedonnardus paniculatus* CT

(longstem spikerush-tumblegrass; ELEMAC-SCHPAN)

Distribution: This community is known to occur at Archuleta Lake in Lincoln County.

Vegetation: *Eleocharis macrostachya* (longstem spikerush) [OBL], codominates the graminoid layer with the grass *Schedonnardus paniculatus* (tumblegrass) [no wetland indicator status available], which is well represented. Ruderal species are common in this community and include the shrub *Gutierrezia sarothrae* (broom snakeweed); and the forbs *Solanum rostratum* (buffalobur), *Solanum elaeagnifolium* (silverleaf nightshade), *Amaranthus retroflexus* (redroot pigweed), and *Cucurbita foetidissima* (buffalogourd).

Environmental Setting: Soils are hydric (1987 Corps of Engineers Wetlands Delineation Manual) Typic Haplotorrerts with a clayey profile. These soils are frequently flooded, alkaline and non-calcareous. Conductivity is 0.29 mS. Elevation is approximately 5400 ft.

Adjacent Vegetation: Bordering the basin is a juniper/mesquite woodland.

Discussion: The *Eleocharis macrostachya-Schedonnardus paniculatus* CT is an early-successional community and a grazing-induced disclimax. Diversity of species is high, but ruderal species dominate. In a less disturbed situation this site could progress towards a more monotypic stand of *Eleocharis macrostachya*.

Documentation: This description is based on cross section Playa6 and plot 93NR09. Species composition may be similar to the playas of Kiowa National Grasslands, New Mexico (Hoagland 1994).

4. *Eleocharis macrostachya/Sida leprosa* CT
(longstem spikerush/scurfy sida; ELEMAC/SIDLEP)

Distribution: This community is known to occur at Cocklebur Lakes East in Chaves County.

Vegetation: This wetland community is represented by a nearly monotypic, luxuriant stand of *Eleocharis macrostachya* (longstem spikerush) [OBL]. *Sida leprosa* (scurfy sida) [no wetland indicator status available], is well represented and codominates in the forb layer. Overall species diversity is low. *Helianthus ciliaris* (blueweed sunflower) is present.

Environmental Setting: ELEMAC/SIDLEP occurs at the innermost zone of the playa where standing water is present much of the year, and the moisture regime exerts a strong influence on the species composition. Soils are hydric (1987 Corps of Engineers Wetlands Delineation Manual) Typic Haplotorrerts with a very fine texture. These soils are moist and clayey throughout the profile. They are frequently flooded, alkaline and calcareous. Conductivity is

1.50 mS. Elevation is approximately 3600 ft.

Adjacent Vegetation: Bordering the basin are mesquite/alkali sacaton shrublands. Mature individuals of *Populus fremontii* and *Tamarix pentandra*/sparse communities are also present.
Discussion: The *Eleocharis macrostachya/Sida leprosa* CT is an early successional community of closed basins. Diversity of species is low, yet cover values are high. Disturbance from grazing is moderate, particularly on the periphery, and relatively low towards the interior of the playa. The hydrology of the basin may be altered by a road which intersects this playa from the adjacent playa.

Documentation: This description is based on cross section Playa1 and plot 93NR03. Species composition may be similar to the playas of Kiowa National Grasslands, New Mexico (Hoagland 1994).

V. *Panicum obtusum* (vine mesquite) Series

1. *Panicum obtusum/Helianthus ciliaris* CT (vine mesquite/blueweed sunflower; PANOBT/HELCIL)

Distribution: This community is known from Arroyo Serrano Lake in Lincoln County.

Vegetation: The grass *Panicum obtusum* (Panicum obtusum) [FAC]), is luxuriant and dominates the graminoid layer. The forb *Helianthus ciliaris* (blueweed sunflower) [FAC], is well represented and codominates this herbaceous wetland community. Overall species diversity is low. Other species present include the graminoid *Eleocharis macrostachya* (longstem spikerush) and the forbs *Phyla cuneifolia* (wedgeleaf frog-fruit), *Hoffmanseggia densiflora* (rushpea) and *Solanum elaeagnifolium* (silverleaf nightshade).

Environmental Setting: Soils are hydric (1987 Corps of Engineers Wetlands Delineation Manual) Typic Haplotorrerts with a clayey profile. These soils are frequently flooded, alkaline and non-calcareous. Conductivity is 0.84 mS. Elevation is approximately 4920 ft.

Adjacent Vegetation: Bordering the basin are mesquite shrublands.

Discussion: The *Panicum obtusum/Helianthus ciliaris* CT is an early-successional community common to closed basins in this region. A series of small ponds and herbaceous-dominated islands characterize this basin. Species diversity is low. Disturbance from grazing is moderate. The size of the plant community is delimited by a moisture regime and occupies a narrow zone between the upland and the standing water.

Documentation: This description is based on cross section Playa7 and plot 93NR10. This type is likely to occur elsewhere in the Southern Great Plains.

V. *Sporobolus airoides* (alkali sacaton) Series

1. *Sporobolus airoides-Buchloe dactyloides* CT
(alkali sacaton-buffalograss; SPOAIR-BUCDAC)

Distribution: This community is known from North Ballard Hill Lake in Chaves County.

Vegetation: The grasses *Sporobolus airoides* (alkali sacaton) [FAC], is abundant while *Buchloe dactyloides* (buffalograss) [FACU], is well represented and codominates this herbaceous community. Shrubs present include *Tamarix pentandra* (saltcedar), *Prosopis glandulosa* (honey mesquite) and *Gutierrezia sarothrae* (broom snakeweed). Graminoids and forbs are not well diversified. Graminoids present include *Panicum obtusum* (vine mesquite), *Bothriochloa saccharoides* (silver sourgrass) and *Eragrostis cilianensis* (stinkgrass). Forbs present include *Solanum elaeagnifolium* (silverleaf nightshade), *Euphorbia serpens* (creeping spurge), *Hoffmanseggia densiflora* (rushpea) and *Asclepias subverticillata* (westernwhorled milkweed).

Environmental Setting: Soils are classified as Aridisols and Typic Camborthids with a clayey-loamy profile. These soils are alkaline and calcareous. Conductivity is 2.28 mS. Elevation is approximately 3590 ft.

Adjacent Vegetation: Bordering the basin is a mesquite/alkali sacaton shrubland community.

Discussion: The *Sporobolus airoides-Buchloe dactyloides* CT appears to be an early- to mid-successional wetland community type. As the moisture regime becomes drier, alkali sacaton may be moving in from the adjacent bottomlands. Diversity of species is low but plant cover is high. This type could cycle back towards a *Panicum obtusum/Helianthus ciliaris* CT in wetter seasons. Disturbance from grazing may also have an influence on the species composition.

Documentation: This description is based on cross section Playa5 and plot 93NR08. Species composition may be similar to the *Buchloe dactyloides* dominated playas of Kiowa National Grasslands, New Mexico (Hoagland 1994).

APPENDIX 2.

Key To The Pecos River Basin Riparian/Wetland Community Types.

Use the key like any other artificial key by determining at the couplet the best combination of potentially dominant species in the community. Community types are keyed to their-six letter acronym of genus and species. The key works best in stands from late-progressional to near-climax stages. Stands in early- to mid-progressional stages cannot generally be keyed directly to their community type. For these stands the community type must be inferred from site factors, indicator species, or successional relationships. Users may need to consult the community characterization abstracts (CCAs) to verify the determination. No stand will fit the CCAs exactly. Canopy coverages of principal understory shrubs, forbs, and graminoids in the CCAs correspond to the following adjectives and nouns used in the vegetation key:

ABSENT - cannot be found in stand (opp = present);
ACCIDENTAL - individuals very infrequent, occasional, or limited to special microsites;
ABUNDANT - canopy coverage > 25%;
COMMON - canopy coverage > 1% (opp = scarce);
DOMINANT - density or cover is as great as, or greater than, any other species of the same life form (two or more species can be dominant, i.e. codominant);
LUXURIANT - canopy coverage > 50%;
POORLY REPRESENTED - canopy coverage < 5% (opp = well-represented);
PRESENT - individuals can be found in the stand (opp = absent);
REGENERATION - understory trees as established seedlings, saplings, or small poles (dbh < 10 in.);
SCARCE - canopy coverage < 1% (opp = common);
WELL-REPRESENTED - canopy coverage >5% (opp = poorly represented).

Appendix 2 (continued).

Key to Forested Wetlands:

1. Needle-leaved evergreen trees dominate the overstory ..... Group A
1. Broad-leaved deciduous trees dominate the overstory 2

    2. Dominant trees include *Acer negundo* and *Populus angustifolia* ..... Group B
    2. Dominant trees include *Populus fremontii, Celtis reticulata,* or *Salix gooddingii* 3

3. Dominant trees of the Plains, includes *Populus fremontii; Celtis reticulata* and/or *Salix gooddingii* absent ..... Group C
3. Dominant trees not of the Plains, *Populus fremontii* may be present and codominate ..... Group D

Key to Community Types:

Group A. Rocky Mountain Montane Needle-Leaved Evergreen Forests

1. *Picea pungens* present in the overstory; of banks and terraces 2
1. Upland sites ..... unclassified

    2. Understories predominantly shrubby; *Alnus oblongifolia* abundant; streambanks ..... PICPUN/ALNOBL
    2. Understories predominantly herbaceous; *Poa pratensis* abundant; terraces ..... PICPUN/POAPRA

Group B. Rocky Mountain Montane Broad-Leaved Deciduous Forests

1. *Acer negundo* dominant and reproducing successfully; clearly not accidental; *Salix exigua* luxuriant and the codominant; usually of terraces
1. *Populus angustifolia* the dominant cottonwood 2

    2. *Alnus oblongifolia* codominates; *Acer negundo* well represented in the understory ..... POPANG
    2. *Alnus oblongifolia* codominates; otherwise not as above ..... POPANG/ALNOBL

3. Understory predominantly shrubby; *Salix exigua* abundant and codominates; *Acer negundo* accidental; usually on point ...bars POPANG
3. Understory predominantly herbaceous; *Poa pratensis* abundant and codominates; other species not well represented; usually on terraces

Group C. Plains Broad-Leaved and Needle-Leaved Deciduous Forests

1. *Populus fremontii* dominant; understory sparse ..... POPFRE/SPARSE
1. Not as above 2

    2. Understory predominantly shrubby; *Salix exigua* abundant ..... POPFRE/SALEXI
    2. Understory predominantly herbaceous graminoids 3

3. *Sporobolus airoides* well represented ..... POPFRE/SPOAIR
3. *Tamarix pentandra* abundant with at least 50% cover 4

    4. *Sporobolus airoides* present ..... POPFRE/SPOAIR; TAMPEN phase
    4. *Salix amygdaloides* well represented and reproducing successfully ..... POPFRE/SALAMY; TAMPEN phase

Group D. Southwest Broad-Leaved Deciduous Forests

1. *Celtis reticulata* present in the overstory 2
1. *Populus fremontii* present in the overstory ..... POPFRE/SALGOO

    2. *Juglans major* well represented; herbaceous layer abundant ..... CELRET/JUGMAJ

Appendix 2 (continued).

2. *Salix gooddingii* well represented; herbaceous layer present ..... CELRET/SALGOO

Key to Scrub-Shrub Wetlands:

1. Broad-leaved deciduous shrubs of Montane regions dominate the overstory ..... Group A
1. Not as above 2

2. Broad-leaved deciduous shrubs of Southwest regions dominate the overstory 3
2. Needle-leaved deciduous shrubs dominate the overstory; of closed basins..... Group D

3. Broad-leaved deciduous shrubs dominate the overstory .....Group B
3. Broad-leaved and needle-leaved deciduous shrubs dominate the overstory .....Group C

Key to Community Types:

Group A. Rocky Mountain Montane Shrublands

1. *Alnus oblongifolia* dominant; of upper montane environments 2
1. *Salix exigua* dominant; of lower montane environments ..... SALEXI/ELYCAN

2. *Cornus stolonifera* abundant; herbaceous layer luxuriant ..... ALNOBL-CORSTO
2. Not as above 3

3. Understory predominantly shrubby; *Salix irrorata* always present and well represented ..... ALNOBL-SALIRR
3. Understory predominantly herbaceous graminoid; other shrubs are present, but scattered; *Calamagrostis canadensis* abundant ALNOBL

Group B. Southwest Broad-Leaved Deciduous Shrublands

1a. *Salix exigua* dominant in the overstory 1b
1b. *Baccharis emoryi* abundant; young cottonwood regeneration may be present in the understory; graminoids are well represented, considerably mor

Group C. Southwest Broad-Leaved and Needle-Leaved Deciduous Shrublands

1. *Tamarix pentandra* dominant in the overstory; canopy cover > 50%; understory sparse .....TAMPEN/SPARSE
1. *Baccharis emoryi* dominant in the overstory; *Tamarix pentandra* abundant; understory predominantly graminoid..... 2

2. *Muhlenbergia asperifolia* well represented .....BACEMO/MUHASP; TAMPEN phase
2. *Sporobolus airoides* well represented..... BACEMO/SPOAIR; TAMPEN phase

Group D. Closed Basin Needle-Leaved Deciduous Shrublands

1. *Tamarix pentandra* dominant in the overstory; other shrubs absent; *Buchloe dactyloides* abundant .....TAMPEN/BUCDAC
1. *Sporobolus airoides* abundant..... TAMPEN/SPOAIR

Key to Persistent-Emergent Wetlands:

1. Rocky Mountain Montane herbaceous wetlands ..... Group A
1. Not as above 2

Appendix 2 (continued).

2. Plains herbaceous wetlands ..... Group B
2. Not as above 3

3. Southwest herbaceous wetlands ..... Group C
3. Not as above 4

4. Closed Basin herbaceous wetlands ..... Group D
4. Not as above ..... unclassified

Key to Community Types:

Group A. Rocky Mountain Montane Herbaceous Wetlands

1. Grassy with diverse shrubs scattered; sedges present; of upper montane environments ..... PHAARU-GLYSTR
1. Sedge dominated; grasses well represented; of lower montane environments 2

    2. Forbs dominated by *Equisetum arvense* ..... CAREMO/EQUARV
    2. Not as above 3

3. Sites tend to be disturbed; dry ..... JUNBAL-CARPRA
3. Sites undisturbed; willows scattered; seasonally ponded ..... CARNEB-CARROS

Group B. Plains Herbaceous Wetlands

1. Freshwater wetlands; *Scirpus americanus* dominant 2
1. Alkaline wetlands; *Distichlis stricta* dominant 3

    2. *Scirpus americanus* abundant; other graminoids codominate ..... SCIAME-PASDIS
    2. *Scirpus americanus* abundant; other forbs codominate ..... SCIAME/TYPLAT

        3. *Tamarix pentandra* abundant; of overflow channels ..... DISSTR-SCIAME; TAMPEN phase
        3. Not as above; *Salicornia utahensis* abundant ..... DISSTR/SALUTA

Group C. Southwest Herbaceous Wetlands

1. *Scirpus acutus* dominant; herbaceous cover luxuriant; tributary wetlands ..... SCIACU-ELEMAC
1. Not as above 2

    2. *Scirpus olneyi* luxuriant; other graminoids codominate; tributary marshes ..... SCIOLN-MUHASP
    2. *Scirpus olneyi* well represented; other forbs codominate; tributary marshes ..... SCIOLN/TYPLAT

Group D. Closed Basin Herbaceous Wetlands

1. Grasses dominate 2
1. *Eleocharis macrostachya* dominates 3

    2. *Panicum obtusum* abundant to luxuriant; shrubs absent ..... PANOBT/HELCIL
    2. *Sporobolus airoides* abundant; *Buchloe dactyloides* well represented; grazed sites ..... SPOAIR-BUCDAC

3. *Iva axillaris* abundant; other forbs codominate ..... ELEMAC/HELCIL; IVAAXI phase
3. Not as above 4

    4. Sites tend to be highly disturbed; ruderal species abundant ..... ELEMAC-SCHPAN

Appendix 2 (continued).

4. Not as above 5

    5. *Helianthus ciliaris* luxuriant ..... ELEMAC/HELCIL
    5. *Sida leprosa* well represented ..... ELEMAC/SIDLEP

APPENDIX 3.

Proposed Ecologically Significant/Restorable Riparian Areas of the Pecos River Basin.

Pecos River Basin Proposed Ecologically Significant Riparian/Wetland Areas.

1. The upper montane reaches of the mainstem of the Pecos River below the Wilderness boundary support good occurrences of montane riparian coniferous forests; the blue spruce/New Mexico alder (*Picea pungens/Alnus oblongifolia*) CT. This CT also occurs on the upper reaches of the Gallinas River north of Gallinas1. This CT occurs on the most hydrologically intact segment of the river, regeneration of riparian species is continual, and negative human impacts are relatively few (P3, P4, and Pecos1).

2. The upper montane reaches of the mainstem of the Pecos River below the Wilderness boundary supports good occurrences, although somewhat fragmented, of montane riparian shrublands; the New Mexico alder-redosier dogwood (*Alnus oblongifolia-Cornus stolonifera*) CT. This type occurs without major alterations of the river, and shows signs of continual existence. Species diversity is rich and cover is luxuriant. (P2 and P5).

3. The upper montane reaches of the mainstem of the Pecos River contains good to excellent examples of montane riparian shrublands, the New Mexico alder-bluestem willow (*Alnus oblongifolia-Salix irrorata*) CT. Although somewhat fragmented, these communities are rich in riparian/wetland species and low in exotics. (P1, P6, P7, P8, and Pecos2).

4. The Gallinas River north of Las Vegas supports a good to excellent occurrence of a large Montane riparian forest that may be globally rare to uncommon. The narrowleaf cottonwood/coyote willow (*Populus angustifolia/Salix exigua*) CT also harbors a small population of foxtail sedge (*Carex vulpinoidea*) that is reportedly rare in New Mexico (Martin and Hutchins 1980). (Gallinas3).

5. The lower montane reaches of the mainstem of the Pecos River, near Tres Lagunas-La Posada, supports an excellent occurrence of an herbaceous Montane wetland, the Nebraska sedge-beaked sedge (*Carex nebrascensis-Carex rostrata*) CT. This marsh is extremely well developed and undisturbed. (Pecos7).

Appendix 3 (continued).

6. The lower montane reaches of the mainstem of the Pecos River near Rowe and San Ysidro contain excellent occurrences of broad-leaved deciduous riparian shrublands, the coyote willow/Canada wildrye (*Salix exigua/Elymus canadensis*) CT. This lush community occurs for several miles on low to mid elevation bars. Steep bluffs are common to this reach and naturally isolate these communities from negative human impacts. Its status has yet to be determined, but like the coyote willow/quackgrass community, it may be relatively uncommon. (Pecos4, 5, and 8).

7. The middle reaches of the mainstem of the Pecos River near Santa Rosa harbor an excellent example of a newly stabilized bar which supports the threesquare-knotgrass (*Scirpus americanus-Paspalum distichum*) CT. This bar is frequently inundated, lush, low in exotics, and could be a potential site for regeneration of obligate riparian tree species like Fremont cottonwood. (Pecos13).

8. The lower reaches of the mainstem of the Pecos River, south of Roswell and the confluence of the Rio Hondo, contains an excellent example of an inland saltgrass meadow; the inland saltgrass/Utah glasswort (*Distichlis stricta/Salicornia utahensis*) CT. The wetland is large and vigorous. The occurrence of exotic species, particularly saltcedar, is low to absent. (Overflow wetland1).

9. Black River at the confluence of Blue Spring supports an excellent example of a Southwest riparian forest, the netleaf hackberry-Arizona walnut (*Celtis reticulata-Juglans major*) CT. This site occurs directly above a waterfall and contains a lush, marshy understory. Disturbance from grazing is minimal. Its occurrence within the Pecos Basin is uncommon (Dick-Peddie 1993). (plot 93PD67).

10. Blue Spring near the headwaters contains an excellent occurrence of a Plains riparian/wetland. This lush marsh is bordered by the Chihuahuan Desert. The bulrush-longstem spikerush (*Scirpus acutus-Eleocharis macrostachya*) CT contains few exotics and supports a wide diversity of plant species. (Blue Spring1).

11. The Rio Hondo and Rio Ruidoso support excellent occurrences of a Southwest riparian forest. The Fremont cottonwood-Goodding's willow (*Populus fremontii-Salix gooddingii*) CT occurs along streams without any major alterations. The understories are lush and exotics are minimal. (Rio Ruidoso1 and Rio Hondo1).

Pecos River Basin Proposed Restorable Riparian/Wetland Areas.

1. Black River from the headwaters to just below the confluence of Blue Springs

Appendix 3 (continued).

harbors good occurrences, although fragmented, of a globally rare riparian deciduous forest, the Fremont cottonwood-Goodding's willow (*Populus fremontii-Salix gooddingii*) CT. This site also contains a population of deergrass (*Muhlenbergia rigens*), which is considered globally rare as it occurs with Fremont cottonwood. Bermudagrass in the understory and domestic livestock grazing lowers the ranking of these sites. (Black River1-3).

2. The middle reaches of the Pecos River in southern DeBaca County, at the mouth of Ward Canyon, contains a large decadent stand of Fremont cottonwood within the seepwillow/alkali sacaton CT having a saltcedar phase and adjacent to a coyote willow/seepwillow (*Salix exigua/Baccharis emoryi*) CT. Nearby is a young stand (five years old) of cottonwood that appears to have been established by seed. While saltcedar is present, the floodplain is not greatly elevated and banks are not deeply downcut. Where the oldest cottonwood stand occurred, the water table was measured within one meter of the soil surface. The site shows great potential for restoration. (Pecos23).

3. Yeso Creek where it crosses under state highway 20 in DeBaca County harbors extensive cattail marshes bordered by seepwillows and coyote willows in good condition. However, cattle were observed to have free access to the creek. Additionally, a large stand of saltcedar borders the upland which the cattle use for shade. Removal of saltcedar and limiting access to the creek by the cattle would significantly improve the habitat of this community. (Yeso Creek1).

4. One playa at Arroyo Serrano contains a good, although small, occurrence of a globally rare or uncommon (status not definitive) example of the vine mesquite-blueweed sunflower (*Panicum obtusum/Helianthus ciliaris*) CT. Disturbance from grazing threatens this community. (Playa7).

A Riparian/Wetland Vegetation Community Classification of New Mexico: Pecos River Basin

Data Addenda

Final Report

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DATA ADDENDA

DATA ADDENDUM 1.

Cross section diagrams are presented by stream reach in Figures A1.1-A1.53[*]. Indicated are the flows (cfs) required to inundate that site for various modeled stage heights. Plot positions, vegetation community acronyms, and soil taxon acronyms are also shown. Soil conductivity values (mS) are presented for the playa cross sections in place of cfs. Tables A1.1-A1.46. are the corresponding results from the hydraulic modeling of flows through the surveyed cross sections. Each Table reports the estimated velocity in feet per second (ft/s) and cfs through each cross section based on the measured stream gradient, a user's supplied Mannings "n" and the cross sectional area of the stream as output by XSPRO (Grant et al. 1992).

[*]Included are cross sections from playas (Figures A1.48-A1.53). Flow data is not presented for cross sections not associated with a stream reach.

DATA ADDENDUM 2.

Soil Profile Descriptions for the Pecos River Basin.

Plot: 92HK01
Cross Section: P1
Community Type: narrowleaf cottonwood/New Mexico alder (POPANG/ALNOBL)
Location: north of the gauging station near Cowles

Classification: Aeric Fluvaquent, mixed, frigid, coarse loamy over sandy skeletal

O 1 to 0 cm; little humus; grass, alder litter.

A1 0 to 12 cm; dark grayish brown (10YR 4/2 ped and crush/dry), black (10YR 2/1 ped and moist); silt loam (10% clay); weak, fine subangular blocky; slightly hard (dry); many very fine, common fine, few medium and coarse roots; 5% gravel; pH 6.4; no effervescence; smooth abrupt boundary.

2B1 12 to 29 cm; dark grayish brown (10YR 4/2 crush/dry), very dark brown (10YR 2/2 ped and rub/moist); loamy sand (5% clay); weak, medium crumb; nonsticky (wet), very friable (moist); few very fine, common fine, many medium, and few coarse roots; 60% gravel, 10% cobble; pH 7.2; no effervescence; smooth clear boundary.

2B2 29 to 70+ cm; dark grayish brown (10YR 4/2 crush/dry), black (10YR 2/1 rub/moist); sand loam (11% clay); fine granular to massive; nonsticky (wet), very friable (moist); few medium and coarse roots; 35% gravel, 50% cobble, 5% stone; pH 7.6; no effervescence.

Plot: 92HK02
Cross section: P1
Community Type: New Mexico alder/bluestem willow (ALNOBL/SALIRR)
Location: north of the gauging station near Cowles

Classification: Typic Fluvaquent, sandy skeletal, mixed frigid

A1 0 to 5 cm; dark brown (10YR 3/3 crush/dry and 7.5YR 3/2 rub/moist); silt loam (10% clay); massive; nonsticky (wet), very friable (moist); many very fine, many fine, common medium, and few coarse roots; common very fine, common fine, few medium and coarse pores; pH 7.6; no effervescence; smooth clear boundary.

Data Addendum 2 (continued).

2B1 5 to 13 cm; grayish brown (10YR 5/2 crush/dry), dark brown (10YR 3/3 rub/moist); sand (3% clay); common, distinct, medium to coarse, strong brown to reddish yellow (7.5YR 5.5/8) mottles; single grain; nonsticky (wet), very friable (moist); many very fine, many fine, common medium, and few coarse roots; common very fine, common fine, few medium and coarse pores; 5% gravel, 8% cobble; pH 7.2; no effervescence; wavy clear boundary.

3B2 13 to 23 cm; dark grayish brown (10YR 4/2 crush/dry), dark brown (7.5YR 3/2 rub/moist); sandy loam (15% clay); massive; nonsticky (wet), friable (moist); many very fine, many fine, common medium and coarse roots; common very fine, common fine, few medium and coarse pores; 15% gravel, 25% cobble; pH 7.6; no effervescence; smooth clear boundary.

4C1 23 to 34+ cm; dark grayish brown (10YR 4/2 crush/dry), dark brown (10YR 3/3 rub/moist); sand (2% clay); common, distinct, medium to coarse, strong brown to reddish yellow (7.5YR 5.5/8) mottles; single grain; nonsticky (wet), very friable (moist); many very fine, many fine, common medium, and common coarse roots; common very fine, common fine, common medium and few coarse pores; 32% gravel, 50% cobble; pH 7.4; no effervescence.

Water at 34 cm.
A1 has abundant roots and organic material; roots very dense; coarse alluvial organic material (tree bark).
2B1 has very dense roots; coarse alluvial organic material (tree bark).
4C1 has roots in the upper few cm.

Plot: 92HK03
Cross section: P2
Community Type: New Mexico alder/redosier dogwood (ALNOBL/CORSTO)
Location: Terrero

Classification: Typic Fluvaquent, loamy skeletal, mixed, frigid

Oi 7 to 0 cm; coarse organic material (rotting wood); 95% coarse organic material.

A 0 to 23 cm; very dark grayish brown (10YR 3/2 rub/moist); loam (12% clay, 48% silt); few, distinct, medium to coarse, dark yellowish brown to yellowish brown (10YR 4.5/6) mottles; weak to moderate, medium crumb; nonsticky (wet), friable (moist); common roots of all sizes; common very fine, common fine, few medium and coarse pores; 10% gravel, 30% cobble, 30% stone; pH 7.2; no effervescence; smooth clear boundary.

Cg1 23 to 41 cm; very dark gray (10YR 3/1 rub/moist); silt loam (17% clay, 58% silt); common, distinct, medium to coarse, dark yellowish brown to yellowish brown (10YR 4.5/6) mottles;

Data Addendum 2 (continued).

weak, medium crumb; slightly sticky (wet), friable (moist); common roots of all sizes; common very fine, common fine, few medium and coarse pores; 10% gravel, 30% cobble, 30% stone; pH 6.8; no effervescence; smooth clear boundary.

Cg2 41 to 61 cm; black (7.5YR 2.5/1 rub/moist); loam (12% clay, 48% silt); massive; nonsticky (wet), friable (moist); few roots of all sizes; common very fine, few fine, medium and coarse pores; 10% gravel, 30% cobble, 30% stone; pH 6.4; no effervescence; smooth clear boundary.

Cg3 61 to 83+ cm; dark gray to very dark gray (5Y 3.5/1 rub/moist); sandy loam (7% clay, 20% silt); massive; nonsticky (wet), friable (moist); few roots of all sizes; common very fine, few fine, medium and coarse pores; 10% gravel, 30% cobble, 30% stone; pH 7.2; no effervescence.

Left bank is 85 cm from pit.
A has coarse organic material (40% of soil) on in upper 5 cm; mottles are in the lower 4cm of the horizon.

Plot: 92HK04
Cross Section: P2
Community Type: narrowleaf cottonwood/New Mexico alder (POPANG/ALNOBL)
Location: Terrero

Classification: Aeric Endoaquept, coarse loamy over loamy skeletal, mixed frigid

A1 0 to 6 cm; very dark grayish brown (10YR 2.5/2) sandy loam; weak moderate crumb; very friable, non-sticky; many very fine, common fine, few medium roots; 1 percent gravel, 5 percent stones; slightly acid (pH 6.6); clear wavy boundary.

AB 6 to 24 cm; very dark grayish brown (10YR 2.5/2) sandy loam; weak fine subangular blocky; very friable, non-sticky; common medium pores; common very fine, fine, medium and coarse roots; 5 percent gravel, 10 percent cobble, 5 percent stone; slightly acid (pH 7.4); gradual smooth boundary.

Bw1 24 to 44 cm; very dark grayish brown (10YR 2.5/2) cobbly sandy loam; weak moderate subangular blocky; very friable, non-sticky; common medium pores; common very fine and fine, many medium and coarse roots; 15 gravel, 20 percent cobbles, 5 percent stone; slightly alkaline (pH 7.4); abrupt smooth boundary.

C1 44 to 60+ cm; dark brown (10YR 3/2.5) gravelly sandy clay loam; weak medium crumb; friable, slightly sticky; few fine, medium and coarse roots; 40 percent gravel, 20 percent cobbles, 10 percent stone.

Data Addendum 2 (continued).

Plot: 92HK05
Cross section: P2
Community Type: narrowleaf cottonwood/New Mexico alder (POPANG/ALNOBL)
Location: Terrero

Classification: Aeric Fluvaquent, sandy skeletal, mixed, frigid

A1 0 to 8 cm; dark grayish brown (10YR 4/2 crush/dry), very dark grayish brown (10YR 3/2 rub/moist); loamy sand to sandy loam; weak, medium crumb to single grain; nonsticky (wet), to very friable (moist); common roots of all sizes; common very fine, common fine, few medium and coarse pores; 30% gravel, 20% cobble; pH 7.6; no effervescence.

B1 8 to 35 cm; dark grayish brown (10YR 4/2 crush/dry), dark brown (10YR 3/3 rub/moist); loamy sand (5% clay, 15% silt); weak, medium crumb to single grain; nonsticky (wet), to very friable (moist); common roots of all sizes; common very fine, common fine, few medium and coarse pores; 25% gravel, 20% cobble, 30% stone; pH 7.6; no effervescence.

B2 35 to 70 cm; yellowish brown (10YR 5/4 crush/dry), dark brown (10YR 3/3 rub/moist); sand (3% clay, 7% silt); weak, medium crumb to single grain; nonsticky (wet), to very friable (moist); common very fine, fine, medium, and few coarse roots; common very fine, common fine, few medium and coarse pores; 25% gravel, 20% cobble, 30% stone; pH 7.6; no effervescence.

C 70 to >73 cm; dark reddish brown (5YR 3/2 crush/dry and rub/moist); loamy sand (5% clay, 15% silt); single grain; nonsticky (wet), to very friable (moist); common very fine, fine, medium, and few coarse roots; common very fine, common fine, few medium and coarse pores; 25% gravel, 20% cobble, 30% stone; pH 7.6; no effervescence.

Water at 73 cm.
A1 has coarse organic material (15%).

Data Addendum 2 (continued).

Plot: 92HK06
Cross section: P3
Community Type: blue spruce/New Mexico alder (PICPUN/ALNOBL)
Location: near Terrero

Classification: Aeric Fluvaquent, sandy skeletal, mixed, frigid

A1 0 to 20 cm; dark brown (10YR 3/3 crush/dry), very dark grayish brown (10YR 3/2 rub/moist); loam (15% clay, 45% silt); moderate to strong, medium crumb; nonsticky (wet), very friable (moist); many very fine, common fine, common medium, and few coarse roots; common very fine, common fine, few medium and ayerza pores; 10% gravel, 5% cobble; pH 7.6; no effervescence; smooth clear boundary.

2B1 20 to 35 cm; dark brown (10YR 3/3 crush/dry), very dark grayish brown (10YR 3/2 rub/moist); loam (15% clay, 45% silt); moderate to strong, medium crumb; nonsticky (wet), very friable (moist); many very fine, common fine, few medium and coarse; common very fine, common fine, few medium and coarse pores; 30% gravel, 25% cobble, 10% stone, 5% boulder; pH 7.6; no effervescence; smooth clear boundary.

2B2 35 to 99cm; dark grayish brown (10YR 4/2 crush/dry), very dark grayish brown to dark brown (10YR 3/2.5 rub/moist); loamy sand (5% clay, 10% silt); weak, medium crumb; nonsticky (wet), very friable (moist); few to common very fine, few to common fine, few medium and coarse roots; common very fine, common fine, few medium and coarse pores; 15% gravel, 15% cobble, 30% stone, 20% boulder; pH 7.8; no effervescence; smooth abrupt boundary.

2C1 99 to 102 cm; grayish brown (10YR 5/2 crush/dry), very dark grayish brown to dark brown (10YR 3/2 rub/moist); silty loam (20% clay, 60% silt); massive; slightly sticky (wet), very friable (moist); few roots and pores of all sizes; 10% gravel, 10% cobble, 40% stone, 30% boulder; pH 7.8; no effervescence.

Water at 102 cm.

Plot: 92HK07
Cross section: P2
Community Type: blue spruce/Kentucky bluegrass (PICPUN/POAPRA)
Location: Terrero

Classification: Fluventic Dystrochrept, loamy, mixed, frigid.

A1 0 to 26 cm; very dark brown (10YR 3/2) silt loam; strong coarse subangular block; very friable; common fine and very fine, few medium and coarse pores; common fine and

Data Addendum 2 (continued).

very fine, few medium and coarse roots; 2 percent gravel; slightly acid (pH 6.4); clear smooth boundary.

Bw1 26 to 51 cm; very dark brown (10YR 3/2) loam; moderate medium subangular blocky; very friable; common fine and very fine, few medium and coarse pores; common very fine, fine, medium and coarse roots; 3 percent gravel; slightly acid (pH 6.6); clear smooth boundary.

Bw2 51 to 76 cm; very dark brown (10YR 3/2) cobbly loam; moderate medium subangular blocky; very friable; common fine and very fine, few medium and coarse pores; common very fine, fine, medium and coarse roots; 3 percent gravel, 10 percent cobbles; clear smooth boundary.

C1 76 to 100+ cm; dark brown (10YR 3/3) cobbly sandy loam; weak fine crumb; common fine and very fine, few medium and coarse pores; few very fine and fine , common medium and coarse roots; slightly alkaline (pH 7.4).

Plot: 92HK08
Cross section: P4
Community Type: blue spruce/New Mexico alder (PICPUN/ALNOBL)
Location: north of the gauging station near Cowles

Classification: Aeric Fluvaquent, loamy over sandy skeletal, mixed, frigid

O 4 to 0 cm; weakly decomposed litter

A1 0 to 40 cm; very dark grayish brown (10YR 3/2 rub/moist); silty loam (20% clay, 70% silt); strong, medium to coarse crumb and few fine subangular blocky; sticky (wet), friable (moist); common roots and pores of all sizes; 2% gravel; pH 7.0; no effervescence.

C1 40 to 60 cm; very dark grayish brown (10YR 3/2 rub/moist); silty loam (15% clay, 55% silt); common, distinct, medium to coarse, yellowish brown to brownish yellow (10YR 5.5/8) mottles; massive; slightly sticky (wet), very friable (moist); common very fine, few fine, medium and coarse roots; common very fine, few fine, medium and coarse pores; 5% gravel, 5% cobble; pH 7.0; no effervescence.

C2 60 to 69 cm; black to very dark gray (10YR 2.5/1 rub/moist); silty loam(15% clay, 55% silt); few, distinct, medium to coarse, yellowish brown to brownish yellow (10YR 5.5/8) mottles; massive; slightly sticky (wet), very friable (moist); common very fine, few fine, medium and coarse roots; common very fine, few fine, medium and coarse pores; 5% gravel, 10% cobble; pH 7.0; no effervescence.

2C3 73 to 86cm; dark yellowish brown (10YR 4/4 crush/dry), dark brown (10YR 3/3

Data Addendum 2 (continued).

rub/moist); sand (5% clay, 5% silt); many, prominent, coarse, yellowish brown to brownish yellow (10YR 5.5/8) mottles, areas of soil are orange; single grain; nonsticky (wet), very friable (moist); few roots of all sizes; common very fine, common fine, few medium and coarse pores; 30% gravel, 55% cobble; pH 7.4; no effervescence.

Water at 86 cm.
Little biological activity below 44 cm.
A horizon has few small sand lenses.
C1 and C2 horizons have occasional to common sand lenses, few square to several square cm; occasional coarse alluvial organic matter (tree shoots).

Plot: 92HK09
Cross section: P6
Community Type: New Mexico alder/bluestem willow (ALNOBL/SALIRR)
Location: near the Wilderness Boundary

Classification: Aquic Dystrochrept, coarse loamy over sandy skeletal, mixed, frigid

A1 0 to 3 cm; grayish brown (10YR 5/2 ped and crush/dry), very dark grayish brown (10YR 3/2 ped and rub/moist); fine loamy sand (5% clay); fine granular; nonsticky (wet), very friable (moist); common very fine and fine roots; pH 7.2; no effervescence; wavy clear boundary.

Bw1 3 to 27 cm; dark grayish brown (10YR 4/2 ped and crush/dry), dark brown to very dark grayish brown (8.75YR 3/2 ped and rub/moist); loam (15% clay) fine strong angular blocky; nonsticky (wet), firm (moist) slightly hard (dry); many very fine, common fine, few medium roots; common fine pores; 1% gravel; pH 7.0; no effervescence; smooth clear boundary.

Bw2 27 to 48 cm; dark grayish brown (10YR 4/2 ped and crush/dry), dark brown to very dark grayish brown (8.75YR 3/2 ped and rub/moist); sandy loam (20% clay) fine strong angular blocky, amalgamated to medium, weak subangular blocky; slightly sticky (wet), firm (moist) slightly hard (dry); few very fine, few fine, many medium and coarse roots; common fine, medium filled pores; 1% gravel, 1% cobble, 1% stone, 1% boulder; pH 7.0; no effervescence; smooth abrupt boundary.

C1 48 to 100 cm; brown (10YR 4/3 ped and crush/dry), very dark grayish brown (10YR 3/2 ped and rub/moist); coarse loamy sand (5% clay); medium subangular blocky; nonsticky (wet), friable (moist); few very fine roots; 30% gravel, 50% cobble, 10% stone; pH 7.4; no effervescence.

A1 is intermittent over Bw1.

Data Addendum 2 (continued).

Plot: 92HK010
Cross section: P5
Community Type: New Mexico alder/redosier dogwood (ALNOBL/CORSTO)
Location: near Cowles

Classification: Typic Fluvaquent, loamy skeletal, mixed, frigid

A1 1 to 13 cm; very dark brown (10YR 2.5/2); gravelly loam; weak coarse subangular blocky; very friable, slightly sticky; few fine, common fine roots; 30 percent gravel, 20 percent cobble, 15 % stone; neutral (pH 7.0); abrupt smooth boundary.

Cg1 13 to 16cm; very dark grayish brown (10YR 3/2); gravelly sandy clay loam; 10 percent very dark gray mottles (10YR 3/1); massive; very friable, sticky; few fine roots; 20 percent gravel, 10 percent cobble, 15 percent stone; neutral (pH 7.0); abrupt smooth boundary.

Cg2 26 to 46 cm; dark brown (10YR 3/3); cobbly sandy loam; 30 percent dark gray mottles (10YR 3/1); massive; very friable, slightly sticky; few fine roots; 10 percent gravel, 20 percent cobbles, 15 percent stone; slightly acid (pH 6.8); clear smooth boundary.

2Cg3 46 to 62+cm; very dark gray (10YR 3/1); clay; 20 percent dark yellowish brown mottles (10YR 4/4); massive; firm; few fine roots; five percent gravel, five percent cobble, 5 percent stone; slightly acid.

Plot: 92HK011
Cross section: P7
Community Type: blue spruce/Kentucky bluegrass (PICPUN/POAPRA)
Location: near the Wilderness Boundary

Classification: Fluventic Dystrochrept, loamy skeletal, mixed, frigid

A1 0 to 6 cm; dark grayish brown (10YR 4/2 crush/dry), dark brown (7.5YR 3/2 rub/moist); silt loam (20% clay, 70% silt); strong, medium crumb; slightly sticky (wet), very friable (moist); many very fine, many fine, few medium and coarse roots; common very fine, common fine, few medium and coarse pores; pH 6.4; no effervescence; smooth abrupt boundary.

A2 6 to 33 cm; dark grayish brown (10YR 4/2 crush/dry), dark brown to very dark grayish brown (8.75YR 3/2 rub/moist); silt loam (20% clay, 70% silt); strong, medium crumb; slightly sticky (wet), very friable (moist); common very fine, common fine, common medium, and few coarse roots; common very fine, common fine, few medium and coarse pores; 5% gravel, 12% cobble; pH 6.6; no effervescence; smooth clear boundary.

Data Addendum 2 (continued).

2B1 33 to 73 cm; dark grayish brown (10YR 4/2 crush/dry), dark brown to very dark grayish brown (8.75YR 3/2 rub/moist); silt loam (15% clay, 55% silt); strong, very fine subangular blocky to strong, medium crumb; slightly sticky (wet), very friable (moist); few very fine, few fine, common medium, and few coarse roots; common very fine, common fine, few medium and coarse pores; 30% gravel, 50% cobble, 5% stone; pH 6.6; no effervescence; smooth clear boundary.

3C1 73 to 85+ cm; dark brown (10YR 3/3 crush/dry), dark brown (7.5YR 3/2 rub/moist); sandy loam (10% clay, 15% silt); moderate, fine crumb; nonsticky (wet), very friable (moist); few roots of all sizes; common very fine, common fine, common medium and few coarse pores; 5% gravel, 20% cobble, 60% stone; pH 7.0; no effervescence.

Plot: 92HK012
Cross section: P7
Community Type: New Mexico alder/bluestem willow (ALNOBL/SALIRR)
Location: near the Wilderness Boundary

Classification: Aeric Fluvaquent, loamy skeletal, mixed, frigid

A1 0 to 10 cm; very dark grayish brown (10YR 3/2 crush/dry), very dark gray to very dark grayish brown (10YR 3/1.5 rub/moist); silty loam (15% clay, 80% silt); strong medium crumb; slightly sticky (wet), friable (moist); many very fine, common fine, few medium and coarse roots; common very fine, common fine, few medium and coarse pores; pH 6.2; no effervescence; wavy abrupt boundary.

B1 10 to 39 cm; dark grayish brown (10YR 4/2 crush/dry), very dark grayish brown (10YR 3/2 rub/moist); sand (3% clay, 9% silt); moderate, medium crumb; nonsticky (wet), very friable (moist); common roots of all sizes; common very fine, common fine, few medium and coarse pores; 50% gravel, 20% cobble; pH 6.6; no effervescence; smooth clear boundary.

B2 39 to 64 cm; dark grayish brown (10YR 4/2 crush/dry), to very dark grayish brown to dark brown (10YR 3/2.5 rub/moist); sand (3% clay, 6% silt); moderate, fine to medium crumb; nonsticky (wet), very friable (moist); common very fine, common fine, few medium and coarse roots; common very fine, common fine, few medium and coarse pores; 30% gravel, 40% cobble, 10% stone; pH 7.0; no effervescence; smooth clear boundary.

C1 64 to 98 cm; dark grayish brown (10YR 4/2 crush/dry), to very dark grayish brown to dark brown (10YR 3/2.5 rub/moist); sand (2% clay, 5% silt); single grain; nonsticky (wet), very friable (moist); few roots of all sizes; common very fine, common fine, few medium and coarse pores; 10% gravel, 15% cobble, 65% stone; pH 7.6; no effervescence.

Water at 98 cm.

Data Addendum 2 (continued).

Plot: 92HK013
Cross section: P8
Community Type: New Mexico alder/bluestem willow (ALNOBL/SALIRR)
Location: near the Wilderness Boundary

Classification: Typic Fluvaquent, loamy skeletal, mixed

A1 1 to 13 cm; dark gray (10YR 4/2) sandy loam, very dark gary (10YR 2.5/1) moist; weak medium crumb; very friable, non-sticky; many fine and very fine roots, 1 percent gravel; neutral (pH 7.0); smooth, abrupt boundary.

Bg1 13 to 27 cm; very dark grayish brown (10YR 3/1.5) loam; weak fine subangular blocky; friable, non-sticky; common very fine and fine roots; 1 percent gravel; slightly acid (pH 6.0); clear smooth bound.

Bg2 17 to 33 cm; very dark gray (10YR 3/1) loam; weak medium subangular blocky; friable, non-sticky; no roots; 1 percent gravel; abrupt wavy boundary.

2Cg1 33 to 55+ cm; very dark gray (10YR 3/1) stony loam; massive; no roots; 5 percent gravel, 30 percent cobbles, 40 percent stones.

Plot: 92HK014
Cross section: P1
Community Type: blue spruce/Kentucky bluegrass (PICPUN/POAPRA)
Location: near Cowles

Classification: Oxyaquic Udifluvent, coarse silty, mixed, frigid

A1 0 to 8 cm; very dark grayish brown (10YR 3/2 rub/moist); silt loam (20% clay, 70% silt); few, distinct, medium to coarse, brownish yellow to yellowish brown (10YR 5.5/8) mottles; strong, medium to coarse granular to few, fine to strong subangular blocky; sticky (wet), friable (moist); many very fine, many fine, few medium and coarse roots; common very fine, common fine, few medium and coarse pores; pH 7.8; no effervescence; smooth clear boundary.

A2 8 to 25 cm; very dark grayish brown (10YR 3/2 rub/moist); silt loam (20% clay, 70% silt); few, distinct, medium to coarse, brownish yellow to yellowish brown (10YR 5.5/8) mottles; strong, medium to coarse granular to few, fine to strong subangular blocky; sticky (wet), friable (moist); many very fine, common fine, few medium and coarse roots; common very fine, common fine, few medium and coarse pores; pH 7.8; no effervescence; smooth clear boundary.

Data Addendum 2 (continued).

Bw1 25 to 54 cm; very dark grayish brown (10YR 3/2 rub/moist); silt loam (15% clay, 55% silt); moderate, fine to medium crumb; slightly sticky (wet), very friable (moist); common very fine, common fine, few medium and coarse roots; common very fine, few fine, medium and coarse pores; pH 7.8; no effervescence; smooth gradual boundary.

Bw2 54 to 100 cm; very dark grayish brown (10YR 3/2 rub/moist); silt loam (15% clay, 55% silt); moderate, fine to medium crumb; slightly sticky (wet), very friable (moist); common very fine, few fine, medium and coarse roots; common very fine, few fine, medium and coarse pores; pH 7.8; no effervescence; smooth abrupt boundary.

2Cg1 100 to 108 cm; very dark grayish brown (10YR 3/2 rub/moist); loamy sand (5% clay, 10% silt); many, faint, medium, strong brown to reddish yellow (7.5YR 5.5/8) mottles; weak, medium crumb; nonsticky (wet), very friable (moist); few roots of all sizes; common very fine, common fine, few medium and coarse pores; 25% gravel, 50% cobble; pH 7.4; no effervescence.

A1 is dry; coarse alluvial (non-root wood) organic material common.
A2 is moist at 10 cm; coarse alluvial (non-root wood) organic material common.
Bw2 has few small (5 by 2 cm) sand pockets.

Plot: 93PD01
Cross Section: Pecos1
Community Type: blue spruce/New Mexico alder (PICPUN/ALNOBL)
Location: Tres Lagunas/La Posada, at Brush Ranch

Classification: Aeric Fluvaquent (AFA), sandy-skeletal, mixed, frigid, non-acid

Oi 0 to 1 cm; graminoid litter.

C1 0 to 20 cm; very dark gray to very dark grayish brown (10YR 3/1.5 dry); loam (12% clay), dark brown (8.75YR 3/3 rub/moist); weak fine sub-angular blocky; friable (moist) and non-sticky (wet); many very fine, many fine, common medium, and common coarse roots; common very fine, common fine, few medium, and few coarse pores; pH 7.09; no effervescence; conductivity .56 mS; clear wavy boundary.

Cg1 20 to 70 cm; dark grayish brown to very dark grayish brown (10YR 3.5/2 rub/moist); coarse sand (4% clay); single grain; loose (dry) loose (moist) and non-sticky (wet); common very fine, common fine, few medium, and few coarse roots; many very fine, common fine, few medium, and few coarse pores; gravel 12%, cobbles 65%, and stones 15%; pH 7.18; no effervescence.

Data Addendum 2 (continued).

Matrix color in C1 affected by uncoated grains.
Water at 70 cm.
Soil saturated from 35-70 cm.
Largest roots (> 1.0 cm) do not penetrate Cg1.

Plot: 93PD02
Cross Section: Pecos2
Community Type: New Mexico alder/bluestem willow (ALNOBL-SALIRR)
Location: Tres Lagunas/La Posada, at Brush Ranch

Classification: Typic Endoaquent (TEA), sandy-skeletal, mixed, frigid, nonacid

Oi 0 to 8 cm; plant parts and litter.

C1 0 to 9 cm; black (7.5YR 2.5/1); silt loam (20% clay); massive; very friable (moist) and slightly sticky (wet); many very fine, many fine, common medium, and few coarse roots; common very fine, common fine, common medium, and few coarse pores; cobbles 5%; pH 6.66; no effervescence; conductivity .40 mS; clear wavy boundary.

Cg2 9 to 12 cm; uncoated grains; sand; single grain; loose (moist) and non-sticky (wet); few very fine, few fine, few medium, and few coarse roots; common very fine, common fine, common medium, and few coarse pores; gravel and cobbles 80%.

Soil saturated throughout.
Water at 17 cm.
Oi is a moist matrix between plant parts and litter.

Plot: 93PD03
Cross Section: Pecos3
Community Type: Nebraska sedge/beaked sedge (CARNEB-CARROS)
Location: Monastery

Classification: Typic Endoaquent (TEA), sandy-skeletal, mixed, frigid, calcareous

Oe 0 to 4 cm; organic matter (willow shoots and forb/graminoid litter); clear wavy boundary.

Cg1 0 to 15 cm; very dark gray (10YR 3/1 ped/moist); silt loam (20% clay); massive; very friable (moist) and sticky (wet); many very fine, many fine, common medium, and few coarse roots; common very fine, common fine, few medium, and few coarse pores; pH 7.60; slight effervescence; conductivity .86 mS; gradual smooth boundary.

Cg2 15 to 36 cm; very dark gray (10YR 3/1 ped/moist); coarse sandy loam; common medium

Data Addendum 2 (continued).

distinct, yellowish brown (10YR 5/7), rare medium distinct, black (10YR 2/1), and few medium distinct, red (2.5YR 4/8) mottles; massive; very friable (moist) and non-sticky (wet); common very fine, common fine, few medium, and few coarse roots; common very fine, common fine, few medium, and few coarse pores; gravel 15% and cobbles 10%; pH 7.64; medium effervescence; smooth gradual boundary.

Cg3 36 to 45 cm; very dark gray (10YR 3/1 ped/moist); loamy sand (5% clay); single grain; loose (moist) and non-sticky (wet); very few roots; common very fine, common fine, few medium fine, and coarse pores; gravel 8% and cobbles 50%; pH 7.67; medium effervescence.

Water at 32 cm.
Soil saturated throughout.
Water seeping into pit at 25 cm.
Cg1 contains buried wood piece.
Cg3 matrix color affected by uncoated grains.
Woody debris on surface.

Plot: 93PD04
Cross Section: Pecos4
Community Type: coyote willow/Canada wildrye (SALEXI/ELYCAN)
Location: Los Trigos Ranch

Classification: Oxyaquic Ustifluvent (OUF), sandy over fine-silty, mixed, mesic, calcareous

Oi 0 to 2 cm; dense organic matter; clear smooth boundary.

A1 0 to 43 cm; dark yellowish brown (10YR 4/4 dry); sandy loam (15% clay), dark yellowish brown (10YR 3/4 rub/moist); medium fine sub-angular blocky; slightly hard (dry) very friable (moist) and plastic (wet); many very fine, many fine, common medium, and common coarse roots; many very fine, many fine, few medium, and few coarse pores; pH 7.71; medium effervescence; conductivity .84 mS; gradual smooth boundary.

C1 43 to 63 cm; brown (7.5YR 4/4 moist); loamy sand (10% clay); single grain; loose (dry) friable (moist) and slightly plastic (wet); common very fine, common fine, many medium, and many coarse roots; many very fine, many fine, common medium, and common coarse pores; gravel 20% and cobbles 8%; pH 7.93; medium effervescence; gradual wavy boundary.

Cg1 63 to 100 cm; dark brown (7.5YR 3/4 dry); sandy clay loam (30% clay), dark brown (7.5YR 3/3 moist); common fine distinct, black (7.5YR 2.5/1) Mn redox concentration mottles; weak medium sub-angular blocky; hard (dry) very friable (moist) and plastic (wet); common very

Data Addendum 2 (continued).

fine, common fine, many medium, and common coarse roots; common very fine, common fine, few medium, and few coarse pores; gravel 10% and cobbles 3%; pH 7.69; medium effervescence.

C1 shows animal activity (slugs, beetles, and other invertebrates).
C1 matrix color affected by uncoated grains.
Soil saturated at 100 cm, no standing water.

Plot: 93PD05
Cross Section: Pecos5
Community Type: coyote willow/Canada wildrye (SALEXI/ELYCAN)
Location: Forked Lightening Ranch

Classification: Oxyaquic Ustifluvent (OUF), coarse-loamy over sandy-skeletal, mixed, mesic, calcareous

C1 0 to 15 cm; yellowish brown (10YR 5/4 dry); loamy sand (3% clay), brown (10YR 4/3 rub/moist); weak fine crumb; loose (dry) friable (moist) and non-sticky (wet); many very fine, many fine, common medium, and common coarse roots; common very fine, common fine, few medium, and few coarse pores; gravel 5%; pH 7.55; medium effervescence; conductivity .56 mS; gradual wavy boundary.

C2 15 to 50 cm; brown (10YR 4/3 dry); sandy loam (10% clay), dark yellowish brown (10YR 3/4 rub/moist); few medium faint, brown (7.5YR 4/4) mottles; massive; slightly hard (dry) friable (moist) and plastic (wet); common very fine, many fine, common medium, and common coarse roots; few very fine, many fine, common medium, and common coarse pores; gravel 10%; pH 7.51; medium effervescence; gradual smooth boundary.

C3 50 to 80 cm; brown to dark brown (7.5YR 3.5/4 moist); coarse to medium sand (3% clay); single grain; loose (moist) and non-sticky (wet); common very fine, many fine, common medium, and common coarse roots; common very fine, common fine, few medium, and few coarse pores; gravel 55%, cobble 20%, and stones 5%; pH 7.55; medium effervescence.

Water at 76 cm.
Earthworms common in C2.
Sand pockets common in C2.
Large pieces of driftwood found on surface of pit.

Plot: 93PD06
Cross Section: Pecos6
Community Type: emoryi sedge/field horsetail (CAREMO/EQUARV)

Data Addendum 2 (continued).

Location: Pecos River Learning Center

Classification: Oxyaquic Ustifluvent (OUF), coarse-loamy over sandy-skeletal, mixed, mesic, calcareous

Oe 0 to 2 cm; organic matter: roots of sedges and other graminoids.

C1 0 to 21 cm; dark yellowish brown (10YR 4/4 dry); sandy loam (4% clay), dark brown (10YR 3/3 moist); weak fine crumb; loose (dry) friable (moist) and slightly plastic (wet); many very fine, common fine, few medium, and few coarse roots; few very fine, many fine, few common, and few coarse pores; gravel 5%; pH 7.70; medium effervescence; conductivity 1.14 mS; gradual wavy boundary.

C2 21 to 71 cm; brown (7.5YR 5/4 dry); sandy loam (8% clay), dark brown (7.5YR 3/4 moist); common medium faint, dark yellowish brown (7.5YR 4/6) Fe redox concentration mottles; massive; slightly hard (dry) friable (moist) and slightly plastic (wet); common very fine, many fine, many medium, and few coarse roots; few very fine, common fine, common medium, and few coarse pores; gravel 10%; pH 7.66; medium effervescence; clear smooth boundary.

C3 71 to 97 cm; brown (7.5YR 5/4 dry); coarse sand (3% clay), dark brown (7.5YR 3/4 moist); single grain; loose (dry) loose (moist) and non-plastic; common very fine, many fine, many medium, and few coarse roots; few very fine, many fine, few medium, and few coarse pores; gravel 30%, cobbles 35%, and stones 5%; pH 7.70; medium effervescence.

Organic matter abundant in C1.
Live earthworms in C2.
Sand pockets common between 10 and 50 cm.
Water at 96 cm.

Plot: 93PD07
Cross Section: Pecos4
Community Type: coyote willow/Canada wildrye (SALEXI/ELYCAN)
Location: Los Trigos Ranch

Classification: Typic Ustifluvent (TUF), coarse-loamy over sandy-skeletal, mixed, mesic, calcareous

Data Addendum 2 (continued).

C1 0 to 11 cm; yellowish brown to light yellowish brown (10YR 5.5/4 moist); fine sand; (3% clay); single grain; loose (dry) loose (moist) and non-plastic (wet); many very fine, many fine, common medium, and common coarse roots; few very fine, many fine, many medium, and few coarse pores; gravel 7%; pH 7.75; medium effervescence; conductivity .21 mS; gradual wavy boundary.

C2 11 to 45 cm; dark yellowish brown (10YR 3/4 dry); sandy loam, (15% clay) very dark grayish brown (10YR 3/2 moist); weak fine sub-angular blocky; hard (dry) friable (moist) and slightly sticky (wet); common very fine, many fine, many medium, and common coarse roots; few very fine, common fine, common medium, and common coarse pores; gravel 3%; pH 7.70; medium effervescence; conductivity .38 mS; diffuse wavy boundary.

C3 45 to 99 cm; brownish yellow (10YR 6/6 dry); medium sand (3% clay), yellowish brown (10YR 5/5 moist); single grain; loose (dry) loose (moist) and non-plastic (wet); few very fine, common fine, few medium, and few coarse roots; few very fine, many fine, few medium, and few coarse pores; gravel 60% and cobble 15%; pH 7.80; medium effervescence.

Surface of pit mostly bare ground.
Uncoated grains affect matrix color in C3.
Ant pores common in C2.

Plot: 93PD08
Cross Section: Pecos7
Community Type: Nebraska sedge-beaked sedge (CARNEB-CARROS)
Location: Tres Lagunas/La Posada

Classification: Aeric Endoaquent (AEA), coarse-silty over sandy-skeletal, mixed, frigid, nonacid

Cg1 0 to 33 cm; very dark grayish brown (10YR 3/2 moist); silt loam (15% clay); massive; hard (dry) very friable (moist) and sticky (wet); many roots of all sizes; common very fine, common fine, few medium, and few coarse pores; gravel 8% and cobble 3%; pH 7.62; medium effervescence; conductivity .86 mS; gradual wavy boundary.

Cg2 33 to 58 cm; very dark brown (10YR 2/2 moist); loamy sand (4% clay); many medium prominent, strong brown (7.5YR 5/8) Fe redox concentration mottles; single grain; loose (dry) loose (moist) and non-sticky (wet); roots of all sizes common; few very fine, common fine, common medium, and few coarse pores; gravel 65% and cobbles 15%; pH 6.91; no effervescence.

Data Addendum 2 (continued).

Live earthworms in Cg1.
Water at 50 cm.
Water seeping in through sides of pit at 47 cm.
3 to 4 cm sized wood pieces found in C1.

Plot: 93PD09
Cross Section: Pecos7
Community Type: narrowleaf cottonwood/Kentucky bluegrass (POPANG/POAPRA)
Location: Tres Lagunas/La Posada

Classification: Mollic Udifluvent (MUF), sandy-skeletal, mixed, frigid, nonacid

A1 0 to 22 cm; very dark grayish brown (10YR 3/2 dry); sandy loam (6% clay), very dark gray (10YR 3/1 moist); weak fine crumb; loose (dry) friable (moist) and slightly plastic (wet); many roots of all sizes; few very fine, many fine, many medium, and few coarse pores; gravel 5%, cobbles 15%, and stones 5%; pH 6.53; no effervescence; conductivity .48 mS; gradual wavy boundary.

C1 22 to 97 cm; yellowish brown to dark yellowish brown (10YR 4.5/6 dry); coarse sand (3% clay), dark yellowish brown (10YR 3.5/4 moist); single grain; loose (dry) loose (moist) and non-plastic (wet); common very fine, common fine, common medium, and few coarse roots; few very fine, many fine, common medium, and few coarse pores; gravel 35%, cobbles 40%, and stones 5%; pH 7.14; no effervescence; clear wavy boundary.

Cg1 97 to 135 cm; dark gray to very dark gray (10YR 3.5/1 dry); silt loam (10% clay), black (10YR 2/1 moist); massive; soft (dry) very friable (moist) and sticky (wet); few very fine, common fine, many medium, and few coarse roots; common very fine, common fine, few medium, and few coarse pores; cobbles 5%; pH 6.83; no effervescence.

Uncoated grains affect the matrix color of C1.
Cg1 is saturated but no standing water found.

Plot: 93PD10
Cross Section: Pecos8
Community Type: coyote willow/Canada wildrye (SALEXI/ELYCAN)
Location: Los Trigos Ranch

Classification: Oxyaquic Ustifluvent (OUF), sandy-skeletal, mixed, mesic, calcareous

C1 0 to 15 cm; dark brown (10YR 3/3 moist); sandy loam (10% clay); common medium distinct,

Data Addendum 2 (continued).

reddish brown (5YR 4/4) Fe redox concentration mottles; massive; slightly hard (dry) friable (moist) and sticky (wet); many very fine, many fine, common medium, and common coarse roots; few very fine, many fine, common medium, and few coarse pores; gravel 5% and cobbles 15%; pH 7.71; medium effervescence; conductivity .51 mS; diffuse wavy boundary.

C2 15 to 86 cm; dark yellowish brown (10YR 3.5/4 moist); coarse sand (5% clay); single grain; loose (dry) loose (moist) non-sticky (wet); many very fine, common fine, common medium, and few coarse roots; few very fine, common fine, common medium, and few coarse pores; gravel 40%, cobbles 35%, and stones 15%; pH 7.78; medium effervescence.

Water at 82 cm.
Large boulder on side bar near soil pit.
Large chunks of driftwood on side bar.
Very fine roots to 20 cm.
Uncoated grains in C2 affect matrix color.
Ant activity common in C1.

Plot: 93PD11
Cross Section: Pecos9
Community Type: narrowleaf cottonwood/coyote willow (POPANG/SALEXI)
Location: La Posada

Classification: Oxyaquic Udifluvent (OUF), coarse-loamy over sandy-skeletal, mixed, frigid, calcareous

A1 0 to 58 cm; dark yellowish brown (10YR 4/4 dry); sandy loam (8% clay), very dark grayish brown (10YR 3/2 moist); few fine distinct, dark yellowish brown (10YR 4/6) Fe redox concentration mottles; weak fine sub-angular blocky; slightly hard (dry) very friable (moist) and slightly sticky (wet); many very fine, many fine, common medium, and few coarse roots; common very fine, many fine, few medium, and few coarse pores; gravel 3% and cobbles 5%; pH 7.34; medium effervescence; conductivity .60 mS; diffuse broken boundary.

C1 58 to 90 cm; dark grayish brown (10YR 4/2 dry); sand (4% clay), brown to dark brown (10YR 3.5/3 moist); single grain; loose (dry) loose (dry) and non-plastic (wet); many very fine, many fine, common medium, and common coarse roots; few very fine, few fine, many medium, and few coarse pores; gravel 60% and cobbles 10%; pH 7.51; medium effervescence.

Water at 86 cm.
Lots of bare ground in area of soil pit.
Live earthworms in A1.
All of roots in C1 occur in upper 10 cm of horizon.
Uncoated grains affect matrix color of C1.

Data Addendum 2 (continued).

Plot: 93PD12
Cross Section: Cow Creek1
Community Type: box elder/coyote willow (ACENEG/SALEXI)
Location: Lower Colonias; south of Bull Creek confluence

Classification: Typic Ustifluvent (TUF), coarse-loamy, mixed, frigid, calcareous

Oe 0 to 3 cm; graminoid and willow litter.

A1 0 to 10 cm; dark brown (10YR 3/3 dry); sandy loam (10% clay), dark grayish brown (10YR 4/2 moist); weak fine sub-angular blocky; slightly hard (dry) very friable (moist) and slightly sticky (wet); many very fine, many fine, common medium, and common coarse roots; common very fine, common fine, common medium, and few coarse pores; trace of gravel; pH 7.61; medium effervescence; conductivity 1.05 mS; gradual wavy boundary.

C1 10 to 41 cm; yellowish brown (10YR 5/4 dry); sandy loam (6% clay), brown (10YR 3/2 moist); many fine distinct, yellowish brown (10YR 5/8) Fe redox concentration mottles; weak fine-medium sub-angular blocky; soft (dry) friable (moist) slightly sticky (wet); common roots of all sizes; few very fine, common fine, many medium, few coarse pores; trace of gravel; pH 7.84; medium effervescence; diffuse wavy boundary.

C2 41 to 150 cm; dark yellowish brown (10YR 4/4 dry); silt loam (12% clay), very dark grayish brown (10YR 3/2 moist); many fine distinct, strong brown (7.5YR 5/8) Fe redox concentration mottles; massive; slightly hard (dry) friable (moist) and sticky (wet); common very fine, common fine, few medium, few coarse roots; common very fine, many fine, few medium, and few coarse pores; trace of gravel; pH 7.75; medium effervescence.

Strong striation found in C2 due to heavy ant activity.
Many fine and very fine roots found at boundary of AG and C1.

Plot: 93PD13
Cross Section: Pecos10
Community Type: box elder/coyote willow (ACENEG/SALEXI)
Location: near San Miguel Pueblo

Classification: Mollic Ustifluvent (MUF), coarse-loamy, mixed, mesic, calcareous

Ap 0 to 23 cm; dark reddish brown (5YR 3/3 moist); sandy loam (10% clay), reddish brown (5YR 4/4 dry); fine weak sub-angular blocky; soft (dry) friable (moist) and slightly sticky (wet); many roots of all sizes; common very fine, common fine, few medium, and few coarse pores; trace of gravel; pH 7.76; medium effervescence; conductivity .51 mS; gradual wavy

Data Addendum 2 (continued).

boundary.

C1 23 to 33 cm; reddish brown (5YR 5/4 dry); medium sand; single grain; loose (dry) loose (moist) and non-plastic (wet); many roots of all sizes; few very fine, many fine , few medium, and few coarse pores; gravel 10% and cobbles 3%; pH 7.86; medium effervescence.

C2 33 to 53 cm; yellowish red (5YR 4/6 dry); sandy loam (12% clay), reddish brown (5YR 4/4 moist); fine weak sub-angular blocky; soft (dry) very friable (moist) and slightly sticky (wet); many very fine, many fine, common medium, and common coarse roots; common very fine, many fine, few medium, and few coarse pores; pH 8.03; medium effervescence; gradual wavy boundary.

C3 53 to 102; brown (7.5YR 4/4 dry); silt loam (8% clay), brown (7.5YR 4/3 moist); common fine faint, brown (7.5YR 4/4) mottles; massive, slightly hard (dry) very friable (moist) and plastic (wet); few very fine, common fine, many medium, and common coarse roots; common very fine, common fine, few medium, and few coarse pores; pH 7.86; medium effervescence; irregular wavy boundary.

C4 102 to 120 cm; brown (7.5YR 4/4 dry); loamy sand (5% clay), dark reddish brown (5YR 3/3 moist); single grain; loose (dry) loose (moist) slightly plastic (wet); few roots; few very fine, many fine, common medium, and few coarse pores; gravel 23% and cobble 5%; pH 7.88; medium effervescence.

Uncoated grains in C5 affect matrix color.
Ant pores common in C1 and C3.

Plot: 93PD14
Cross Section: Pecos10
Community Type: coyote willow/Canada wildrye (SALEXI/ELYCAN)
Location: near San Miguel Pueblo

Classification: Aeric Fluvaquent (AFA), coarse-loamy over sandy, mixed, mesic, calcareous

Oi 0 to 3 cm; willow and graminoid litter; gradual wavy boundary.

C1 0 to 27 cm; dark reddish brown to reddish brown (5YR 3.5/3 moist); silt loam (22% clay); many medium faint, yellowish red (5YR 4/6) Fe redox concentration mottles; massive; very hard (dry) very friable (moist) and plastic (wet); common very fine, common fine, many medium, and many coarse roots; many very fine, many fine, few medium, and few coarse pores; pH 7.66; medium effervescence; conductivity .48 mS; gradual wavy boundary.

Data Addendum 2 (continued).

C2 27 to 57 cm; dark reddish brown (5YR 3/2 ped/moist); silt loam (13% clay), reddish brown (5YR 4/3 rub/moist); many coarse distinct, reddish brown (5YR 4/4) mottles; massive; hard (dry) very friable (moist) sticky (wet); common very fine, common fine, many medium, and many coarse roots; few very fine, common fine, few medium, and few coarse pores; pH 7.72; medium effervescence; gradual wavy boundary.

C3 57 to 88 cm; dark brown to dark yellowish brown (10YR 3/3.5 moist); loamy sand (4% clay); common medium distinct, strong brown (7.5YR 5/6) Fe redox concentration mottles; single grain; loose (dry) friable (moist) and slightly sticky (wet); few roots; few very fine, common fine, few medium, and few coarse pores; traces of gravel and pH 7.78; medium effervescence.

Water at 89 cm.
Uncoated grains affect matrix color of C3.
Striations in C1 and C2 maybe due to ant activity.

Plot: 93PD15
Cross Section: Pecos11
Community Type: Fremont cottonwood/coyote willow (POPFRE/SALEXI)
Location: Sena

Classification: Typic Ustifluvent (TUF), sandy-skeletal, mixed, mesic, calcareous

Oi 0 to 3 cm; mostly cottonwood leaf litter; gradual wavy boundary.

C1 0 to 20 cm; reddish brown (5YR 4/4 dry); loam (13% clay), dark reddish brown (5YR 3/3 moist); common fine distinct, yellowish red (5YR 4/6) mottles; weak medium sub-angular blocky; slightly hard (dry) very friable (moist) and sticky (wet); many very fine, many fine, common medium, and common coarse roots; few very fine, many fine, few medium, and few coarse pores; gravel 5%; pH 7.53; medium effervescence; conductivity .56 mS; gradual wavy boundary.

C2 20 to 60 cm; yellowish brown to yellowish red (5YR 4/5 dry); coarse sand (4% clay), reddish brown to dark reddish brown (5YR 3.5/4 moist); single grain; loose (dry) loose (moist) and slightly sticky (wet); common very fine, few fine, common medium, and many coarse roots; few very fine, common fine, many medium, and few coarse pores; gravel 40% and cobbles 10%; pH 7.52; medium effervescence; clear smooth boundary.

C3 60 to 65 cm; dark reddish brown (5YR 3/3 dry); sandy loam (10% clay), dark brown (7.5 YR 3/3 moist); many medium prominent, yellowish red (5YR 4/6) Fe redox concentration mottles; massive; soft (dry) very friable (moist) and sticky (wet); common very fine, few fine,

Data Addendum 2 (continued).

common medium, and many coarse roots; few very fine, many fine, common medium, and few coarse pores; gravel 5%; pH 7.65; medium effervescence; broken smooth boundary.

C4 65 to 106 cm; brown to strong brown (7.5YR 4/5 dry); loamy sand (6% clay), dark brown (7.5YR 3/3.5 moist); single grain; loose (dry) loose (dry) and slightly sticky (wet); few very fine, few fine, common medium, and common coarse roots; common very fine, common fine, many medium, and many coarse pores; gravel 20%, cobbles 15%, and stones 5%; pH 7.72; medium effervescence.

Uncoated grains in C2 and C4 affect matrix color.
Ant activity in C1.

Plot: 93PD16
Cross Section: Pecos16
Community Type: coyote willow/Canada wildrye (SALEXI/ELYCAN)
Location: Sena

Classification: Typic Ustifluvent (TUF), sandy-skeletal, mixed, mesic, calcareous

C1 0 to 15 cm; reddish brown (5YR 5/4 dry); sandy loam (5% clay), reddish brown (5YR 4/3 moist); common medium prominent, yellowish red (5YR 5/6) mottles; single grain; soft/loose (dry) friable (moist) and slightly plastic (wet); common very fine, few fine, few medium, and few coarse roots; few very fine, many fine, few medium, and common coarse pores; gravel 5% and cobbles 15%; pH 7.66; medium effervescence; conductivity .32 mS; gradual wavy boundary.

C2 15 to 89 cm; reddish brown (5YR 4.5/4 dry); sandy loam (8% clay), reddish brown (5YR 4/3 moist); weak fine sub-angular blocky; slightly hard (dry) friable (moist) and sightly plastic (wet); common very fine, many fine, many medium, and common coarse roots; few very fine, common fine, few medium, and few coarse pores; gravel 20%, cobbles 15%, and stones 20%; pH 7.70; medium effervescence.

Large pieces of driftwood found on surface of bar.

Plot: 93PD17
Cross Section: Pecos17
Community Type: Fremont cottonwood/coyote willow (POPFRE/SALEXI)
Location: Lovato

Classification: Oxyaquic Ustifluvent (OUF), coarse-loamy over sandy-skeletal, mixed, mesic, calcareous

Data Addendum 2 (continued).

Oi 0 to 3; litter layer: cottonwood leaves and old graminoid stems.

A1 0 to 38 cm; dark reddish brown (5YR 3/3 moist); silt loam (10% clay); weak fine sub-angular blocky; hard (dry) very friable (moist) and sticky (wet); common very fine, common fine, common medium, and few coarse roots; common very fine, many fine, few medium, and few coarse pores; pH 7.83; medium effervescence; conductivity .69 mS; clear smooth boundary.

C1 38 to 48 cm; yellowish red (5YR 5/6 ped/moist); sandy loam (12% clay), reddish brown (5YR 4/4 rub/moist); common medium distinct, yellowish brown (10YR 5/8), common fine distinct, very dark grayish brown (10YR 3/2) Mn redox concentration, and many coarse distinct, yellowish red (5YR 4/6) Fe redox concentration mottles; single grain; soft (dry) friable (moist) and slightly plastic (wet); few very fine, few fine, common medium, and common coarse roots; common very fine, many fine, common medium, and few coarse; gravel 5%; pH 7.76; medium effervescence; gradual wavy boundary.

C2 48 to 99 cm; brown (7.5YR 4/4 moist); loamy sand (4% clay); single grain; loose (dry) loose (moist) slightly sticky (wet); common very fine, many fine, common medium, and few coarse roots; few very fine, many fine, many medium, and few coarse pores; gravel 25% and cobbles 15%; pH 7.84; medium effervescence.

Water at 100 cm.

Plot: 93PD18
Cross Section: Pecos9
Community Type: narrowleaf cottonwood/coyote willow (POPANG/SALEXI)
Location: La Posada

Classification: Oxyaquic Udifluvent (OUF), coarse-loamy over sandy-skeletal, mixed, frigid, nonacid

A1 0 to 52 cm; very dark grayish brown (10YR 3/2 moist); sandy loam (10% clay); very weak fine sub-angular blocky; slightly hard (dry) very friable (moist) and slightly sticky (wet); many very fine, many fine, common medium, and common coarse roots; common very fine, common fine, few medium, and few coarse; common very fine, common fine, few medium, and few coarse pores; pH 7.50; no effervescence; conductivity .42 mS; diffuse wavy boundary.

C1 52 to 77 cm; brown to dark yellowish brown (10YR 4/3.5 ped/moist); loamy sand (8% clay), brown (10YR 4/3 rub/moist); many medium prominent, yellowish red (5YR 4/6) Fe redox

Data Addendum 2 (continued).

concentration mottles; single grain; loose (dry) slightly friable (moist) and non-plastic (wet); few very fine, common fine, many medium, and many coarse roots; few very fine, many fine, common medium, and common coarse pores; trace of gravel; pH 7.30; no effervescence; gradual wavy boundary.

C2 77 to 93 cm; dark grayish brown to very dark grayish brown (10YR 3.5/2 moist); loamy sand (5% clay); single grain; loose (dry) loose (moist) and non-plastic (wet); few very fine, common fine, many medium, and many coarse roots; few very fine, few fine, common medium, and common coarse pores; gravel 55%, cobble 15%, and a trace of boulders; pH 7.31; no effervescence.

Water at 93 cm.
Uncoated grains in C1 and C2 affect matrix color.
Live earthworms found throughout pit.

Plot: 93PD19
Cross Section: Pecos9
Community Type: narrowleaf cottonwood/coyote willow (POPANG/SALEXI)
Location: La Posada

Classification: Oxyaquic Udifluvent (OUF), sandy-skeletal, mixed, frigid, nonacid

A1 0 to 25 cm; very dark gray to dark brown (7.5YR 3/1.5 moist); sandy loam (10% clay); weak fine sub-angular blocky; slightly hard (dry) friable (moist) and slightly sticky (wet); many very fine, many fine, common medium, and common coarse roots; common very fine, many fine, few medium, and few coarse pores; traces of gravel and cobbles; pH 7.19; no effervescence; conductivity .52 mS; gradual wavy boundary.

C1 25 to 59 cm; brown to dark yellowish brown (10YR 4/3.5 ped/moist); loamy sand (5% clay), very dark grayish brown (10YR 3/2 rub/moist); single grain; loose (dry) loose (moist) and non-plastic (wet); common very fine, many fine, many medium, and many coarse roots; few very fine, many fine, many medium, and few coarse pores; traces of gravel and cobbles; pH 7.17; no effervescence; clear smooth boundary.

C2 59 to 137 cm; dark brown (10YR 3/3 moist); loamy sand (4% clay); single grain; loose (dry) loose (moist) and non-plastic (wet); few very fine, few fine, common medium, and many coarse roots; few very fine, many fine, many medium, and few coarse pores; gravel 40% and cobbles 15%; pH 7.29; no effervescence.

Live earthworms and other invertebrates found in A1 and C1.
Water at 132 cm.
Uncoated grains in C1 and C2 affect matrix color.

Data Addendum 2 (continued).

Plot: 93PD20
Cross Section: Gallinas1
Community Type: New Mexico alder/Canada reedgrass (ALNOBL/CALCAN)
Location: Calf Canyon

Classification: Mollic Endoaquent (MEA), coarse-loamy, mixed, frigid, acid

Ag1 0 to 20 cm; black (2.5Y 2.5/1 moist); silt loam (20% clay); common fine prominent, yellowish brown (10YR 5/8) Fe redox concentration mottles; massive; hard (dry) very friable (moist) and very sticky (wet); many very fine, many fine, many medium, and common coarse roots; few very fine, many fine, common medium, and few coarse pores; trace of gravel; pH 4.76; no effervescence; conductivity .30 mS; gradual wavy boundary.

Cg1 20 to 50 cm; dark olive brown (2.5YR 3/3 moist); loamy sand (8% clay); common coarse prominent, dark yellowish brown (10YR 4/6) mottles; massive; slightly hard (dry) friable (moist) and slightly plastic (wet); common very fine, common fine, many medium, and many coarse roots; few very fine, many fine, many medium, and few coarse pores; gravel 15%; pH 4.28; no effervescence.

Pit saturated throughout.
Water at 47 cm.
Uncoated grains in Cg2 affect matrix color.

Plot: 93PD21
Cross Section: Gallinas1
Community Type: New Mexico alder/Canada reedgrass (ALNOBL/CALCAN)
Location: Calf Canyon

Classification: Mollic Endoaquent (MEA), fine-loamy over sandy-skeletal, mixed, frigid, nonacid

Oe 0 to 2 cm; organic matter; clear wavy boundary.

Ag1 0 to 53 cm; black (10YR 2/1 moist); silt loam (18% clay); few fine distinct, dark yellowish brown (10YR 3/4) Fe redox concentration mottles; massive; slightly hard (dry) friable (moist) and sticky (wet); common very fine, common fine, many medium, and many coarse roots; common very fine, common fine, few medium, and few coarse pores; trace of gravel, cobble, and stone; pH 5.35; no effervescence; conductivity .40 mS; clear smooth boundary.

Cg1 53 to 67 cm; dark brown (10YR 3/3 moist); coarse sand; common medium distinct, yellowish

Data Addendum 2 (continued).

red (5YR 5/6) Fe redox concentration mottles; single grain; loose (dry) loose (moist) and non-plastic (wet); few roots; few very fine, common fine, common medium, and few coarse pores; gravel 30%, cobble 15%, and stones 15%; pH 5.17; no effervescence.

Uncoated grains in Cg2 affect matrix color.
Water at 65 cm
Water seeped in through sides of pit.
Buried stick in Cg1.

Plot: 93PD22
Cross Section: Gallinas2
Community Type: reed canarygrass-fowl mannagrass (PHAARU-GLYSTR)
Location: Camp Long

Classification: Mollic Endoaquent (MEA), fine-loamy, mixed frigid, acid

Ag1 0 to 39 cm; very dark brown (10YR 2/2 ped/moist); silt loam (20% clay), black (10YR 2/1 rub/moist); common fine distinct, yellowish brown (10YR 5/8) Fe redox concentration mottles; massive; soft (dry) very friable (moist) and sticky (wet); many very fine, many fine, common medium, and few coarse roots; common very fine, common fine, few medium, and few coarse pores; pH 5.34; no effervescence; conductivity .42 mS; clear wavy boundary.

ACg1 39 to 54 cm; very dark gray (10YR 3/1 ped/moist); sandy loam (5% clay), black (10YR 2/1 rub/moist); massive; soft (dry) friable (moist) and slightly plastic (wet); common very fine, common fine, few fine, and few coarse roots; few very fine, common fine, common medium, and few coarse pores; gravel 3%; pH 4.51; no effervescence.

Uncoated grains in Cg2 affect matrix color.
Water at 40 cm.
Water seeped through sides of pit and leveled off at 33 cm.
Soil saturated throughout.
Cg1 layer contains large amounts of organic matter.

Plot: 93PD23
Cross Section: Gallinas3
Community Type: narrowleaf cottonwood/coyote willow (POPANG/SALEXI)
Location: Las Vegas

Classification: Aeric Fluvaquent (AFA), coarse-loamy over sandy-skeletal, mixed, frigid, nonacid

A1 0 to 10 cm; very dark grayish brown (10YR 3/2 moist); silt loam (15% clay); weak fine sub-

Data Addendum 2 (continued).

angular blocky; soft (dry) friable (moist) and plastic (wet); common very fine, many fine, many medium, and coarse common roots; common very fine, common fine, few medium, and few coarse pores; traces of gravel; pH 7.50; medium effervescence; conductivity 3.84 mS; diffuse irregular boundary.

C1 10 to 40 cm; brown to dark yellowish brown (10YR 4/3.5 ped/moist); sandy loam (12% clay); many coarse distinct, dark red (2.5YR 3/6) Fe redox concentration mottles; soft (dry) friable (moist) and plastic (wet); common very fine, common fine, many medium, and few coarse roots; common pores; gravel 8%; pH 7.60; medium effervescence; conductivity 2.12 mS; clear wavy boundary.

Cg1 40 to 45; very dark gray (10YR 3/1 moist); silty clay loam (27% clay); many coarse distinct, black (10YR 2/1) mottles; massive; very hard (dry) very friable (moist) and very plastic (wet); few very fine, common fine, many medium, and few coarse roots; common very fine, common very fine, common fine, few medium, and few coarse pores; gravel 5%; pH 7.50; medium effervescence; clear gradual boundary.

C2 45 to 54 cm; very dark grayish brown (10YR 3/2 moist); coarse sand (3% clay); single grain; loose (dry) loose (moist) non-plastic (wet); few roots; few very fine, common fine, many medium, and common coarse pores; gravel 55% and cobbles 15%; pH 7.65; no effervescence.

Standing water at 50 cm.
C2 is saturated.
Uncoated grains in C2 affects the matrix color.

Plot: 93PD24
Cross Section: Gallinas3
Community Type: narrowleaf cottonwood/coyote willow (POPANG/SALEXI)
Location: Las Vegas

Classification: Aeric Fluvaquent (AFA), coarse-loamy over sandy-skeletal, mixed, frigid, nonacid

C1 0 to 23 cm; very dark grayish brown (10YR 3/2 moist); silt loam (15% clay); many medium faint, brown (10YR 4/3) mottles; massive; hard (dry) very friable (moist) and plastic (wet); many very fine, many fine, many medium, and common coarse roots; few very fine, common fine, few medium, and few coarse pores; pH 7.51; medium effervescence; conductivity 4.96 mS; clear wavy boundary.

C2 23 to 34 cm; very dark gray (10YR 3/1 ped/moist); sandy loam (8% clay), dark gray to very dark gray (10YR 3.5/1 rub/moist); common medium distinct, red (2.5YR 4/6) mottles; massive;

Data Addendum 2 (continued).

hard (dry) friable (moist) and slightly sticky (wet); many roots; few very fine, many fine, common medium, and common coarse pores; gravel 5%; pH 7.56; medium effervescence; clear wavy boundary.

C3 34 to 51 cm; very dark grayish brown (10YR 3/2 ped/moist); gravelly coarse sand (3% clay), brown to dark yellowish brown (10YR 4/3.5 rub/moist); single grain; loose (dry) loose (moist) and non-plastic (wet); many very fine, many fine, few medium, and few coarse roots; few very fine, common fine, common medium, and few coarse pores; gravel 55%, cobbles 15%, and a trace of stones; pH 7.70; no effervescence.

Water at 49 cm.
Earthworm activity in C1.
Strong striations in C1.
C3 is saturated throughout.
Sand lens in C2 is brown (10YR 4/3).

Plot: 93PD25
Cross Section: Box Canyon1
Community Type: wire rush-field clustered sedge (JUNBAL-CARPRA)
Location: Las Vegas National Wildlife Refuge

Classification: Mollic Endoaquent (MEA), coarse-loamy, mixed, frigid, nonacid

Oe 0 to 2 cm; litter layer; gradual wavy boundary.

Cg1 0 to 92 cm; black (2.5Y 2.5/1 ped/moist); sandy loam (6% clay), black (10YR 2/1 rub/moist); common very fine distinct, light red (2.5YR 6/8) Fe redox concentration mottles; massive; common very fine prominent brown (7.5YR 4/6), common very fine prominent light gray (7.5 YR 7/1) mottles; massive; soft (dry) friable (wet) and slightly plastic (wet); many very fine, many fine, few medium, and few coarse roots; few very fine, common fine, common medium, and few coarse pores; gravel 5%, cobble 5%, and stones 5%; pH 7.34; no effervescence; conductivity 4.35 mS; gradual wavy boundary.
Cg2 92 to 94 cm; dark gray to very dark gray (10YR 3.5/1 moist); sandy loam; massive; very hard (dry) friable (moist) and sticky (wet); few roots; few very fine, common fine, common medium, and common coarse pores; gravel 20%, cobbles 15%, stones 55%, and traces of boulders; pH 7.33; no effervescence.

Data Addendum 2 (continued).

Water at 94 cm.
Upper 10 cm in Cg1 contains most of roots in horizon.
Cg2 is saturated.
Cg1 contains ant burrows.

Plot: 93PD26
Cross Section: Box Canyon1
Community Type: Fremont cottonwood/coyote willow (POPFRE/SALEXI)
Location: Las Vegas National Wildlife Refuge

Classification: Typic Endoaquent (TEA), fine-loamy, over sandy-skeletal, mixed, frigid, calcareous

Cg1 0 to 33 cm; very dark gray to dark gray (10YR 3.5/1 moist); silt loam (20% clay); many fine prominent, strong brown (7.5YR 4/6) Fe redox concentration and common medium faint, gray (10YR 5/1) mottles; massive; very hard (dry) very friable (moist) and sticky (wet); many very fine, many fine, common medium, and few coarse roots; common very fine, common fine, few medium and few coarse pores; trace of gravel and cobble; pH 7.58; medium effervescence; conductivity 2.10 mS; clear smooth boundary.

Cg2 33 to 44 cm; grayish brown (10YR 5/2 dry); loamy sand (8% clay); dark grayish brown (10YR 4/2 moist); single grain; soft (dry) friable to loose (moist) and non-plastic; few roots; few very fine, few fine, common medium, and common coarse pores; gravel 30% and cobble 10%; pH 7.64; medium effervescence.

Water at 32 cm.
Water seeped into sides of pit; Cg2 entirely under water after a few minutes.
Final water height is 21 cm.

Plot: 93PD27
Cross Section: Pecos13
Community Type: Fremont cottonwood/alkali sacaton (POPFRE/SPOAIR)
Location: south of Santa Rosa Dam

Classification: Typic Ustifluvent (TUF), coarse-loamy, mixed, mesic, calcareous

C1 0 to 30 cm; brown (7.5YR 4/4 dry); silt loam (5% clay), brown to dark brown (7.5YR 3.5/4 moist); many fine prominent, light brown (7.5YR 6/4) mottles; very weak fine sub-angular blocky; soft (dry) friable (moist) and slightly sticky (wet); common very fine, common fine, common medium, and few coarse roots; few very fine, common fine, common medium, and few coarse roots; pH 8.28; medium effervescence; conductivity 3.80 mS; broken irregular

Data Addendum 2 (continued).

boundary.

C2 30 to 52 cm; brown (7.5YR 5/4 dry); silt loam (5% clay), dark brown (7.5YR 3/4) moist; many fine prominent, light brown (7.5YR 6/4) mottles; weak medium sub-angular blocky; soft (dry) friable (moist) and slightly sticky (wet); common very fine, common fine, common medium, and few coarse roots; few very fine, common fine, common medium, and few coarse pores; pH 7.93; medium effervescence; gradual wavy boundary.

C3 52 to 99 cm; brown (7.5YR 4/4 dry); silt loam (5% clay), brown to dark brown (7.5YR 3.5/4 moist); many fine prominent, very weak fine sub-angular blocky; soft (dry) friable (moist) and slightly sticky (wet); common very fine, common fine, few medium, and few coarse roots; few very fine, common fine, common medium, and few coarse roots; pH 8.28; medium effervescence; broken irregular boundary.

C4 99 to 143 cm; brown (7.5YR 4/3 ped/moist); sandy loam (12% clay), dark brown (7.5YR 3/3 rub/moist); many fine prominent, pink to light brown (7.5YR 6.5/3) mottles; weak fine sub-angular blocky; few very fine, few fine, common medium, common, and common coarse roots; common very fine, common fine, few medium, and few coarse pores; pH 8.43; medium effervescence; gradual wavy boundary.

C5 > 143 cm; gravel and cobble layer.
Ant activity common in upper horizons.

Plot: 93PD28
Cross Section: Pecos13
Community Type: threesquare-knotgrass (SCIAME-PASDIS)
Location: south of Santa Rosa Dam

Classification: Sulfic Fluvaquent (SFA), coarse-loamy, mixed, mesic, calcareous

A1 0 to 10 cm; brown (7.5YR 4/3 moist); silt loam (20% clay); massive; hard (dry) very friable (moist) and plastic (wet); common very fine, many fine, few medium, and few coarse roots; common very fine, common fine, few medium, and few coarse pores; pH 7.38; medium effervescence; conductivity 2.04 mS; gradual wavy boundary.

C1 10 to 24 cm; reddish brown (5YR 4/4 moist); sand; common medium distinct, yellowish red (5YR 4/6) mottles; single grain; loose (dry) loose (moist) and non-plastic (wet); many very fine, many fine, few medium, and few coarse roots; few very fine, many fine, common fine, few coarse pores; pH 7.89; medium effervescence; conductivity 1.32 mS; gradual wavy boundary.

C2 24 to 57 cm; reddish brown (5YR 4/3 moist); sandy loam (5% clay); few medium prominent,

Data Addendum 2 (continued).

yellowish red (5YR 4/6) and common medium prominent, brown to dark brown (7.5YR 3.5/2) mottles; massive; slightly hard (dry) friable (moist) and slightly plastic (wet); common very fine, common fine, common medium, and few coarse roots; few very fine, common fine, few medium, and few coarse pores; pH 7.72; medium effervescence; gradual smooth boundary.

C3 57 to 70 cm; brown (7.5YR 4.5/4 moist); coarse sand; single grain; loose (dry) loose (moist) and non-plastic (wet); common very fine, few fine, few medium, and few coarse roots; few very fine, many fine, common medium, and few coarse pores; gravel and cobble 10%; pH 7.68; medium effervescence.

Water at 65 cm.
Uncoated grains in C1 and C3 affect matrix color.
C3 is saturated throughout.
C2 horizon has a lot of decomposing organic matter.
Pit has rotten smell; possibly sulphur or methane gas emission.

Plot: 93PD29
Cross Section: Pecos14
Community Type: Fremont cottonwood-peachleaf willow (POPFRE-SALAMY)
Location: River Ranch; north of Santa Rosa Dam

Classification: Oxyaquic Ustifluvent (OUF), coarse-loamy over very-fine, mixed, mesic, calcareous

C1 0 to 20 cm; dark brown (7.5YR 3/3 moist); silt loam (20% clay); weak medium sub-angular blocky; hard (dry) friable (moist) and slightly sticky (wet); many very fine, many fine, common medium, and few coarse roots; common very fine, common fine, few medium, and few coarse pores; pH 7.76; medium effervescence; conductivity 2.32 mS; gradual wavy boundary.

C2 20 to 26 cm; brown (7.5YR 4/4 ped/moist); loamy sand (5% clay), dark brown (7.5YR 3/4 rub/moist), common medium distinct, strong brown (7.5YR 5/6) mottles; single grain; soft (dry) loose (moist) and slightly plastic (wet); many very fine, many fine, few medium, and few coarse roots; few very fine, common fine, common medium, and few coarse pores; pH 7.83; medium effervescence; gradual wavy boundary.

C3 26 to 85 cm; reddish yellow (7.5YR 6/6 dry); silt loam (12% clay), dark brown (7.5YR 3/4)

Data Addendum 2 (continued).

ped/moist, dark brown (7.5YR 3/3 rub/moist); common coarse faint, strong brown (7.5YR 4/6) Fe redox concentration and common medium distinct, very dark gray to dark brown (7.5YR 3/1.5) Mn redox concentration mottles; weak medium sub-angular blocky; soft (dry) friable (moist) and slightly plastic (wet); common very fine, common fine, few medium, and few coarse roots; few very fine, common fine, common medium, and few coarse pores; pH 7.87; medium effervescence.

Css1 85 to 115 cm; dark reddish brown (5YR 3/3 moist); clay (60% clay); common fine faint, yellowish red (5YR 4/6) mottles; massive; hard (dry) very friable (moist) and very plastic (wet); few roots; many very fine, common medium, few medium and few coarse pores; pH 7.65; medium effervescence.

Water at 110 cm.
Live earthworms found in C1.
Uncoated grains in C2 affect matrix color.
C4 structure has strong striations within the matrix (shrink and swell evidence).

Plot: 93PD30
Cross Section: Pecos15
Community Type: Fremont cottonwood/alkali sacaton (POPFRE/SPOAIR); saltcedar (TAMPEN) phase
Location: La Espiata Peak

Classification: Oxyaquic Torrifluvent (OTF), sandy, mixed, thermic, calcareous

C1 0 toAp1 0 to 20 cm; brown (7.5YR 5/4 dry); silt loam (10% clay), brown (7.5YR 4/4) moist; weak fine sub-angular blocky; hard (dry) friable (moist) and plastic (wet); many very fine, many fine, common many, and few coarse roots; common very fine, common fine, few medium, and few coarse pores; pH 7.68; medium effervescence; conductivity 1.12 mS; clear smooth boundary.

C1 20 to 55 cm; light brown (7.5 6/4 dry); loamy sand (4% clay), brown (7.5YR 4.5/3) moist; single grain; loose (dry) loose (moist) non-plastic (wet); common very fine, common fine, few medium, and few coarse roots; few very fine, common fine, common medium, and few coarse pores; pH 7.81; medium effervescence; clear smooth boundary.

C2 55 to 59 cm; brown (7.5YR 4/3 moist); clay (60% clay); fine common prominent, pinkish gray (7.5YR 6/2) mottles; massive; hard (dry) very friable (moist) plastic (wet); common very

Data Addendum 2 (continued).

fine, common fine, few medium, and few coarse roots; many very fine, common fine, few medium, and few coarse pores; pH 7.83; medium effervescence; clear wavy boundary.

C3 59 to 103 cm; brown (7.5YR 4.5/4 moist); loamy sand (6% clay); single grain; soft (dry) loose (moist) and non-plastic (wet); few roots; few very fine, many fine, common medium, and common coarse pores; trace of gravel: pH 7.98; medium effervescence; clear smooth boundary.

C4 103 to 150 cm; brown (7.5 4/4 moist); loamy sand (4% clay); medium common distinct, strong brown (7.5YR 5/8) and medium common prominent, black (7.5YR 2.5/1) mottles; single grain; loose (dry) loose (moist) and non-plastic (wet); few roots; few very fine, many fine, common medium, and few coarse pores; pH 7.90; medium effervescence.

Water at 148 cm.
Live worms in C1.

Plot: 93PD31
Cross Section: Pecos15
Community Type: seepwillow/alkali muhly (BACEMO/MUHASP); saltcedar (TAMPEN) phase
Location: La Espiata Peak

Classification: Aquic TorriFluvent (ATF), fine over sandy, mixed, thermic, calcareous

C1 0 to 60 cm; reddish brown (5YR 4/4 moist); silty clay (35% clay); many fine prominent, white (7.5YR 8/1) mottles; massive; slightly hard (dry) very friable (moist) and plastic (wet); common very fine, common fine, many medium, and few coarse roots; common very fine, common fine, few medium, and few coarse pores; trace of gravel; pH 8.02; medium effervescence; conductivity 9.80 mS; clear smooth boundary.

C2 60 to 69 cm; light yellowish brown (10YR 6/4 ped/moist); loamy sand (3% clay), yellowish brown to dark yellowish brown (10YR 4.5/4 rub/moist); many coarse prominent, very dark gray (7.5YR 3/1) Mn redox concentration and many coarse prominent, strong brown (7.5YR 4.5/6) Fe redox concentration mottles; single grain; loose (dry) loose (moist) non-plastic (wet); common very fine, few fine, common medium, and few coarse roots; few very fine, common fine, common medium, and few coarse pores; pH 7.90; medium effervescence; gradual smooth boundary.

Data Addendum 2 (continued).

C3 69 to 79 cm; brown (7.5YR 4/2 ped/moist); loamy sand (6% clay), brown (7.5YR 4/3) rub moist; common fine faint, strong brown (7.5YR 4/6) and common medium distinct, very dark gray (7.5YR 3/1) Mn redox concentration mottles; single grain; soft (dry) loose (moist) non-plastic (wet); common very fine, common fine, few medium, and few coarse roots; few very fine, few fine, common medium, and few coarse pores; pH 8.05; medium effervescence; gradual smooth boundary.

C4 79 to 103 cm; brown (7.5YR 5/2 moist); loamy sand (3% clay); common medium distinct, very dark gray (7.5YR 3/1) Mn redox concentration mottles; single grain; loose (dry) loose (moist) and non-plastic (wet); common very fine, common fine, few medium, and few coarse roots; few very fine, many fine, many medium, and many coarse pores; trace of gravel; pH 8.08; medium effervescence.

Water at 100 cm.
Lots of flood debris at surface of pit.
C4 is saturated throughout.
Uncoated grains in C4 affect matrix color.

Plot: 93PD32
Cross Section: Pecos16
Community Type: Fremont cottonwood/alkali sacaton (POPFRE/SPOAIR); saltcedar (TAMPEN) phase
Location: Cottonwood Draw

Classification: Oxyaquic Torrifluvent (OTF), sandy, mixed, thermic, nonacid

Cp1 0 to 40 cm; light brown to brown (7.5YR 5.5/4 ped/moist); loamy sand (7% clay), brown (7.5 YR 4/4 rub/moist); weak medium sub-angular blocky; soft (dry) loose (moist) non-plastic (wet); many very fine, many fine, common medium, and common coarse roots; few very fine, common fine, many medium, and few coarse pores; pH 7.90; medium effervescence; conductivity 2.20 mS; clear smooth boundary.

C1 40 to 56 cm; brown (7.5YR 4/4 moist); clay loam (40% clay); common fine distinct, strong brown (7.5YR 5/6) Fe redox concentration mottles; massive to weak fine platy; hard (dry) friable (moist) and plastic (wet); common very fine, common fine, many medium, and common coarse roots; common very fine, common fine, few medium, and few coarse pores; pH 7.82; clear wavy boundary.

C2 56 to 137 cm; light brown to brown (7.5YR 5.5/4 ped/moist); loamy sand (5% clay), brown (10 YR 4.5/4 rub/moist); common fine distinct, dark brown (7.5YR 3/2) mottles; single grain;

Data Addendum 2 (continued).

loose (dry) loose (moist) non-plastic (wet); few very fine, few fine, common medium, and common coarse roots; few very fine, common medium, common medium, and few coarse pores; pH 8.10; no effervescence.

Sand pockets common in C1.

Plot: 93PD33
Cross Section: Pecos16
Community Type: coyote willow-seepwillow (SALEXI/BACEMO)
Location: Cottonwood Draw

Classification: Oxyaquic Torrifluvent (OTF), sandy, mixed, thermic, nonacid

C1 0 to 36 cm; pink (7.5YR 7/4 dry); medium to coarse sand, light brown to brown (7.5YR 5.5/4 moist); single grain; loose (dry) loose (moist) non-plastic (wet); common very fine, many fine, many medium, and few coarse roots; few very fine, many fine, common medium, and few coarse pores; gravel 20%; pH 7.94; medium effervescence; conductivity .70 mS; clear wavy boundary.

C2 36 to 43 cm; brown (7.5YR 4.5/4 moist); loamy sand (5% sand); single grain; loose (dry) loose (moist) and non-plastic (wet); common very fine, common fine, few medium, and few coarse roots; few very fine, many fine, common medium, few coarse pores; pH 7.98; medium effervescence; diffuse irregular boundary.

C3 43 to 67 cm; brown (7.5YR 4/4 moist); clay (50% clay); massive; hard (dry) friable (moist) and plastic (wet); common very fine, many fine, many medium, and few coarse roots; common very fine, common fine, few medium, and few coarse pores; pH 7.74; medium effervescence; clear smooth boundary.

C4 67 to 127 cm; dark brown to brown (7.5YR 3.5/3 moist); medium to coarse sand; few fine distinct, dark brown (7.5YR 3/2) mottles; single grain; loose (dry) loose (moist) and non-plastic (wet); few roots; few very fine, many fine, common medium, and few coarse pores; gravel 20%; pH 8.03; no effervescence.

Three clay balls found in pit.
Water at 127 cm.
C4 is saturated throughout.

Plot: 93PD34
Cross Section: Pecos16
Community Type: coyote willow-seepwillow (SALEXI-BACEMO)
Location: Cottonwood Draw

Data Addendum 2 (continued).

Classification: Oxyaquic Ustipsamment (OUP), mixed, thermic, nonacid

C1 0 to 22 cm; reddish brown (5YR 4/4 moist); clay (65% clay); weak fine sub-angular blocky; very hard (dry) very friable (moist) and plastic (wet); many very fine, many fine, common medium, and common coarse roots; many very fine, common fine, few medium, and few coarse pores; pH 7.87; medium effervescence; conductivity 3.86 mS; gradual smooth boundary.

C2 22 to 44 cm; light reddish brown to reddish brown (7.5YR 5.5/4 moist); loamy sand (3% clay); common medium faint, yellowish red (7.5YR 5/6) Fe redox concentration mottles; single grain; loose (dry) loose (moist) non-plastic (wet); common roots; few very fine, many fine, common medium, and few coarse pores; pH 7.90; medium effervescence; gradual smooth boundary.

C3 44 to 85 cm; brown (7.5YR 4/4 moist); loamy sand; common coarse distinct, strong brown (7.5YR 5/8) Fe redox concentration and common medium distinct, very dark gray (7.5YR 3/1) Mn redox concentration mottles; single grain; loose (dry) loose (moist) non-plastic (wet); few very fine, common fine, common medium, and few coarse roots; few very fine, few fine, common medium, and few coarse pores; pH 7.86; no effervescence.

Water at 82 cm.
C3 is saturated throughout.
Uncoated grains in C2 and C3 affect matrix color.

Plot: 93PD35
Cross Section: Pecos17
Community Type: Fremont cottonwood/alkali sacaton (POPFRE/SPOAIR)
Location: Bitter Lake National Wildlife Refuge

Classification: Aquic Ustipsamment (AUP), mixed, thermic, nonacid

A1 0 to 26 cm; reddish brown (5YR 4/4 moist); clay (70% clay); many fine prominent, white (5YR 8/1) mottles; massive; slightly hard (dry) very friable (moist) and plastic (wet); many very fine, many fine, many common, and few coarse roots; many very fine, many fine, few medium, and few coarse pores; pH 8.03; medium effervescence; conductivity 8.70 mS; clear wavy boundary.

C1 26 to 48 cm; reddish brown (5YR 4.5/4 moist); loamy sand (4% clay); common fine faint, yellowish red; (7.5YR 5/8) mottles; single grain; loose (dry) loose (moist) and non-plastic (wet); common very fine, many fine, many medium, and common coarse roots; few very fine, many fine, common medium, and few coarse pores; pH 8.33; medium effervescence; gradual smooth boundary.

Data Addendum 2 (continued).

C2 48 to 94 cm; reddish brown (5YR 4/3.5 moist); loamy sand (6% clay); many coarse prominent, black (5YR 2.5/1) and common medium distinct, yellowish red (5YR 5/6) mottles; single grain; soft (dry) loose (moist) and non-plastic (wet); common roots; few very fine, few fine, common medium, and few coarse pores; pH 8.05; medium effervescence.

Water at 92 cm.
Uncoated grains in C1 affect matrix color.

Plot: 93PD36
Cross Section: Pecos17
Community Type: coyote willow-seep willow (SALEXI-BACEMO)
Location: Bitter Lake National Wildlife Refuge

Classification: Typic Psamment (TPA), mixed, thermic, nonacid

C1 0 to 19 cm; reddish brown (5YR 3.5/4 moist); clay (65% clay); massive; hard (dry) very friable (moist) and plastic (wet); common very fine, common fine, many medium, and many coarse roots; common very fine, many fine, few medium, and few coarse pores; pH 7.90; medium effervescence; conductivity .72 mS; clear smooth boundary.

C2 19 to 47 cm; reddish brown (5YR 4.5/4 moist); loamy sand (4% clay); common medium distinct, yellowish red (5YR 5/8) Fe redox concentration and common medium prominent, dark reddish brown (5YR 3/2) Mn redox concentration mottles; single grain; few very fine and common fine, medium, and coarse roots; few very fine, few fine, common medium, and common coarse pores; pH 7.94; no effervescence.

Water at 47 cm.

Plot: 93PD37
Cross Section: Overflow Wetland1
Community Type: inland saltgrass/Utah glasswort (DISSTR/SALUTA)
Location: Overflow Wetland; southeast of Roswell

Classification: Typic Endoaquent (TEA), very fine, mixed thermic, calcareous

Cz1 0 to 37 cm; brown (7.5YR 4/3 moist); clay (75% clay); many medium distinct, light reddish brown (5YR 6/3) mottles; weak fine sub-angular blocky; hard (dry) very friable (moist) and plastic (wet); common very fine, many fine, many medium, and few coarse roots; common very fine, common fine, few medium, and few coarse pores; pH 8.17; medium effervescence; conductivity 37.2 mS; diffuse smooth boundary.

Data Addendum 2 (continued).

Cg1 37 to 72 cm; gray to grayish brown (2.5Y 5/2.5 ped/moist); clay (65% clay); dark gray to dark grayish brown (2.5Y 4/2.5 rub/moist); many medium prominent, white (2.5Y 8/1) and common medium distinct, very dark gray (2.5Y 3/1) mottles; massive; slightly hard (dry) very friable (moist) and sticky (wet); few roots; many very fine, common fine, few medium, and few coarse pores; pH 7.97; medium effervescence.

Water at 72 cm.
Cg1 is saturated throughout.

Plot: 93PD38
Cross Section: Overflow Wetland1
Community Type: inland saltgrass/Utah glasswort (DISSTR/SALUTA)
Location: Overflow Wetland; south of Roswell

Classification: Typic Endoaquent (TEA), very fine, mixed, thermic, calcareous

C1 0 to 40 cm; reddish brown (5YR 4/3.5 ped/moist); clay (70% clay), reddish brown to dark reddish brown (5YR 3.5/3 rub/moist); many medium prominent, pink (5YR 7/3) and common medium prominent, black (N 2.5) mottles; massive; hard (dry) very friable (moist) and sticky (wet); many very fine, fine, and medium, and few coarse roots; many very fine, many fine, few medium, and few coarse pores; pH 7.94; medium effervescence; clear smooth boundary.

Cg1 40 to 45 cm; gray to dark gray (N 4.5 ped/moist); clay (60%), greenish gray to dark greenish gray (5GY 4.5/1 rub/moist); many medium prominent, light gray (5Y 7/2) mottles; massive; hard (dry) very friable (moist) and sticky (wet); common very fine, common fine, few medium, and few coarse roots; many very fine, many fine, few medium and few coarse pores; pH 8.11; no effervescence.

Water at 33 cm.
Water seeped in through sides of pit from 33 to 45 cm.
Pit was saturated throughout.

Plot: 93PD39
Cross Section: Pecos18
Community Type: seepwillow/alkali muhly (BACEMO/MUHASP); saltcedar (TAMPEN) phase
Location: Puerto de Luna North

Classification: Oxyaquic Ustifluvent (OUF), coarse-loamy over sandy-skeletal, mixed, mesic, nonacid

Data Addendum 2 (continued).

C1 0 to 34 cm; brown (7.5YR 4/3.5 moist); sandy loam (8% clay); common medium distinct, brown (7.5YR 5/4) mottles; very weak fine sub-angular blocky; soft (dry) friable (moist) and slightly plastic (wet); many very fine, many fine, common medium, and common coarse roots; few very fine, many fine, common medium, and few coarse pores; pH 7.76; medium effervescence; conductivity 2.82 mS; gradual smooth boundary.

C2 34 to 72 cm; pink to light brown (7.5YR 6.5YR/4 dry) medium sand, brown (7.5YR 4.5/4) moist; single grain; loose (dry) loose (moist) non-plastic (wet); common very fine, common fine, few medium, and few coarse roots; few very fine, common fine, many medium, few coarse pores; gravel 5%; pH 7.89; medium effervescence; clear smooth boundary.

C3 72 to 129 cm; light yellowish brown to yellowish brown (10YR 5.5/4 moist); coarse sand; common coarse prominent, yellowish red (5YR 5/8) mottles; single grain; loose (dry) loose (moist) non-plastic (wet); few roots; few very fine, many fine, common medium, and few coarse pores; gravel 40% and cobbles 10%; pH 7.85; weak effervescence.

Uncoated grains in C2 and C3 affect matrix color.
Water at 125 cm.
Ant and worm activity noted.
Mottle layer in C3 is 100 to 103 cm deep (ring around pit; 5YR 5/8 Fe redox concentration layer).
Flood debris present near pit.

Plot: 93PD40
Cross Section: Pecos18
Community Type: Fremont cottonwood/alkali sacaton (POPFRE/SPOAIR)
Location: Puerto de Luna North

Classification: Mollic Ustifluvent (MUF), very fine, mixed, mesic, calcareous

Oi 0 to 2 cm; cottonwood litter; clear smooth boundary.

A1 0 to 39 cm; reddish brown to dark reddish brown (5YR 3.5/3 moist); clay (55% clay); massive; hard (dry) friable to firm (moist) and sticky (wet); many very fine, many fine, common medium, and common coarse roots; many very fine, many fine, few medium, and few coarse pores; pH 7.63; medium effervescence; conductivity 1.23 mS; gradual wavy boundary.

C1 39 to 64 cm; light brown (7.5YR 6/4 dry); medium sand (3% clay), brown (7.5YR 4.5/4) moist; single grain; loose (dry) loose (moist) and non-plastic (wet); common very fine, common fine, few medium, and few coarse roots; few very fine, many fine, common medium, and few coarse pores; gravel 7%; pH 7.71; medium effervescence; diffuse irregular boundary.

C2 64 to 133 cm; brown (7.5YR 4.5/4 ped/moist); sandy loam (10% clay), reddish brown (5YR 4/3

Data Addendum 2 (continued).

rub/moist); weak medium sub-angular blocky; slightly hard (dry) friable (moist) and slightly plastic (wet); few very fine, common fine, many medium, and many coarse roots; few very fine, many fine, common medium, and few coarse pores; pH 7.74; medium effervescence; clear smooth boundary.

C3 133 to 148 cm; light brown (7.5YR 6/4 dry); loamy sand (5% clay), brown (7.5YR 4/4 moist); single grain; loose (dry) loose (moist) non-plastic (wet); few roots; few very fine, common fine, many medium, and few coarse pores; pH 7.80; medium effervescence.

Uncoated grains in C3 affect matrix color.
Sand pockets common throughout C2.
A1 shows shrink/swell evidence.

Plot: 93PD41
Cross Section: Pecos19
Community Type: Fremont cottonwood/alkali sacaton (POPFRE/SPOAIR); saltcedar (TAMPEN) phase
Location: Puerto de Luna

Classification: Typic Ustifluvent (TUF), coarse-loamy, mixed, mesic, calcareous

Oe 0 to 3 cm; litter from cottonwood; clear wavy boundary.

C1 0 to 13 cm; brown (7.5YR 5/4 dry); loamy sand (3% clay), brown (7.5YR 4/4) moist; single grain; loose (dry) loose (moist) and non-plastic (wet); many very fine, many fine, common medium, and common coarse roots; few very fine, few medium, many coarse pores; pH 7.68; medium effervescence; conductivity .40 mS; gradual wavy boundary.

C2 13 to 87 cm; brown (7.5YR 4.5/4 moist); sandy loam (8% clay); weak fine sub-angular blocky; soft (dry) friable (moist) plastic (wet); few very fine, and common fine, medium, and coarse roots; few very fine, many fine, common medium, and few coarse pores; trace of gravel; pH 7.91; medium effervescence; conductivity 1.28 mS; gradual irregular boundary.

C3 87 to 113 cm; pink to light brown (7.5YR 6.5/4 dry); loamy sand (4% clay), brown (7.5YR 4.5/4 moist); common medium distinct, brown (7.5YR 4/4) mottles; single grain; loose (dry) loose (moist) and non-plastic (wet); few very fine, few fine, common medium, and few coarse roots; few very fine, many fine, common medium, and common coarse pores; pH 7.95; medium effervescence; gradual broken boundary.

C4 113 to 117 cm; brown (7.5 YR 4/4 ped/moist); loam (10% clay), reddish brown (5YR 4/4

Data Addendum 2 (continued).

rub/moist); weak medium sub-angular blocky; slightly hard (dry) friable (moist) and plastic (wet); few very fine, common fine, common medium, and few coarse roots; few very fine, many fine, common medium, and few coarse pores; pH 8.12; medium effervescence; clear wavy boundary.

C5 117 to 149 cm; brown (7.5YR 4/4 moist); loamy sand (5% clay); single grain; loose (dry) loose (moist) and non-plastic (wet); few roots; few very fine, many fine, many medium, and few coarse pores; pH 8.28; medium effervescence.

Uncoated grains in C1 and C2 affect matrix color.
5 x 8 cm animal burrow found in C2.

Plot: 93PD42
Cross Section: Pecos19
Community Type: threesquare/cattail (SCIAME/TYPLAT)
Location: Puerto de Luna

Classification: Typic Fluvaquent (TFA), sandy-skeletal, mixed, mesic, calcareous

C1 0 to 4 cm; brown (7.5YR 4/4); silty clay (50% clay); massive; hard (dry) very friable (moist) and slightly sticky (wet); many very fine, many fine, many medium, and few coarse roots; common very fine, common fine, few medium, and few coarse pores; pH 7.90; medium effervescence; conductivity 6.80 mS; clear smooth boundary.

C2 4 to 32 cm; dark brown to brown (7.5YR 3.5/4 moist); sandy loam (10% clay); common fine prominent, strong brown (7.5YR 5/8) mottles; massive; slightly hard (dry) friable (moist) and slightly plastic (wet); many very fine, many fine, many medium, and few coarse roots; few very fine, many fine, common medium, and few coarse pores; trace of gravel; pH 8.12; medium effervescence; conductivity 5.40 mS; clear abrupt boundary.

C3 32 to 65 cm; dark grayish brown to brown (10YR 4/2.5 moist); coarse sand; single grain; loose (dry) loose (moist) and non-plastic (wet); common very fine, few fine, medium, and coarse roots; few very fine, many fine, many medium, and manu coarse pores; gravel 35%, cobbles 13%, and trace of stones; pH 7.85; medium effervescence.

Uncoated grains in C3 affect matrix color.
C3 is saturated throughout.
Water at 59 cm.

Plot: 93PD43

Data Addendum 2 (continued).

Cross Section: Pecos20
Community Type: Fremont cottonwood/sparse (POPFRE/SPARSE)
Location: Anton Chico

Classification: Oxyaquic Ustipsamment (OUP), mixed, mesic, calcareous

C1 0 to 30 cm; reddish brown (5YR 5/4 dry); sandy loam (10% clay), reddish brown (5YR 4/4) moist; weak medium sub-angular blocky; slightly hard (dry) friable (moist) and slightly plastic (wet); common very fine, common fine, common medium, and many coarse roots; few very fine, common fine, common medium, and few coarse pores; pH 7.87; medium effervescence; conductivity .40 mS; gradual wavy boundary.

C2 30 to 97 cm; reddish brown (5YR 4/4); sandy loam (7% clay); weak medium sub-angular blocky; soft (dry) friable (moist) and slightly plastic (wet); few very fine, common fine, common medium, common coarse roots; few very fine, common fine, common medium, and few coarse pores; pH 8.01; medium effervescence.

Water flowing in from sides of pit form pasture runoff.

Plot: 93PD44
Cross Section: Pecos20
Community Type: threesquare-knotgrass (SCIAME-PASDIS)
Location: Anton Chico

Classification: Aquic Ustipsamment (AUP), mixed, mesic, calcareous

C1 0 to 69 cm; reddish brown to dark reddish brown (5YR 3.5/4 moist); sandy loam (10% clay); common medium distinct, black (5YR 2.5/1) and few fine distinct, dark yellowish brown (10YR 4/6) Fe redox concentration mottles; massive; soft to loose (dry) friable (moist) slightly plastic (wet); common very fine, many fine, common medium, and few coarse roots; few very fine, common fine, many medium, and few coarse pores; pH 7.70; medium effervescence; conductivity .34 mS.

Water at 66 cm.
Water draining in from sides of pit at 35 cm (from pasture runoff).
Many medium pores are water capillaries.
Pit saturated throughout.
Sand lens at 8 cm.

Plot: 93PD45
Cross Section: Pecos21
Community Type: seepwillow/alkali sacaton (BACEMO/SPOAIR); saltcedar (TAMPEN)

Data Addendum 2 (continued).

Location: Eighteen Mile Bend

Classification: Oxyaquic Ustifluvent (OUF), very fine over sandy, mixed, mesic, calcareous

C1 0 to 47 cm; reddish brown (5YR 4/4 moist); clay (70% clay); many fine distinct, pinkish white (5YR 8/2) mottles; massive; hard (dry) very firm (moist) very plastic (wet); many very fine, many fine, common fine, and few coarse roots; many very fine, common fine, few medium, and few coarse pores; pH 7.87; medium effervescence; conductivity 5.66 mS; clear smooth boundary.

C2 47 to 88 cm; light yellowish brown to yellowish brown (10YR 5.5/4 moist); medium sand; many coarse distinct, strong brown (7.5YR 5/6) and common medium distinct, very dark grayish brown (10YR 3/2) mottles; single grain; loose (dry) loose (moist) and non-plastic (wet); common very fine, common fine, few medium, and few coarse roots; few very fine, many fine, common medium, and few coarse pores; trace of gravel; pH 7.83; medium effervescence.

Uncoated grains in C2 affect matrix color.
C2 saturated throughout.
Water at 83 cm.
Fine striations in C1 may be due to worm casts.

Plot: 93PD46
Cross Section: Pecos21
Community Type: seepwillow/alkali sacaton (BACEMO/SPOAIR); saltcedar (TAMPEN)
Location: Eighteen Mile Bend

Classification: Oxyaquic Ustifluvent (OUF), sandy over very fine, mixed, mesic, calcareous

C1 0 to 35 cm; brown (7.5YR 4.5/4 moist); medium to fine sand; single grain; loose (dry) loose (moist) non-plastic (wet); many very fine, many fine, common medium, and few coarse roots; few very fine, many fine, many medium, and few coarse pores; pH 7.86; medium effervescence; conductivity .56 mS.

C2 35 to 45 cm; brown (7.5YR 4/4 moist); sandy clay loam (33% clay); massive; slightly hard (dry) friable (moist) plastic (wet); few very fine, common fine, many medium, and few coarse roots; common very fine, common fine, common medium, and few coarse pores; pH 7.84; medium effervescence; clear smooth boundary.

C3 45 to 66 cm; light brown (7.5YR 6/4 ped/moist); loamy sand (5% clay), brown (7.5YR 4/4 rub/moist); medium common faint, brown (7.5YR 4/4) mottles; single grain; loose (dry) loose (moist) and non-plastic (wet); few very fine, common fine, common medium, and few

Data Addendum 2 (continued).

coarse roots; few very fine, common fine, common medium, and few coarse pores; pH 7.98; medium effervescence; clear smooth boundary.

C4 66 to 92 cm; reddish brown (5YR 4/4 moist); clay (60% clay); many fine distinct, pinkish white (5YR 8/2) mottles; medium fine sub-angular blocky; hard (dry) very friable and very plastic (wet); many very fine, common fine, few medium, and few coarse roots; common very fine, common fine, few medium, and few coarse pores; pH 8.09; medium effervescence; abrupt smooth boundary.

C5 92 to 148 light brown to brown (7.5YR 5.5/4 ped/moist); medium sand, brown (7.5YR 4.5/3 rub/moist); few medium distinct, black (7.5YR 2.5/1) mottles; single grain; loose (dry) loose (moist) non-plastic (wet); common very fine, common fine, few medium, and few coarse roots; few very fine, few fine, many medium, and few coarse pores; pH 8.05; medium effervescence.

Uncoated grains in C1 and C5 affect matrix color.
Mottles in C5 are thin lamellae near top of horizon.

Plot: 93PD47
Cross Section: Pecos22
Community Type: seepwillow/alkali sacaton (BACEMO/SPOAIR); saltcedar (TAMPEN)
Location: Baldy Mountain

Classification: Oxyaquic Ustifluvent (OUF), very fine over fine-loamy, mixed, mesic, calcareous

C1 0 to 23 cm; brown (7.5YR 4.5/4 moist); sandy loam (10% clay); weak fine sub-angular blocky; soft (dry) friable (moist) slightly plastic (wet); many very fine, many fine, many medium, and few coarse roots; few very fine, few fine, common medium, and common coarse pores; pH 7.86; medium effervescence; conductivity 1.56 mS; clear smooth boundary.

C2 23 to 31 cm; dark reddish gray (5YR 4/2); clay (70% clay); massive; very hard (dry) very firm (moist) slightly plastic (wet); many very fine, many fine, common medium, and few coarse roots; many very fine, common fine, few medium, and few coarse pores; pH 8.00; medium effervescence; clear smooth boundary.

C3 31 to 46 cm; light brown (7.5YR 6/4 ped/moist); fine to medium sand, brown (7.5YR 4/4 rub/moist); common medium prominent, very dark brown (10YR 2/2) Mn redox concentration and common medium prominent, strong brown (7.5YR 5/8) Fe redox concentration mottles; single grain; loose (dry) loose (moist) and non-plastic (wet); many very fine, common fine, common medium, and few coarse roots; few very fine, many fine, common medium, and few coarse pores; pH 7.86; medium effervescence; broken smooth boundary.

Data Addendum 2 (continued).

C4 46 to 92 cm; brown (7.5YR 4/4 moist); silt loam (15% clay); massive; soft (dry) friable (moist) slightly plastic (wet); common roots; few very fine, many fine, common medium, few coarse pores; pH 8.33; medium effervescence; gradual smooth boundary.

C5 92 to 143 cm; brown (7.5YR 4.5/4 moist); loamy sand (6% clay); common medium prominent, yellowish red (5YR 5/8) Fe redox concentration mottles; single grain; loose (dry) loose (moist) and non-plastic (wet); common very fine, many fine, common medium, and few coarse roots; few very fine, common fine, many medium, and few coarse pores; pH 8.45; medium effervescence.

Sand lenses present in C1 and C4.
Uncoated grains in C5 affect matrix color.
Mn redox concentration mottles in C3 are horizontal lamellae.

Plot: 93PD48
Cross Section: Pecos22
Community Type: inland saltgrass-threesquare (DISSTR-SCIAME); saltcedar (TAMPEN)
Location: Baldy Mountain

Classification: Aeric Fluvaquent (AFA), very fine, mixed, mesic, calcareous

C1 0 to 8 cm; reddish brown (5YR 5/4 dry); clay (80% clay), reddish brown (5YR 4/4 moist); massive; very hard (dry) very friable (moist) and plastic (wet); many very fine, many fine, common medium, and few coarse roots; many very fine, common fine, few medium, and few coarse pores; pH 8.10; medium effervescence; conductivity 7.64 mS; clear smooth boundary.

C2 8 to 24 cm; brown (7.5YR 4/4 moist); loamy sand (4% clay); single grain; soft to loose (dry) loose (moist) and non-plastic (wet); many very fine, many fine, many medium, and few coarse roots; few very fine, common fine, many medium, and few coarse pores; pH 7.98; medium effervescence; conductivity 1.48 mS; clear smooth boundary.

C3 24 to 52 cm; reddish brown (5YR 4/4 moist); clay (70% clay); massive; hard (dry) very friable (moist) and sticky (wet); common roots; many very fine, common fine, few medium, and few coarse pores; pH 8.14; medium effervescence.

Water at 46 cm.
Uncoated grains in C2 affect matrix color.
Sand lenses in C3 common.

Plot: 93PD49
Cross Section: Pecos23

Data Addendum 2 (continued).

Community Type: seepwillow/alkali sacaton (BACEMO-SPOAIR); saltcedar (TAMPEN)
Location: Ward Canyon

Classification: Typic Fluvaquent (TFA), very fine over sandy, mixed, mesic, calcareous

Oi 0 to 2 cm; litter layer; clear wavy boundary.

C1 0 to 38 cm; reddish brown (5YR 4/4 moist); clay (75% clay); common fine prominent, pinkish gray (5YR 7/2) mottles; massive; very hard (dry) firm (moist) and slightly sticky (wet); many roots; many very fine, common fine, few medium, and few coarse pores; pH 7.97; medium effervescence; conductivity 4.40 mS; clear wavy boundary.

Cd1 38 to 83 cm; brown (7.5YR 4/4 moist); loamy sand (4% clay); common medium distinct, strong brown (7.5YR 5/6) Fe redox concentration and many coarse prominent, very dark gray (10YR 3/1) Mn redox concentration mottles; single grain; loose (dry) loose (moist) and non-plastic (wet); common very fine, common fine, many medium, and common coarse roots; few very fine, few fine, many medium, and many coarse pores; pH 8.19; medium effervescence.

Water at 79 cm.
Uncoated grains in C2 affect matrix color.
C2 is saturated throughout.
Coarse roots stop at 1 in. mixture layer of C1 and C2.

Plot: 93PD50
Cross Section: Pecos23
Community Type: seepwillow/alkali sacaton (BACEMO-SPOAIR); saltcedar (TAMPEN)
Location: Ward Canyon

Classification: Typic Fluvaquent (TFA), sandy, mixed, mesic, calcareous

Oi 0 to 2 cm; litter layer

C1 0 to 30 cm; reddish brown (5YR 4/4 moist); clay (50% clay); massive; hard (dry) very friable (moist) and plastic (wet); many very fine, many fine, common medium, and few coarse roots; common very fine, many fine, few medium, and few coarse pores; pH 8.09; medium effervescence; conductivity 5.32 mS; gradual wavy boundary.

C2 30 to 79 cm; brown (7.5YR 5/4 ped/moist); medium sand, brown (7.5YR 4/3) rub/moist; common medium prominent, yellowish red (5YR 5/8) and common coarse prominent, very dark grayish brown (10YR 3/2) mottles; single grain; loose (dry) loose (moist) and non-plastic (wet); common very fine, common fine, few medium, and few coarse roots; few very

Data Addendum 2 (continued).

fine, many fine, common medium, and few coarse pores; pH 7.97.

Water at 75 cm.
Uncoated grains in C2 affect matrix color.
Very fine striations in C1 may be due to ant activity.
C2 saturated at 58 cm.

Plot: 93PD51
Cross Section: Pecos24
Community Type: coyote willow-seepwillow (SALEXI-BACEMO)
Location: Fort Sumner

Classification: Typic Psammaquent (TPA), mixed, mesic, calcareous

C1 0 to 10 cm; brown (7.5YR 4/3.5 moist); loam (17% clay); massive; hard (dry) friable (moist) and plastic; many very fine, many fine, few medium, and few coarse roots; common very fine, common fine, few medium, few coarse pores; pH 7.76; medium effervescence; conductivity 2.44 mS; clear broken boundary.

C2 10 to 59 cm; very pale brown (10YR 7/4 dry); medium to coarse sand, light yellowish brown to yellowish brown (10YR 5.5/4 moist); common medium faint, strong brown (7.5YR 5/6) mottles; single grain; loose (dry) loose (moist) and non-plastic (wet); many very fine, common fine, common medium, and few coarse roots; few very fine, common fine, common medium, and few coarse pores; trace of gravel; pH 7.90; medium effervescence.

Water at 55 cm.
Uncoated grains in C2 affect matrix color.

Plot: 93PD52
Cross Section: Pecos24
Community Type: Fremont cottonwood/alkali sacaton (POPFRE/SPOAIR); saltcedar (TAMPEN) phase
Location: Ft. Sumner

Classification: Typic Ustifluvent (TUF), coarse-loamy over very-fine, mixed, mesic, calcareous

Data Addendum 2 (continued).

A1 0 to 10 cm; brown (7.5YR 5/4 dry); silt loam (15% clay), brown (7.5YR 4/3 moist); weak fine sub-angular blocky; slightly hard (dry) very friable (moist) and plastic (wet); many very fine, many fine, many medium, and few coarse roots; common very fine, many fine, common medium, and few coarse pores; pH 7.66; medium effervescence; conductivity 1.01 mS; gradual smooth boundary.

C1 10 to 56 cm; brown (7.5YR 4.5/4 moist); sandy loam (12% clay); common fine prominent, white (10YR 8/1) mottles; massive; soft (dry) slightly friable (moist) and slightly plastic (wet); many very fine, common fine, common medium, and few coarse pores; few very fine, few fine, many medium, and few coarse pores; pH 7.96; medium effervescence; clear broken boundary.

C2 56 to 71 cm; dark reddish brown (5YR 3/3 moist); clay (80% clay); many fine prominent, white (10YR 8/1) mottles; massive; hard (dry) very firm (moist) and very plastic (wet); common very fine, many fine, common medium, and few coarse pores; pH 8.24; medium effervescence; clear smooth boundary.

C3 71 to 104 cm; pink to light brown (7.5YR 6.5/4 ped/moist); fine sand, brown (7.5YR 5/4 rub/moist); common medium distinct, strong brown (7.5 YR 5/8) and common medium distinct, dark brown (7.5YR 3/3) Mn redox concentration mottles; single grain; loose (dry) loose (moist) and non-plastic (wet); few very fine, common fine, few medium, and few coarse roots; few very fine, many fine, and common medium, and few coarse pores; trace of gravel; pH 8.13; medium effervescence; clear smooth boundary.

C4 104 to 145 cm; light brown to brown (7.5YR 5.5/4 ped/moist); medium sand, brown (7.5 4/4 rub/moist); common medium faint, strong brown (7.5YR 5/6) mottles; single grain; loose (dry) loose (moist) and non-plastic (wet); few very fine, few fine, common medium, and common coarse roots; few very fine, common fine, common medium, and few coarse pores; gravel 3%; pH 8.25; medium effervescence.

Uncoated grains in C4 affect matrix color.

Plot: 93PD53
Cross Section: Rio Ruidoso1
Community Type: Fremont cottonwood-Goodding's willow (POPFRE-SALGOO)
Location: San Patricio

Classification: Aeric Fluvaquent (AFA), coarse-loamy, mixed, mesic, calcareous

Oi 0 to 3 cm; willow and cottonwood litter.

C1 0 to 76 cm; brown (10YR 4.5/2 moist); sandy loam (12% clay); common fine distinct, yellowish brown (10YR 5/6) Fe redox concentration mottles; massive; soft (dry) friable (moist) and

Data Addendum 2 (continued).

slightly plastic (wet); many roots; few very fine, common fine, common medium, and few coarse pores; pH 7.92; medium effervescence; conductivity 4.12 mS; clear smooth boundary.

C2 76 to 96 cm; dark gray to dark grayish brown (10YR 4/1.5 ped/moist); sandy loam (10% clay) very dark gray (10YR 3/1 rub/moist); common medium prominent, yellowish red (5YR 5/6) Fe redox concentration and many medium distinct, very dark gray (2.5YR 3/1) Mn redox concentration mottles; massive; slightly hard (dry) friable (moist) and slightly plastic (wet); few very fine, few fine, common medium, and common coarse roots; few very fine, common fine, common medium, and common coarse pores; pH 7.66; medium effervescence.

C2 saturated throughout.
Water at 85 cm.
Pit went through an active underground channel (channel began at 53 cm and was 1 ft wide).
Live earthworms found in C1.

Plot: 93PD54
Cross Section: Rio Hondo1
Community Type: Fremont cottonwood-Goodding's willow (POPFRE-SALGOO)
Location: Circle Diamond Ranch

Classification: Oxyaquic Ustifluvent (OUF), coarse-loamy, mixed, mesic, calcareous

Oi 0 to 3 cm; litter layer; clear wavy boundary.

C1 0 to 21 cm; light yellowish brown to yellowish brown (10YR 5.5/4 dry); sandy loam (5% clay), dark grayish brown (10YR 4/2 moist); weak fine sub-angular blocky; many very fine, many fine, many medium, and common coarse roots; few very fine, common fine, many medium, and few coarse pores; pH 7.71; medium effervescence; conductivity .64; mS; broken irregular boundary.

C2 21 to 113 cm; dark grayish brown (10YR 4/2 moist); loam (13% clay); common fine distinct, white (10YR 8/1) mottles; massive; hard (dry) friable (moist) and slightly plastic (wet); common very fine, common fine, many medium, and many coarse roots; few very fine, common fine, common medium, and few coarse pores; pH 7.78; medium effervescence; clear smooth boundary.

C3 113 to 125 cm; yellowish brown (10YR 5/4 dry); medium to coarse sand, dark grayish brown (10YR 4/2 moist); common medium distinct, strong brown (7.5YR 5/8) Fe redox concentration mottles; single grain; loose (dry) loose (moist) and non-plastic (wet); few roots; few very fine, many fine, common medium, and few coarse pores; gravel 45% and cobbles 10%; pH 7.95; medium effervescence.

Uncoated grains in C3 affect matrix color.

Data Addendum 2 (continued).

Very fine striations in C2 maybe due to ant and worm casts.

Plot: 93PD55
Cross Section: Rio Hondo1
Community Type: Fremont cottonwood-Goodding's willow (POPFRE-SALGOO)
Location: Circle Diamond Ranch

Classification: Oxyaquic Ustifluvent (OUF), sandy over coarse-loamy, mixed, mesic, calcareous

Oi 0 to 3 cm; litter layer; clear wavy boundary.

C1 0 to 39 cm; light yellowish brown to yellowish brown (10YR 5.5/4 dry); sandy loam (10% clay), dark grayish brown (10YR 4/2 moist); massive; soft (dry) friable (moist) and slightly plastic (wet); common very fine, common fine, common medium, and few coarse roots; few very fine, common fine, common medium, and few coarse pores; pH 7.68; medium effervescence; conductivity .64 mS; clear smooth boundary.

C2 39 to 68 cm; light yellowish brown to yellowish brown (10YR 5.5/4 dry); loamy sand (4% clay), dark grayish brown (10YR 4/2 moist); single grain; loose (dry) loose (moist) and non-plastic (wet); many very fine, many fine, common few, and few coarse roots; few very fine, common fine, common medium, and few coarse pores; pH 7.77; medium effervescence; clear smooth boundary.

C3 68 to 134 cm; dark grayish brown to very dark grayish brown (10YR 3.5/2 moist); loam (13% clay); common fine distinct, yellowish brown (10YR 5/8) Fe redox concentration and common fine distinct, white (7.5YR 8/1) mottles; massive; hard (dry) friable (moist) and slightly plastic (wet); common roots; few very fine, common fine, common medium, and few coarse pores; trace of gravel; pH 7.90; medium effervescence.

Uncoated grains in C2 affect matrix color.
Ant and worm activity common in C1 and C2.

Plot: 93PD56
Cross Section: Pecos25

Data Addendum 2 (continued).

Community Type: saltcedar/sparse (TAMPEN/SPARSE)
Location: Artesia

Classification: Typic Torrifluvent (TTF), very-fine, mixed, thermic, calcareous

C1 0 to 33 cm; light brown (7.5YR 6/4 dry); silt loam (15% clay), brown (7.5 4/3 moist); medium very fine platy; slightly hard (dry) friable (moist) slightly plastic (wet); few very fine, common fine, common medium, and common coarse roots; common very fine, common fine, common medium, and few coarse pores; pH 7.78; medium effervescence; conductivity 1.68 mS; diffuse irregular boundary.

C2 33 to 126 cm; dark reddish brown to reddish brown (5YR 3.5/3 moist); clay (75% clay); many fine prominent, white (10YR 8/1) and many medium distinct, brown (7.5YR 5/4) mottles; massive; very hard (dry) firm (moist) and slightly sticky (wet); few very fine, common fine, common medium, and common coarse roots; many very fine, many fine, and few coarse pores; trace of gravel; pH 7.71; medium effervescence.

Ant activity common in C1.
Sand lenses common in C2.

Plot: 93PD57
Cross Section: Black River1
Community Type: netleaf hackberry-Goodding's willow (CELRET-SALGOO)
Location: headwaters of the Black River

Classification: Mollic Fluvaquent (MFA), loamy-skeletal, mixed, thermic, calcareous

A1 0 to 39 cm; grayish brown (2.5Y 5/2 dry); silt loam (10% clay), very dark grayish brown (10YR 3/2 moist); common medium prominent, yellowish brown (10YR 5/8) Fe redox concentration mottles; massive; hard (dry) friable (moist) and plastic (wet); many very fine, many fine, few medium, and few coarse roots; common very fine, common fine, common medium, and few coarse pores; gravel 20% and cobble 40%; pH 7.49; medium effervescence; conductivity 2.96 mS; clear smooth boundary.

Cg1 39 to 43 cm; gray (2.5Y 6/1 dry); clay (55% clay); gray to dark gray (2.5Y 4.5/1) moist; massive; very hard (dry) very friable (moist) and slightly sticky (wet); many very fine, many fine, few medium, and few coarse roots; many very fine, common fine, common medium, and few coarse pores; gravel 15% and cobble 10%; pH 7.62; medium effervescence.

Water at 38 cm.
0 to 5 root layer.
Cg1 is saturated throughout.

Data Addendum 2 (continued).

Plot: 93PD60
Cross Section: Yeso Creek1
Community Type: seepwillow/alkali sacaton (BACEMO/SPOAIR); saltcedar (TAMPEN)
Location: Yeso Creek

Classification: Aeric Fluvaquent (AFA), coarse-loamy, mixed, thermic, calcareous

C1 0 to 22 cm; brown (7.5YR 4/2.5 moist); clay (75% clay); common fine distinct, pinkish white (7.5YR 8/2) and common coarse distinct, very dark gray (7.5YR 3/1) Mn redox concentration mottles; massive; hard (dry) firm (moist) and very plastic (wet); few very fine, common fine, many medium, and common coarse roots; many very fine, common fine, few medium, and few coarse pores; pH 8.18; medium effervescence; conductivity 7.56 mS; diffuse smooth boundary.

C2 22 to 54 cm; brown (7.5YR 4/3); sandy loam (17% clay); single grain; common medium distinct, strong brown (7.5YR 5/6) Fe redox concentration mottles; slightly hard (dry) friable (moist) and non-sticky (wet); common very fine, many fine, many medium, and few coarse roots; few very fine, many fine, many medium, and few coarse pores; pH 8.07; medium effervescence.

Uncoated grains in C2 affect matrix color.
Standing water at 42 cm.

Plot: 93PD62
Cross Section: no cross section
Community Type: Fremont cottonwood-Goodding's willow (POPFRE-SALGOO)
Location: Rattlesnake Spring

Classification: Typic Fluvaquent (TFA), loamy-skeletal, mixed, thermic, calcareous

Oe 0 to 2 cm; litter layer.

A1 0 to 6 cm; very dark grayish brown (10YR 3/2 dry); silt loam (8% clay), black (10YR 2/1) moist; weak fine sub-angular blocky; loose (dry) loose (moist) and non-plastic (wet); many

Data Addendum 2 (continued).

very fine, fine, medium and common coarse roots; common very fine, common pores; trace of gravel; pH 7.90; medium effervescence; clear conductivity 9.20; smooth boundary.

Cg1 6 to 74 cm; gray to grayish brown (2.5Y 5/1.5 moist); clay; massive; hard (dry) very friable (moist) and plastic (wet); many very fine, fine, medium, and common coarse roots; many very fine, common fine, few medium, and few coarse pores; gravel 25% and cobbles 5%; pH 7.68; medium effervescence; conductivity 1.04 mS.

Water at 65 cm.

Water seeping in from sides of pit.

Cg1 is saturated throughout.

Plot: 93PD63
Cross Section: Pecos26
Community Type: inland saltgrass-threesquare (DISSTR-SCIAME); saltcedar (TAMPEN)
Location: Scoggin Flat near Loving

Classification: Typic Fluvaquent (TFA), sandy-skeletal, mixed, thermic, calcareous

C1 0 to 4 cm; light gray (10YR 7/2.5 dry); silt loam (15% clay), light olive brown (2.5Y 5/3) moist; massive; hard (dry), friable (moist) and slightly plastic (wet); many very fine, many fine, common medium, and common few roots; common very fine, common fine, few medium, and few coarse roots; common very fine, common fine, few medium, and few coarse pores; gravel 5% and a trace of cobbles; pH 8.04; medium effervescence; conductivity 16.32 mS; clear smooth boundary.

C2 4 to 21 cm; light yellowish brown to yellowish brown (10YR 5.5/4 moist); medium sand; single grain; many medium distinct, strong brown (7.5YR 5/6) Fe redox concentration mottles; loose (dry) loose (moist) and non-plastic (wet); many very fine, many fine, common medium, and few coarse roots; few very fine, many fine, common medium, and common coarse pores; gravel 15% and cobble 5%; pH 8.03; medium effervescence; conductivity 4.44 mS; clear smooth boundary.

C3 21 to 64 cm; dark grayish brown (10YR 4/2 moist); sandy loam (12% clay); loose to soft (dry) friable (moist) and slightly plastic (wet); many very fine, many fine, few medium, and few coarse roots; few very fine, common fine, many medium, and few coarse pores; gravel 30% and cobble 15%; pH 7.81; medium effervescence; clear smooth boundary.

Cg1 64 to 67 cm; very dark gray (2.5Y 4/1 moist); sandy clay (45% clay); massive; medium common faint, dark grayish brown (2.5Y 4/2) mottles; slightly hard (dry) very plastic (moist) and plastic (wet); common very fine, common fine, few medium, and few coarse roots; common very fine, common fine, common medium, and few coarse pores; gravel 5% and a trace of cobble; pH 7.88; medium effervescence.

Data Addendum 2 (continued).

Water at 64 cm.
Water seeping into pit at 64 cm.
Uncoated grains in C2 and C3 affect matrix color.

Plot: 93PD66
Cross Section: Black River3
Community Type: Fremont cottonwood-Goodding's willow (POPFRE-SALGOO)
Location: Black River south of Blue Spring confluence

Classification: Typic Fluvaquent (TFA), sandy-skeletal, mixed, thermic, calcareous

Oi 0 to 2 cm; graminoid and willow litter.

C1 0 to 22 cm; brown to yellowish brown (10YR 5/3.5 moist); sandy loam (8% clay); massive; dark many coarse faint, grayish brown (10YR 4/2) Mn redox concentration, common fine distinct, strong brown (7.5YR 5/6) Fe redox concentration, and common fine distinct, very pale brown (10YR 8/2) mottles; hard (dry) friable (moist) and slightly plastic (wet); many roots; few very fine, many fine, common medium, and few coarse pores; trace of gravel, cobble, and stones; pH 8.09; medium effervescence; conductivity 6.35 mS.

Cg1 22 to 44 cm; dark gray (2.5Y 4/1 moist) coarse sand; single grain; loose (dry) loose (moist) and non-plastic (wet); many very fine, many fine, common medium, and common coarse roots; few very fine, many fine, many medium, and common coarse pores; gravel 60%, cobble 15%, and a trace of stones; pH 7.65; medium effervescence.

Water at 34 cm.
Uncoated grains in Cg1 affect matrix color.
Cg1 is saturated throughout.

Plot: 93NR02
Cross Section: Playa1
Community Type: longstem spikerush/blueweed sunflower (ELEMAC/HELCIL)
Location: Cocklebur Lakes East

Classification: Typic Haplotorrert (THT), very fine, mixed, calcareous, thermic

Oi 0 to 1 cm; litter

C1 0 to 89 cm; brown (7.5YR 4/2 moist); clay (70% clay); common medium faint, brown

Data Addendum 2 (continued).

(7.5YR 4/4) and common fine prominent, pinkish white (7.5 YR 8/2) mottles; massive; very hard (dry) very friable (moist) and very plastic (wet); many very fine, common fine, common medium, and few coarse roots; many very fine, common fine, few medium, and few coarse pores; pH 7.75; conductivity 2.48 mS; medium effervescence.

Plot: 93NR03
Cross Section: Playa1
Community Type: longstem spikerush/scurfy sida (ELEMAC/SIDLEP)
Location: Cocklebur Lakes East

Classification: Typic Haplotorrert (THT), very fine, mixed, calcareous, thermic

C1 0 to 81 cm; dark reddish brown (5YR 3/3 moist); clay (80% clay); massive; very hard (dry) very friable (moist) and very plastic (wet); many very fine, many fine, and few coarse roots; many very fine, many fine, few medium, and few coarse pores; pH 7.81; conductivity 1.5 mS; medium effervescence.

Horizon moist but not saturated.

Plot: 93NR04
Cross Section: Playa2
Community Type: salt cedar/alkali sacaton (TAMPEN/SPOAIR)
Location: Salt Lake

Classification: Aquic Camborthid (ACO), coarse-loamy, over very fine, over coarse-loamy, over very fine; mixed, nonacid, thermic

A1 0 to 41 cm; yellowish red (5YR 4/6 moist); loamy sand (7% clay); fine weak subangular blocky; soft (dry) loose (moist) and non-plastic (wet); many very fine, many fine, many medium, and few coarse roots; few very fine, common fine, common medium, and few coarse pores; pH 8.53; conductivity 12.03 mS; medium effervescence; clear smooth boundary.

Bs1 41 to 58 cm; red (2.5YR 4/6 moist); sandy clay (50% clay); massive; soft (dry) loose (moist) and slightly plastic (wet); many very fine, many fine, common medium, and few coarse roots; few very fine, common fine, few medium, and few coarse pores; pH 8.37; medium effervescence; gradual wavy boundary.

C1 58 to 68 cm; yellowish red (5YR 5/8 ped/moist); loamy sand (5% clay), red (2.5YR 4.5/6 rub/moist); fine weak sub-angular blocky; soft (dry) very friable (moist) and non-

Data Addendum 2 (continued).

plastic (wet); common very fine, common fine, few medium, and few coarse roots; few very fine, many fine, few medium, and few coarse pores; pH 8.43; no effervescence; gradual wavy boundary.

C2 68 to 85 cm; red (2.5YR 4/6 moist); sandy loam (12% clay); weak medium sub-angular blocky; slightly hard (dry) friable (moist) and non-plastic (wet); common very fine, common fine, few medium, and few coarse roots; few very fine, common fine, common medium, and few coarse pores; pH 8.28; no effervescence; broken irregular boundary.

Cg1 85 to 106 cm; light yellowish brown (2.5YR 6/3 ped/moist); clay (60% clay), light olive brown (2.5Y 5/3 rub/moist); common medium distinct, light gray to gray (N 6.5) mottles; massive; hard (dry) very friable (moist) and very plastic (wet); few very fine, few fine, few medium, and few coarse roots; many very fine, common fine, few medium, and few coarse pores; pH 8.21; medium effervescence.

Matrix color in C3 is affected by uncoated grains.
Dark reddish brown (2.5YR-3.5/YR) clay lamellae common in C3.
Ant pores common in C1.

Plot: 93NR05
Cross Section: Playa3
Community Type: longstem spikerush-vine mesquite (ELEMAC-PANOBT); poverty sumpweed (IVAAXI) phase
Location: Curlew Lake

Classification: Typic Haplotorrert (THT), very fine, mixed, calcareous, thermic

Css1 0 to 94 cm; reddish brown (5YR 4/4 moist); clay (75% clay); few fine prominent white (5YR 8/1) mottles; medium fine sub-angular blocky; very hard (dry) firm (moist) and sticky (wet); common very fine, common fine, few medium, and few coarse roots; many very fine, few fine, few medium, and few coarse pores; pH 8.17; conductivity 7.88 mS; medium effervescence.

Extensive oil development.

Plot: 93NR07
Cross Section: Playa5
Community Type: salt cedar/buffalograss (TAMPEN/BUCDAC)
Location: North Ballard Hill

Classification: Typic Haplotorrert (THT), very fine, mixed, calcareous, thermic

C1 0 to 16 cm; brown (7.5YR 4/4 moist); clay (80% clay); massive; hard (dry) firm (moist) and

Data Addendum 2 (continued).

plastic (wet); many very fine, common fine, few medium, and few coarse roots; many very fine, many fine, few medium, and few coarse pores; pH 7.85; conductivity 2.85 mS; medium effervescence; clear smooth boundary.

C2 16 to 95 cm; brown (7.5YR 4/3 moist); clay (55% clay); many medium prominent, pink (7.5YR 8/3) mottles; weak medium sub-angular blocky; hard (dry) very friable (moist) and sticky (wet); many very fine, common fine, few medium, and few coarse roots; many very fine, common fine, few medium, and few coarse pores; pH 7.72; medium effervescence.

Plot: 93NR08
Cross Section: Playa5
Community Type: alkali sacaton-buffalograss (SPOAIR-BUCDAC)
Location: North Ballard Hill

Classification: Typic Camborthid (TCO), fine-loamy, mixed, calcareous, thermic

A1 0 to 17 cm; light brown (7.5YR 6/4 ped/moist); silt loam (10% clay), brown (7.5YR 5/4 rub/moist); single grain; loose (dry) friable (moist) and slightly plastic (wet); common very fine, many fine, few medium, and few coarse roots; few very fine, many fine, few medium, and few coarse pores; pH 7.91; conductivity 2.28 mS; medium effervescence; abrupt smooth boundary.

C1 17 to 78 cm; strong brown (7.5YR 5/6 ped/moist); silt loam (8% clay), brown (7.5YR 5/4 rub/moist); many medium distinct, brown (7.5YR 4/3) and many fine distinct, pinkish white (7.5YR 8/2) mottles; weak medium platy; soft (dry) friable (moist) and slightly plastic (wet); common very fine, common fine, few medium, and few coarse roots; common very fine, many fine, few medium, and few coarse pores; pH 7.71; medium effervescence.

C1 layer very difficult to excavate.
Two pink (7.5YR 7/3) lenses occur in A1.

Plot: 93NR09
Cross Section: Playa6
Community Type: longstem spikerush/tumblegrass (ELEMAC/SCHPAN)
Location: Archuleta Creek

Classification: Typic Haplotorrert (THT), very fine, mixed, nonacid, mesic

Css1 0 to 25 cm; dark brown (7.5YR 3/2 ped/moist); clay (60% clay), brown to dark brown (7.5YR 3.5/2 rub/moist); massive; hard (dry) very friable (moist) and sticky (wet); few very fine, few fine, few medium, and few coarse roots; common very fine, common fine,

Data Addendum 2 (continued).

few medium, and few coarse pores; trace of cobbles; pH 7.42; conductivity .92 mS; no effervescence; diffuse smooth boundary.

C1 25 to 85 cm; dark brown (7.5YR 3/2.5 ped/moist); clay (60% clay), dark brown to brown (7.5YR 3.5/2 rub/moist); many, medium, prominent, pink (7.5YR 8/3) mottles; weak fine platy; very hard (dry) firm (moist) and sticky (wet); few very fine, few fine, few medium, and few coarse roots; many very fine, common fine, few medium, and few coarse pores; trace of gravel; pH 7.37; no effervescence.

Cobbles and stones are common in playa floodplain.

Plot: 93NR010
Cross Section: Playa7
Community Type: vine mesquite/blueweed sunflower (PANOBT/HELCIL)
Location: Arroyo Serrano

Classification: Typic Haplotorrert (THT), very fine, mixed, nonacid, mesic

Oi 0 to 3 cm; organic matter

A1 0 to 7 cm; brown (7.5YR 4/3 ped/moist); clay (50% clay), dark brown to brown (7.5YR 3.5/2 rub/moist); common medium distinct, very dark gray (7.5YR 3/1) mottles; massive; soft (dry) very friable (moist) and very plastic (wet); many very fine, many fine, few medium, and few coarse roots; many very fine, many fine, few medium, and few coarse pores; pH 7.31; conductivity .84 mS; traces of gravel and cobbles; no effervescence; and gradual smooth boundary.

C1 7 to 102 cm; brown (7.5YR 4/2 ped/moist); clay (70% clay), brown (7.5YR 4/3 rub/moist); weak fine sub-angular blocky; hard (dry) firm (moist) and plastic (wet); many very fine, many fine, few medium, and few coarse roots; many very fine, common fine, few medium, and few coarse pores; pH 7.48; no effervescence.

Playa surface undulating.

DATA ADDENDUM 3.

Diagnostic properties of soils classified in the Pecos River Basin from Order to Family Classes. Modified from Soil Taxonomy (Soil Survey Staff 1988).

CLASSIFICATION	DESCRIPTION
ORDER	
ENTISOLS	newly formed soils that lack pedogenic horizons.
SUBORDER	
A. Aquents	permanently saturated or have aquic conditions* between 40-50 cm of the soil surface.
GREAT GROUP	
1. Psammaquents	have a sandy texture between 25-100 cm.
SUBGROUP	
a. Typic Psammaquents**	wet sandy soils.
GREAT GROUP	
2. Fluvaquents	have an irregular decrease of carbon content with depth due to alluvial deposits with slope is less than 25%.
SUBGROUP	
a. Sulfic Fluvaquents**	have sulfidic materials within 100 cm of the surface.
b. Typic Fluvaquents**	the wettest of the subgroup.
c. Aeric Fluvaquents**	are lightest in color and the driest of the Fluvaquents.
d. Mollic Fluvaquents**	have a thick, dark organic layer at the surface.
GREAT GROUP	
3. Endoaquents	aquents that do not have the characteristics of the Fluvaquents or Psammaquents.
SUBGROUP	
a. Mollic Endoaquents**	have a thick, dark, organic layer at the surface.
b. Typic Endoaquents**	other Endoaquents.
c. Aeric Endoaquents**	are lighter in color and driest of the Endoaquents.
SUBORDER	
B. Psamments	have a sandy texture between 25-100 cm of the soil surface.
GREAT GROUP	
1. Ustipsamments	sandy soils with a limited moisture regime but occurs during active plant growth.
SUBGROUP	
a. Aquic Ustipsamment**	have aquic conditions and are saturated within 100. cm of the surface for some time during the year.
b. Oxyaquic Ustipsamment	saturated within 100 cm for 1 month during most years.

Data Addendum 3 (continued).

SUBORDER

C. Fluvents . . . . . have an irregular decrease in carbon content with depth due to alluvial deposits with slopes less than 25%.

GREAT GROUP

1. Ustifluvents . . . . . have a limited moisture regime that occurs during active plant growth.

SUBGROUP

a. Oxyaquic Ustifluvent . . . . saturated within 150 cm for 1 month during most years.
b. Mollic Ustifluvent. . . . . have a thick, dark, organically rich layer at the surface.
c. Typic Ustifluvent** . . . . . do not have aquic conditions within 50 cm of the surface.

GREAT GROUP

2. Udifluvents . . . . . are moist throughout (for most of the year).

SUBGROUP

a. Mollic Udifluvent** . . . . . have a thick, dark, organically rich layer at the surface.
b. Oxyaquic Udifluvents . . . . saturated within 100 cm for 1 month in most years.

GREAT GROUP

3. Torrifluvents . . . . . alluvial soils that are hot and dry.

SUBGROUP

a. Aquic Torrifluvent** . . . . . have aquic conditions within 100 cm of the surface
b. Oxyaquic Torrifluvents . . . . . are saturated within 100 cm for 1 month in most years
c. Typic Torrifluvents . . . . . are the driest of the subgroup.

ORDER

INCEPTISOLS . . . . . are moderately developed and display some pedogenic horizons; do not have a dry moisture regime.

SUBORDER

A. Ochrepts . . . . . have a surface horizon that is light in color (Ochric epipedon), does not have rock structure and is not fresh sediment.

GREAT GROUP

1.Dystochrept . . . . . have a moderate moisture regime and cool temperature regime; do not have carbonates, a duripan layer, or a sulfuric horizon.

SUBGROUP

a. Aquic Dystrochrept** . . . . . have aquic conditions within 60 cm.
b. Fluventic Dystrochrept. . . . . have an irregular decrease in organic carbon and a slope of less than 25%.

ORDER

VERTISOLS. . . . . commonly found in upland depressions or playas; are fine-textured, have an undulating surface when moist and develop deep cracks when dry.

SUBORDER

A. Torrerts . . . . . may have closed cracks due to animal activity, wind, rain;

Data Addendum 3 (continued).

cracks do not remain closed for more than two months.

GREAT GROUP

1. Haplotorrert . . . . . do not have a salic, gypsic or calcic horizon.

SUBGROUP

a. Typic Haplotorrert** . . . . . are fine-textured, dark and deep.

ORDER

ARIDISOLS . . . . . are hot and dry soils that support xerophytic vegetation; pedogenic horizons form as a result of the movement and concentration of carbonates, salts, and clays.

SUBORDER

A. Orthids . . . . . do not have a subsurface horizon that is saline (Natric horizon) or formed by the illuvation of clays (Argillic horizon).

GREAT GROUP

1. Camborthids. . . . . do not have a duripan, calcic, or gypsic layer.

SUBGROUP

a. Aquic Camborthid** . . . . . have aquic conditions (reduced matrix) within 100 cm of the soil surface.

b. Typic Camborthid . . . . . do not have any unique horizons or other identifying physical characteristics.

FAMILY CLASSES+

PARTICLE SIZE (determined from 25-100 cm)

Fragmental: any soil where the rock fragments (>2 mm) predominate (90% or more). Particles <2 mm account for up to 10% of the total volume.

Sandy-skeletal: any soil where 35% or more of the volume are rock fragments with a sandy texture. Particles <2 mm account for 10% or more of the total volume.

Loamy-skeletal: any soil where 35% or more of the volume are rock fragments, with a texture of fine sand or finer. Particles <2 mm account for 10% or more of the total volume.

Clayey-skeletal: any soil where 35% or more of the volume are rock fragments with 10% or more particles <2 mm. Clay particles represent 35% (by weight) or more the total weight.

Sandy: any soil with less than 35% rock fragments, with a texture of sand or loamy sand. The sandy family class in any Psamment soil is omitted. By definition, a Psamment is sandy, so the designation is omitted.

Coarse-loamy: any soil with 15% or more (by weight) sand and less than 18% (by weight) clay. Their texture is sandy loam.

Fine-loamy: any soil with 15% or more (by weight) sand and 18 to 35% (by weight) clay. They are sandy clay soils.

Coarse-silty: any soil with less than 15% (by weight) sand and less than 18% (by weight) clay. They are silty loam soils.

Fine-silty: any soil with less than 15% (by weight) sand and 18 to 35% (by weight) clay. They are silty clay loam soils.

Fine: any soil with 35 to 60% (by weight) clay. In Vertisols, 30 to 60% clay is required.

Very-fine: any soil with 60% (by weight) clay.

Data Addendum 3 (continued).

CALCAREOUS AND REACTION CLASSES

Calcareous: all horizons effervesce with 0.1 M HCl.
Nonacid: in 0.01 M CaCl (2:1), the pH is 5.0 or more in some or all horizons.
Acid: in 0.01 M CaCl (2:1), the pH is <5.0 in all horizons.

TEMPERATURE CLASSES[++]

Frigid: lower than 8^{o} C.
Mesic: 8^{o} C to 15^{o} C.
Thermic: 15^{o} C to 22^{o} C.

[*]Aquic conditions are redoximorphic features which include: redox concentrations (iron or manganese oxides), redox depletions (gray or blue mottles areas where Fe-Mn oxides have been reduced), and a reduced matrix (gley) (Vepraskas 1992). The presence of aquic conditions is indicative of longer periods of saturation. Oxyaquic subgroups have shorter periods of saturation.

[**]Hydric soils as defined by the Corps of Engineers Wetlands Delineation Manual (1987).

[+]Only the family classes that were used are described. All mineralogy was mixed.

[++]Generally, a frigid temperature class was assigned to areas containing Ponderosa pine and blue spruce; a mesic temperature class was assigned to areas with pinon pine and juniper; and thermic temperature classes were assigned to areas containing desert scrub.

DATA ADDENDUM 4.

Plant species list for the Pecos River Basin including botanical nomenclature following Martin and Hutchins (1980) and common names following Beetle (1970) with modifications.

Scientific Name	Common Name	Acronym
TREES		
Abies concolor - yng regen	white fir	ABICON1
Abies concolor - mature	white fir	ABICON3
Acer negundo - yng regen	boxelder	ACENEG1
Acer negundo - adv regen	boxelder	ACENEG2
Acer negundo - mature	boxelder	ACENEG3
Alnus oblongifolia - yng regen	New Mexico alder	ALNOBL1
Alnus oblongifolia - adv regen	New Mexico alder	ALNOBL2
Alnus oblongifolia - mature	New Mexico alder	ALNOBL3
Celtis reticulata	netleaf hackberry	CELRET
Elaeagnus angustifolia - adv regen	Russian olive	ELAANG2
Elaeagnus angustifolia - mature	Russian olive	ELAANG3
Juglans major - mature	Arizona walnut	JUGMAJ3
Juniperus monosperma	oneseeded juniper	JUNMON
Juniperus monosperma - mature	oneseeded juniper	JUNMON3
Juniperus scopulorum - yng regen	Rocky Mountain juniper	JUNSCO1
Juniperus scopulorum - adv regen	Rocky Mountain juniper	JUNSCO2
Juniperus scopulorum - mature	Rocky Mountain juniper	JUNSCO3
Moras alba - adv regen	white mulberry	MORALB2
Picea pungens - yng regen	blue spruce	PICPUN1
Picea pungens - adv regen	blue spruce	PICPUN2
Picea pungens - mature	blue spruce	PICPUN3
Pinus edulis - adv regen	pinyon pine	PINEDU2
Pinus edulis - mature	pinyon pine	PINEDU3
Pinus ponderosa - adv regen	ponderosa pine	PINPON2
Pinus ponderosa - mature	ponderosa pine	PINPON3
Populus x acuminata - mature	lanceleaf cottonwood	POPACU3
Populus angustifolia - yng regen	narrowleaf cottonwood	POPANG1
Populus angustifolia - adv regen	narrowleaf cottonwood	POPANG2
Populus angustifolia - mature	narrowleaf cottonwood	POPANG3
Populus fremontii	Fremont cottonwood	POPFRE
Populus fremontii - yng regen	Fremont cottonwood	POPFRE1
Populus fremontii - adv regen	Fremont cottonwood	POPFRE2
Populus fremontii - mature	Fremont cottonwood	POPFRE3
Populus tremuloides - adv regen	quaking aspen	POPTRE2
Populus tremuloides - mature	quaking aspen	POPTRE3
Pseudotsuga menziesii - mature	Douglas fir	PSEMEN3
Pyrus malus	pear	PYRMAL
Quercus gambelii - yng regen	Gambel's oak	QUEGAM1
Quercus gambelii - adv regen	Gambel's oak	QUEGAM2
Salix amygdaloides - adv regen	peachleaf willow	SALAMY2
Salix babylonica - mature	weeping willow	SALBAB3
Salix gooddingii	Goodding's willow	SALGOO
Salix gooddingii - adv regen	Goodding's willow	SALGOO2
Salix gooddingii - mature	Goodding's willow	SALGOO3
Ulmus pumila - yng regen	Siberian elm	ULMPUM1
Ulmus pumila - mature	Siberian elm	ULMPUM3
SHRUBS		

Data Addendum 4 (continued).

Scientific Name	Common Name	Acronym
Acacia neovernicosa	acacia	ACANEO
Artemisia bigelovii	Bigelow sagebrush	ARTBIG
Artemisia filifolia	sand sagebrush	ARTFIL
Artemesia spp.	sagewort/wormwood	ARTSPP
Atriplex canescens	fourwing saltbush	ATRCAN
Atriplex spp.	saltbush	ATRIPL
Baccharis emoryi	seepwillow	BACEMO
Baccharis glutinosa	groundsel-tree	BACGLU
Berberis fendleri	Colorado barberry	BERFEN
Berberis repens	creeping barberry	BERREP
Berberis trifoliolata	agarito barberry	BERTRI
Ceanothus fendleri	Fendler ceanothus	CEAFEN
Cercocarpus montanus	true mountain mahogany	CERMON
Chilopsis linearis	common desert willow	CHILIN
Chrysothamnus nauseosus	rubber rabbitbrush	CHRNAU
Chrysothamnus pulchellus	southwest rabbitbrush	CHRPUL
Chrysothamnus viscidiflorus	Douglas rabbitbrush	CHRVIS
Cornus stolonifera	redosier dogwood	CORSTO
Fallugia paradoxa	apache plume	FALPAR
Flourensia cernua	American tarbush	FLOCER
Gutierrezia sarothrae	broom snakeweed	GUTSAR
Juglans microcarpa	river walnut	JUGMIC
Juniperus communis	dwarf juniper	JUNCOM
Larrea tridentata	creosotebush	LARTRI
Lonicera involucrata	bearberry honeysuckle	LONINV
Lycium berlandieri	berlander wolfberry	LYCBER
Lycium pallidum	pale wolfberry	LYCPAL
Opuntia imbricata	walkingstick cholla	OPUIMB
Opuntia kleiniae	candle cholla	OPUKLE
Opuntia leptocaulis	tesajo	OPULEP
Opuntia phaeacantha	prickly pear	OPUPHA
Potentilla fruticosa	shrubby cinquefoil	POTFRU
Prosopis glandulosa	honey mesquite	PROGLA
Prunus virginiana	common chokecherry	PRUVIR
Quercus gambelii	gambel's oak	QUEGAM
Quercus undulata	wavyleaf oak	QUEUND
Rhus copallina	flameleaf sumac	RHUCOP
Rhus microphylla	littleleaf sumac	RHUMIC
Rhus trilobata	skunkbush sumac	RHUTRI
Ribes americanum	American black currant	RIBAME
Ribes inerme	whitestem currant	RIBINE
Ribes leptanthum	trumpet gooseberry	RIBLEP
Ribes mescalerium	Mescalero currant	RIBMES
Robinia neomexicana	New Mexico locust	ROBNEO
Rosa woodsii	woods rose	ROSWOO
Rubus deliciosus	Boulder raspberry	RUBDEL
Rubus leucodermis	whitebark raspberry	RUBLEU
Rubus neomexicanus	New Mexican raspberry	RUBNEO
Rubus strigosus	blackberry	RUBSTR
Salix bebbiana	Bebb willow	SALBEB
Salix boothii	Booth willow	SALBOO
Salix caudata	whiplash willow	SALCAU
Salix exigua	coyote willow	SALEXI
Salix interior	sandbar willow	SALINT
Salix irrorata	bluestem willow	SALIRR
Salix lasiandra	pacific willow	SALLAS
Salix lutea	yellow willow	SALLUT
Salix monticola	willow	SALMON

Data Addendum 4 (continued).

Scientific Name	Common Name	Acronym
Salix spp.	willow	SALSPP
Salix subcoerulea	blue willow	SALSUB
Salix taxifolia	yewleaf willow	SALTAX
Symphoricarpos oreophilus	mountain snowberry	SYMORE
Tamarix gallica	French tamarisk	TAMGAL
Tamarix pentandra	saltcedar	TAMPEN
Toxicodendron radicans	poison ivy	TOXRAD
Vitis arizonica	canyon grape	VITARI
Vitis vulpina	riverbank grape	VITVUL
Yucca elata	soaptree yucca	YUCELA
Yucca glauca	small soapweed	YUCGLA
GRAMINOIDS		
Agropyron intermedium	intermediate wheatgrass	AGRINT
Agropyron repens	quackgrass	AGRREP
Agropyron smithii	western wheatgrass	AGRSMI
Agropyron trachycaulum	slender wheatgrass	AGRTRA
Agrostis alba	redtop bent	AGRALB
Agrostis scabra	rough bent	AGRSCA
Agrostis semiverticillata	water bent	AGRSEM
Agrostis stolonifera	carpet bent	AGRSTO
Andropogon glomeratus	bushy bluestem	ANDGLO
Aristida divaricata	threeawngrass	ARIDIV
Aristida purpurea	purple threeawn	ARIPUR
Aristida ternipes var. hamulosa	spider threeawn	ARITERH
Avena fatua	wild oats	AVEFAT
Beckmannia syzigachne	American sloughgrass	BECSYZ
Bothriochloa saccharoides	silver sourgrass	BOTSAC
Bouteloua barbatus	sixweeks grama	BOUBAR
Bouteloua curtipendula	sideoats grama	BOUCUR
Bouteloua eriopoda	black grama	BOUERI
Bouteloua gracilis	blue grama	BOUGRA
Bouteloua hirsuta	hairy grama	BOUHIR
Bromus carinatus	California brome	BROCAR
Bromus catharticus	rescue grass	BROCAT
Bromus ciliatus	fringed brome	BROCIL
Bromus inermis	smooth brome	BROINE
Bromus japonicus	Japanese brome	BROJAP
Bromus tectorum	cheatgrass	BROTEC
Buchloe dactyloides	buffalograss	BUCDAC
Calamagrostis canadensis	Canada reedgrass	CALCAN
Calamovilfa longifolia	prairie sandreed	CALLON
Carex aquatilis	water sedge	CARAQU
Carex disperma	softleaved sedge	CARDIS
Carex emoryi	Emory sedge	CAREMO
Carex festivella	ovalhead sedge	CARFES
Carex geophila	peanut sedge	CARGEO
Carex hystricina	bottlebrush sedge	CARHYS
Carex microptera	smallwing sedge	CARMIC
Carex nebraskensis	Nebraska sedge	CARNEB
Carex occidentalis	western sedge	CAROCC
Carex praegracilis	fieldclustered sedge	CARPRA
Carex rostrata	beaked sedge	CARROS1
Carex simulata	analogne sedge	CARSIM
Carex stipata	owlfruit sedge	CARSTI
Carex vulpinoidea	fox sedge	CARVUL
Cenchrus incertus	field sandbur	CENPAU
Chara spp.	stonewort	CHASPP

Data Addendum 4 (continued).

Scientific Name	Common Name	Acronym
Chloris cucullata	hooded windmillgrass	CHLCUC
Chloris verticillata	tumble windmillgrass	CHLVER
Chloris virgata	showy chloris	CHLVIR
Cinna latifolia	drooping woodreed	CINLAT
Cladium jamaicense	sawgrass	CLAJAM
Cortaderia selloana	selloa pampasgrass	CORSEL
Cynodon dactylon	Bermudagrass	CYNDAC
Cyperus esculentus	chufa flatsedge	CYPESC
Cyperus fendlerianus	fendler flatsedge	CYPFEN
Cyperus uniflorus	oneflower flatsedge	CYPUNI
Dactylis glomerata	orchardgrass	DACGLO
Deschampsia caespitosa	tufted hairgrass	DESCAE
Distichlis stricta	inland saltgrass	DISSTR
Echinochloa crus-galli	barnyard grass	ECHCRU
Eleocharis atropurpurea	spikerush	ELEATR
Eleocharis macrostachya	longstem spikerush	ELEMAC
Elymus canadensis	Canada wildrye	ELYCAN
Elymus glaucus	blue wildrye	ELYGLA
Eragrostis cilianensis	stinkgrass	ERACIL
Erioneuron pulchellum	fluffgrass	ERIPUL
Festuca arundinacea	tall fescue	FESARU
Festuca pratensis	meadow fescue	FESPRA
Glyceria elata	tall mannagrass	GLYELA
Glyceria striata	fowl mannagrass	GLYSTR
Hilaria jamesii	galleta	HILJAM
Hilaria mutica	tabosa galleta	HILMUT
Hordeum jubatum	foxtail barley	HORJUB
Hordeum pusillum	little barley	HORPUS
Juncus acuminatus	tapertip rush	JUNACU
Juncus balticus	Baltic rush	JUNBAL
Juncus bufonius	toad rush	JUNBUF
Juncus longistylis	longstyle rush	JUNLON
Juncus saximontanus	Rocky Mountain rush	JUNSAX
Juncus tenuis	poverty rush	JUNTEN
Juncus torreyi	Torrey rush	JUNTOR
Koeleria cristata	prairie junegrass	KOECRI
Leersia oryzoides	rice cutgrass	LEEORY
Leptoloma cognatum	fall witchgrass	LEPCOG
Lolium multiflorum	Italian darnel	LOLMUL
Lycurus phleoides	wolftail	LYCPHL
Muhlenbergia arenacea	ear muhly	MUHARE1
Muhlenbergia arenicola	sand muhly	MUHARE
Muhlenbergia asperifolia	alkali muhly	MUHASP
Muhlenbergia porteri	bush muhly	MUHPOR
Muhlenbergia racemosa	green muhly	MUHRAC
Muhlenbergia rigens	deergrass	MUHRIG
Muhlenbergia wrightii	spike muhly	MUHWRI
Oryzopsis hymenoides	Indian ricegrass	ORYHYM
Panicum capillare	witchgrass	PANCAP
Panicum hallii	Hall's panicgrass	PANHAL
Panicum obtusum	vine mesquite	PANOBT
Panicum virgatum	switchgrass	PANVIR
Paspalum distichum	knotgrass	PASDIS
Phalaris arundinacea	reed canarygrass	PHAARU
Phleum alpinum	alpine timothy	PHLALP
Phleum pratensis	common timothy	PHLPRA
Phragmites australis	common reed	PHRAUS
Poa compressa	Canada bluegrass	POACOM

Data Addendum 4 (continued).

Scientific Name	Common Name	Acronym
Poa fendleriana	mutton bluegrass	POAFEN
Poa palustris	fowl bluegrass	POAPAL
Poa pratensis	Kentucky bluegrass	POAPRA
Poa spp.	bluegrass	POASPP
Polypogon monspeliensis	rabbitfoot grass	POLMON
Schedonnardus paniculatus	tumblegrass	SCHPAN
Schizachyrium scoparium	little bluestem	SCHSCO
Scirpus acutus	tulegrass	SCIACU
Scirpus americanus	threesquare	SCIAME
Scirpus maritimus	saltmarsh bulrush	SCIMAR
Scirpus microcarpus	panicled bulrush	SCIMIC
Scirpus olneyi	Olney bulrush	SCIOLN
Scirpus validus	softstem bulrush	SCIVAL
Scleropogon brevifolius	burrograss	SCLBRE
Setaria leucopila	tall bristlegrass	SETLEU
Setaria pumila	bristlegrass	SETPUM
Setaria viridis	green bristlegrass	SETVIR
Sitanion hystrix	bottlebrush squirreltail	SITHYS
Sorghastrum nutans	yellow indiangrass	SORNUT
Sporobolus airoides	alkali sacaton	SPOAIR
Sporobolus asper	tall dropseed	SPOASP
Sporobolus contractus	spike dropseed	SPOCON
Sporobolus cryptandrus	sand dropseed	SPOCRY
Sporobolus flexuosus	mesa dropseed	SPOFLE
Sporobolus wrightii	Wright sacaton	SPOWRI
Stipa robusta	sleepygrass	STIROB
Tridens albescens	white tridens	TRIALB
Trisetum montanum	Rocky Mountain trisetum	TRIMON
FORBS		
Achillea millefolium	common yarrow	ACHMIL
Aconitum columbianum	Columbia monkshood	ACOCOL
Actaea arguta	western baneberry	ACTARG
Adiantum nigrum	maidenhair fern	ADINIG
Agrimonia striata	roadside agrimony	AGRSTR
Allionia incarnata	trailing allionia	ALLINC
Allium cernuum	nodding onion	ALLCER
Allium spp.	onion	ALLSPP
Amaranthus retroflexus	redroot pigweed	AMARET
Amaranthus spp.	pigweed	AMARAN
Ambrosia artemisiifolia	common ragweed	AMBART
Ambrosia psilostachya	western ragweed	AMBPSI
Anemone cylindrica	candle anemone	ANECYL
Antennaria umbrinella	umber pussytoes	ANTUMB
Aphanostephus skirrhobasis	Arkansas dozedaisy	APHSKI
Apocynum cannabinum	indianhemp dogbane	APOCAN
Arabis drummondii	Drummond rockcress	ARADRU
Artemisia dracunculus	tarragon sagewort	ARTDRA1
Artemisia filifolia	sand sagebrush	ARTFIL
Artemisia franserioides	ragweed sagewort	ARTFRA
Artemisia frigida	fringed sagewort	ARTFRI
Artemisia ludoviciana	Louisiana sagewort	ARTLUD
Asclepias latifolia	broadleaf milkweed	ASCLAT
Asclepias spp.	milkweed	ASCSPP
Asclepias subverticillata	westernwhorled milkweed	ASCSUB
Asparagus officinalis	garden asparagus	ASPOFF
Aster ericoides	heath aster	ASTERI
Aster foliaceus	leafybract aster	ASTFOL

Data Addendum 4 (continued).

Scientific Name	Common Name	Acronym
Aster spp.	aster	ASTSPP
Bacopa rotundifolia	water hyssop	BACROT
Barbarea orthocerus	American wintercress	BARORT
Berula erecta	stalky berula	BERERE
Besseya plantaginea	plantain kittentails	BESPLA
Bidens cernua	nodding beggarticks	BIDCER
Brassica juncea	Indian mustard	BRAJUN
Calylophus hartwegii	evening primrose	CALHAR
Campanula rotundifolia	bluebell bellflower	CAMROT
Capsella bursa-pastoris	shepherdspurse	CAPBUR
Cardamine cordifolia	heartleaf bittercress	CARCOR
Cardaria draba	pepperweed whitetop	CARDRA
Cassia roemeriana	two-leaved senna	CASROE
Castilleja lineata	Indian paintbrush	CASLIN
Centaurium calycosum	Arizona centaury	CENCAL
Centaurium texense	Lady Bird's centaury	CENTEX
Cerastium arvense	starry cerastium	CERARV
Cerastium nutans	nodding cerastium	CERNUT
Chenopodium albescens	goosefoot	CHEALB1
Chenopodium album	lambsquarters	CHEALB
Chenopodium berlandieri	pitseed goosefoot	CHEBER
Chenopodium fremontii	Fremont goosefoot	CHEFRE
Chenopodium murale	nettleleaf goosefoot	CHEMUR
Chrysanthemum leucanthemum	oxeyedaisy chrysanthemum	CHRLEU
Chrysopsis canescens	golden aster	CHRCAN
Cichorium intybus	common chicory	CICINT
Cicuta douglasii	Douglas waterhemlock	CICDOU
Circaea alpina	alpine circaea	CIRALP
Cirsium arvense	Canada thistle	CIRARV
Cirsium neomexicanum	New Mexican thistle	CIRNEO
Cirsium ochrocentrum	yellow thistle	CIROCH
Cirsium pallidum	thistle	CIRPAL
Cirsium spp.	thistle	CIRSPP
Cirsium vulgare	bull thistle	CIRVUL
Clematis drummondii	Drummond clematis	CLEDRU
Clematis ligusticifolia	western virginsbower	CLELIG
Clinopodium vulgare	mint	CLIVUL
Comandra pallida	pale bastardtoadflax	COMPAL
Conium maculatum	poison hemlock	CONMAC
Convolvulus arvensis	field bindweed	CONARV
Conyza canadensis	Canada horseweed	CONCAN
Cressa truxillensis	cressa	CRETRU
Croton texensis	Texas croton	CROTEX
Cucurbita foetidissima	buffalogourd	CUCFOE
Cuscuta cuspidata	field dodder	CUSCUS
Cyclanthera dissecta	gourd	CYCDIS
Cystopteris fragilis	brittle bladderfern	CYSFRA
Desmanthus illinoensis	Illinois bundleflower	DESILL
Dipsacus sylvestris	teasel	DIPSYL
Dithyrea wislizenii	Wislizenius spectaclepod	DITWIS
Dodecatheon pulchellum	shooting star	DODPUL
Epilobium ciliatum	willowherb	EPICIL
Epilobium hornemannii	Hornemann's willowherb	EPIHOR
Epilobium paniculatum	autumn willowherb	EPIPAN
Epilobium spp.	willowherb	EPISPP
Equisetum arvense	field horsetail	EQUARV
Equisetum laevigatum	smooth horsetail	EQULAE
Erigeron divergens	spreading fleabane	ERIDIV

Data Addendum 4 (continued).

Scientific Name	Common Name	Acronym
Erigeron flagellaris	trailing fleabane	ERIFLA
Erigeron formosissimus	fleabane	ERIFOR
Erigeron speciosus var. speciosus	Oregon fleabane	ERISPE
Erigeron spp.	fleabane	ERISPP
Eriogonum annuum	knotweed	ERIANN
Eupatorium herbaceum	sunflower	EUPHER
Euphorbia dentata	toothed spurge	EUPDEN
Euphorbia micromera	desert spurge	EUPMIC
Euphorbia prostrata	prostrate spurge	EUPPRO
Euphorbia seriophyle	spurge	EUPSER
Euphorbia serpens	creeping spurge	EUPSER3
Eustoma exaltatum	gentian	EUSEXA
Evolvulus sericeus	morning glory	EVOSER
Flaveria campestris	alkali flaveria	FLACAM
Flaveria chloraefolia	clasping flaveria	FLACHL
Fragaria americana	American strawberry	FRAAME
Funastrum cynanchoides	milkweed	FUNCYN
Gaillardia pulchella	indianblanket	GAIPUL
Galium aparine	catchweed bedstraw	GALAPA
Galium boreale	northern bedstraw	GALBOR
Gaura coccinea	scarlet gaura	GAUCOC
Geranium atropurpurea	purple geranium	GERATR
Geranium caespitosum	pineywoods geranium	GERCAE
Geranium richardsonii	Richardson's geranium	GERRIC
Geum macrophyllum	largeleaf avens	GEUMAC
Geum rivale	water avens	GEURIV
Glycyrrhiza lepidota	American licorice	GLYLEP
Greggia camporum	mustard	GRECAM
Grindelia squarrosa	curleycup gumweed	GRISQU
Habenaria hyperborea	northern bog orchid	HABHYP
Helianthus annuus	common sunflower	HELANN
Helianthus ciliaris	blueweed sunflower	HELCIL
Helianthus nuttallii	sunflower	HELNUT
Helianthus petiolaris	prairie sunflower	HELPET
Heliotropium greggii	heliotrope	HELGRE
Heracleum lanatum	common cowparsnip	HERLAN
Heterotheca latifolia	camphorweed	HETLAT
Heterotheca psammophila	sunflower	HETPSA
Hoffmanseggia densiflora	rushpea	HOFDEN
Hydrocotyl verticillata	whorled pennywort	HYDVER
Hymenoclea monogyra	burrobush	HYMMON
Hymenopappus filifolius	sunflower	HYMFIL
Hymenopappus newberryi	hymenopappus	HYMNEW
Hypericum formosum	southwestern St. Johnswort	HYPFOR
Ipomopsis aggregata	phlox	IPOAGG
Iris missouriensis	Rocky Mountain iris	IRIMIS
Iva axillaris	poverty sumpweed	IVAAXI
Kallstroemia hirsutissima	hairy caltrop	KALHIR
Lactuca serriola	prickly lettuce	LACSER
Lathyrus graminifolius	grassleaf peavine	LATGRA
Lepidium montanum	mustard plant	LEPMON
Lesquerella fendleri	Fendler's bladderpod	LESFEN
Lesquerella spp.	bladderpod	LESSPP
Ligusticum porteri	Porter's lovage	LIGPOR
Limonium limbatum	plumbago	LIMLIM
Linum lewisii	Lewis flax	LINLEW
Lobelia cardinalis	cardinal flower lobelia	LOBCAR
Lythrum californicum	California loosestrife	LYTCAL

Data Addendum 4 (continued).

Scientific Name	Common Name	Acronym
Machaeranthera tanacetifolia	tahoka daisy	MACTAN
Macromeria viridiflora	macromeria	MACVIR
Marrubium vulgare	common hoarhound	MARVUL
Medicago lupulina	black medic	MEDLUP
Medicago sativa	alfalfa	MEDSAT
Melampodium leucanthum	plains blackfoot	MELLEU
Melilotus alba	white sweetclover	MELALB
Melilotus officinalis	yellow sweetclover	MELOFF
Mentha arvensis	field mint	MENARV
Mentha spicata	spearmint	MENSPI
Mentzelia multicaulis	stick leaf	MENMUL
Mertensia ciliata	mountain bluebells	MERCIL
Mertensia franciscana	franciscan bluebells	MERFRA
Mimulus guttatus	common monkeyflower	MIMGUT
Mirabilis longiflora	sweet four o'clock	MIRLON
Monarda menthaefolia	mintleaf beebalm	MONMEN
Nerisyrenia camporum	mustard plant	NERCAM
Nerisyrenia linearifolia	mustard plant	NERLIN
Oenothera hookeri	Hooker evening primrose	OENHOO
Oenothera pallida	pale evening primrose	OENPAL
Oenothera strigosa	evening primrose	OENSTR
Orobanche uniflora	broomrape	OROUNI
Oxalis dillenii	sorrel	OXADIL
Oxypolis fendleri	Fendler cowbane	OXYFEN
Oxytropis sericea	locoweed	OXYSER
Parthenocissus inserta	thicket creeper	PARINS
Pastinaca sativa	garden parsnip	PASSAT
Pedicularis canadensis	early lousewort	PEDCAN
Pedicularis grayi	Gray's lousewort	PEDGRA
Penstemon barbatus	beardlip penstemon	PENBAR
Perezia nana	desert holly	PERNAN
Petalostemon candidum	white prairie clover	PETCAN
Phacelia crenulata	water leaf	PHACRE
Phacelia spp.	phacelia	PHACEL
Phlox nana	Santa Fe phlox	PHLNAN
Phyla cuneifolia	wedgeleaf frog-fruit	PHYCUN
Phyla lanceolata	northern frog-fruit	PHYLAN
Physalis virginiana	Virginia groundcherry	PHYVIR
Phytolacca americana	pokeweed	PHYAME
Plantago lanceolata	buckhorn plantain	PLALAN
Plantago major	common plantain	PLAMAJ
Pluchea purpurascens	canela	PLUPUR
Polanisia trachysperma	roughseed clammyseed	POLTRA
Polemonium foliosissimum	leafy polemonium	POLFOL
Poliomintha incana	hoary rosemarymint	POLINC
Polygonum aviculare	prostrate knotweed	POLAVI
Polygonum lapathifolium	curlthumb knotweed	POLLAP
Polygonum persicaria	spottedthumb knotweed	POLPER
Portulaca oleracea	purslane portulaca	POROLE
Portulaca retusa	purslane	PORRET
Potentilla anserina	silverweed cinquefoil	POTANS
Potentilla hippiana	horse cinquefoil	POTHIP
Potentilla pulcherrima	showy cinquefoil	POTPUL
Potentilla thurberi	Thurber cinquefoil	POTTHU
Proboscidea parviflora	New Mexico devilsclaws	PROPAR
Prunella vulgaris	common selfheal	PRUVUL
Pseudocymopteris montana	mountain parsley	PSEMON
Psilostrophe tagetina	woolly paperflower	PSITAG

Data Addendum 4 (continued).

Scientific Name	Common Name	Acronym
Pterospora andromedea	woodland pinedrops	PTEAND
Pteridium aquilinum	western brackenfern	PTEAQU
Ranunculus aquatilis	watercrowfoot buttercup	RANAQU
Ranunculus cymbalaria	shore buttercup	RANCYM
Ranunculus spp.	buttercup	RANSPP
Ranunculus uncinatus	buttercup	RANUNC
Ratibida columnaris	upright prairie coneflower	RATCOL
Ratibida tagetes	prairie coneflower	RATTAG
Reverchonia arenaria	spurge	REVARE
Rorippa nasturtium-aquaticum	watercress	RORNAS
Rorippa sinuata	spreading yellow watercress	RORSIN
Rudbeckia hirta	blackeyed coneflower	RUDHIR
Rudbeckia laciniata	cutleaf coneflower	RUDLAC
Rumex altissimus	pale dock	RUMALT
Rumex crispus	curly dock	RUMCRI
Salicornia utahensis	Utah glasswort	SALUTA
Salsola kali	Russian thistle	SALKAL
Salvia farinacea	mealycup sage	SALFAR
Salvia reflexa	Rocky Mountain sage	SALREF
Samolus cuneatus	brookweed	SAMCUN
Scutellaria tesselata	skullcap	SCUTES
Selinocarpus lanceolatus	moon pod	SELLAN
Senecio bigelovii	Bigelow groundsel	SENBIG
Senecio douglasii	Douglas groundsel	SENDOU
Senecio fendleri	Fendler groundsel	SENFEN
Senecio longilobus	threadleaf groundsel	SENLON
Senecio sanguisorboides	groundsel	SENSAN
Senecio spartioides	broom groundsel	SENSPA
Senecio spp.	groundsel	SENSPP
Sida leprosa	scurfy mallow	SIDLEP
Sidalcea candida	white checkermallow	SIDCAN
Sidalcea neomexicana	New Mexican checkermallow	SIDNEO
Silene scouleri	Scouler silene	SILSCO
Sisymbrium linearifolium	mustard plant	SISLIN
Sisyrinchium montanum	Colorado blue-eyed grass	SISMON
Smilacina stellata	starry false solomonseal	SMISTE
Solanum elaeagnifolium	silverleaf nightshade	SOLELA
Solanum rostratum	buffalobur	SOLROS
Solidago altissima	tall goldenrod	SOLALT
Solidago canadensis	Canada goldenrod	SOLCAN
Solidago nemoralis	dyer goldenrod	SOLNEM
Solidago occidentalis	western goldenrod	SOLOCC
Solidago rigida	stiff goldenrod	SOLRIG
Solidago spp.	goldenrod	SOLSPP
Solidago wrightii	goldenrod	SOLWRI
Sonchus arvensis	field sowthistle	SONARV
Sonchus oleraceus	common sowthistle	SONOLE
Sphaeralcea angustifolia	narrowleaf globemallow	SPHANG
Sphaeralcea fendleri	Fendler globemallow	SPHFEN
Sphaeralcea subhastata	mallow plant	SPHSUB
Stephanomeria pauciflora	wire lettuce	STEPAU
Taraxacum officinale	dandelion	TAROFF
Teucrium canadense	germander	TEUCAN
Thalictrum fendleri	fendler meadowrue	THAFEN
Thelesperma megapotamicum	sunflower	THEMEG
Thermopsis pinetorum	pine thermopsis	THEPIN
Thlaspi alpestre	alpine pennycress	THLALP
Thlaspi arvense	field pennycress	THLARV

Data Addendum 4 (continued).

Scientific Name	Common Name	Acronym
Townsendia eximia	townsendia	TOWEXI
Tradescantia occidentalis	prairie spiderwort	TRAOCC
Tragopogon dubius	yellow salsify	TRADUB
Tragopogon pratensis	meadow salsify	TRAPRA
Trifolium hybridum	alsike clover	TRIHYB
Trifolium pratense	red clover	TRIPRA
Trifolium repens	white clover	TRIREP
Typha latifolia	common cattail	TYPLAT
Urtica gracilenta	nettle	URTGRA
Valeriana edulis	edible valerian	VALEDU
Veratrum californicum	California falsehellebore	VERCAL
Verbascum thapsus	flannel mullein	VERTHA
Verbena bipinnatifida	Dakota verbena	VERBIP
Verbena bracteata	prostrate vervain	VERBRA
Verbena macdougalii	New Mexican vervain	VERMAC
Verbena scabra	sandpaper vervain	VERSCA
Veronica americana	American speedwell	VERAME
Veronica connata	speedwell	VERCON
Vicia americana	American vetch	VICAME
Viguiera multiflora	showy goldeneye	VIGMUL
Viola canadensis	Canada white violet	VIOCAN
Viola missouriensis	Missouri violet	VIOMIS
Xanthium strumarium	cocklebur	XANSTR
Zannichellia palustris	horned pondweed	ZANPAL

DATA ADDENDUM 5.

Summary tables for plant community types of the Pecos River Basin (1992 and 1993 data, excluding playas) providing constancy values, [D/C], (the frequency of species occurrences per community type) and average percent canopy cover values [CON] for dominant and other frequently encountered plant species.

The following Community Types correspond to the Type No. of the summary tables:

1. *Picea pungens/Alnus oblongifolia* CT
2. *Picea pungens/Poa pratensis* CT
3. *Acer negundo/Salix exigua* CT
4. *Populus angustifolia/Alnus oblongifolia* CT
5. *Populus angustifolia/Alnus oblongifolia* CT *Acer negundo* phase
6. *Populus angustifolia/Poa pratensis* CT
7. *Populus angustifolia/Salix exigua* CT
8. *Populus fremontii*/Sparse CT
9. *Populus fremontii-Salix amygdaloides* CT *Tamarix pentandra* phase
10. *Populus fremontii/Salix exigua* CT
11. *Populus fremontii/Sporobolus airoides* CT
12. *Populus fremontii/Sporobolus airoides* CT *Tamarix pentandra* phase
13. *Celtis reticulata/Juglans major* CT
14. *Celtis reticulata-Salix gooddingii* CT
15. *Populus fremontii-Salix gooddingii* CT
16. *Alnus oblongifolia-Calamagrostis canadensis* CT
17. *Alnus oblongifolia-Cornus stolonifera* CT
18. *Alnus oblongifolia-Salix irrorata* CT
19. *Salix exigua/Elymus canadensis* CT
20. *Salix exigua-Baccharis emoryi* CT
21. *Baccharis emoryi/Muhlenbergia asperifolia* CT *Tamarix pentandra* phase
22. *Baccharis emoryi/Sporobolus airoides* CT *Tamarix pentandra* phase
23. *Tamarix pentandra*/Sparse CT
24. *Phalaris arundinacea-Glyceria striata* CT
25. *Carex emoryi/Equisetum arvense* CT
26. *Carex nebrascensis-Carex rostrata* CT
27. *Juncus balticus-Carex praegracilis* CT
28. *Distichlis stricta/Salicornia utahensis* CT
29. *Distichlis stricta-Scirpus americanus* CT *Tamarix pentandra* phase
30. *Scirpus americanus-Paspalum distichum* CT
31. *Scirpus americanus/Typha latifolia* CT
32. *Scirpus acutus-Eleocharis macrostachya* CT
33. *Scirpus olneyi-Muhlenbergia asperifolia* CT
34. *Scirpus olneyi/Typha latifolia* CT

Data Addendum 5 (continued).

ROCKY MOUNTAIN MONTANE RIPARIAN/WETLAND VEGETATION

TYPE NO:	1. 0		2. 0		3. 0		4. 0		5. 0	
NO. PLOTS:	(4)		(3)		(2)		(4)		(1)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
TREES										
Abies concolor - mature	2	50	<1	33						
Acer negundo - mature					20	100	5	25	80	100
Acer negundo - adv					5	100	30	25	25	100
Alnus oblongifolia - mature	13	75					50	50	10	100
Alnus oblongifolia - adv	30	25					36	50		
Picea pungens - mature	10	100								
Populus angustifolia - mature	<1	25					10	75	5	100
Populus angustifolia - adv							3	50		
Populus angustifolia - yng									2	100
Pseudotsuga menziesii - mature	15	50								
SHRUBS										
Apocynum cannabinum					<1	50				
Berberis fendleri	<1	25					1	25		
Berberis repens										
Cornus stolonifera	6	25					2	50	10	100
Glycyrrhiza lepidota										
Juniperus monosperma - mature										
Juniperus scopulorum - mature							3	25	2	100
Lonicera involucrata	<1	75					5	25	5	100
Prunus virginiana					<1	100				
Ribes inerme	<1	100	1	33	<1	50	5	75	2	100
Rosa woodsii	3	100	<1	33	13	100	2	100	2	100
Rubus leucodermis	<1	50	<1	33			<1	25		
Rubus strigosus	<1	25					10	25	2	100
Symphoricarpos oreophilus	<1	25	2	33			1	25	2	100
Salix bebbiana										
Salix boothii	3	25								
Salix caudata	<1	25								
Salix irrorata	2	25					2	25		
Salix lasiandra	1	25								
Salix lutea	2	50			5	50	2	50	2	100
Salix monticola										
Salix subcoerulea	1	25					<1	25		
GRAMINOIDS										
Agropyron smithii			1	33			1	25	<1	100
Agropyron trachycaulum	<1	25			1	50	<1	75		
Agrostis alba	<1	25	<1	33	30	50	20	25	5	100
Agrostis stolonifera			1	33			2	25		
Beckmannia syzigachne										
Calamagrostis canadensis	<1	25								
Calamovilfa longifolia					1	50				
Carex aquatilis										
Carex disperma	<1	25								
Carex emoryi										
Carex festivella	<1	25								
Carex geophila										
Carex hystricina										
Carex microptera										
Carex nebraskensis										

Data Addendum 5 (continued).

ROCKY MOUNTAIN MONTANE RIPARIAN/WETLAND VEGETATION

TYPE NO:	1. 0		2. 0		3. 0		4. 0		5. 0	
NO. PLOTS:	(4)		(3)		(2)		(4)		(1)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
GRAMINOIDS, cont.										
Carex occidentalis										
Carex praegracilis										
Carex rostrata	<1	25								
Carex simulata										
Carex stipata							<1	25		
Carex vulpinoidea										
Cyperus fendlerianus										
Deschampsia caespitosa	<1	25								
Dactylis glomerata	5	25			1	50	2	25	1	100
Eleocharis atropurpurea										
Eleocharis macrostachya										
Elymus canadensis					1	50	1	25	<1	100
Elymus glaucus	<1	25					<1	25		
Festuca pratensis	<1	25	1	33	5	50				
Glyceria elata										
Glyceria striata	<1	25							<1	100
Juncus acuminatus										
Juncus balticus										
Juncus bufonius										
Juncus longistylis										
Juncus saximontanus										
Juncus tenuis										
Juncus torreyi										
Phalaris arundinacea										
Phleum pratensis	<1	75	2	100	3	50	2	50	1	100
Poa pratensis	9	100	39	67	1	50	13	50		
FORBS										
Aconitum columbianum	1	75					<1	50	2	100
Actaea arguta										
Adiantum nigrum										
Agrimonia striata	<1	50	<1	33	<1	50	1	75	<1	100
Anemone cylindrica			<1	33						
Aster foliaceus	<1	50	<1	67			1	50		
Bacopa rotundifolia										
Berula erecta										
Besseya plantaginea	<1	25								
Campanula rotundifolia	<1	75	<1	67			<1	25		
Cardamine cordifolia										
Cicuta douglasii					<1	50				
Circaea alpina	<1	25								
Clematis ligusticifolia					2	100	10	25	3	100
Conium maculatum	<1	25			<1	50				
Equisetum arvense	2	100	<1	33	<1	100	<1	100	1	100
Equisetum laevigatum										
Fragaria americana	<1	50								
Galium aparine	<1	50					<1	25		
Galium boreale	<1	25	<1	33						
Geranium atropurpurea					<1	50	<1	25		
Geranium caespitosum			<1	67			<1	25		

Data Addendum 5 (continued).

ROCKY MOUNTAIN MONTANE RIPARIAN/WETLAND VEGETATION

TYPE NO:	1. 0		2. 0		3. 0		4. 0		5. 0	
NO. PLOTS:	(4)		(3)		(2)		(4)		(1)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
FORBS, cont.										
Geranium richardsonii	<1	75	<1	100			<1	50	1	100
Geum macrophyllum	<1	50	1	33			<1	50		
Habenaria hyperborea	<1	25								
Heracleum lanatum	6	100	1	33			12	75	3	100
Iris missouriensis	<1	50	<1	33			<1	25		
Mertensia franciscana	<1	50	<1	33			<1	50		
Mimulus guttatus										
Oenothera strigosa							2	25	<1	100
Oxypolis fendleri	<1	100					<1	50		
Parthenocissus inserta	<1	25			2	100	8	25	3	100
Pastinaca sativa										
Prunella vulgaris	<1	50					<1	75	<1	100
Ranunculus aquatilis										
Ranunculus cymbalaria										
Ranunculus uncinatus										
Rorippa nasturtium-aquaticum										
Rorippa sinuata							<1	25		
Rudbeckia laciniata	1	100	<1	33	40	50	4	75	1	100
Samolus cuneatus										
Sidalcea candida	<1	75					<1	25		
Sida neomexicana										
Sisyrinchium montanum										
Smilacina stellata	1	75					2	75	<1	100
Solidago canadensis					4	100	2	25	5	100
Trifolium repens	<1	50	2	100						
Veratrum californicum										
Veronica americana										
Veronica connata										
Vicia americana			<1	67			<1	25		
Viola canadensis	<1	50					<1	50		
Viola missouriensis										

Data Addendum 5 (continued).

SOUTHWEST AND PLAINS RIPARIAN/WETLAND VEGETATION

TYPE NO:	1. 0		2. 0		3. 0		4. 0		5. 0	
NO. PLOTS:	(4)		(3)		(2)		(4)		(1)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
TREES										
Populus fremontii - mature										
Populus fremontii - adv										
Populus fremontii - yng										
Populus x acuminata - mature										
Celtis reticulata										
Elaeagnus angustifolia - mature										
Elaeagnus angustifolia - adv										
Juglans major - mature										
Salix amygdaloides - adv									1	100
Salix babylonica - mature										
Salix gooddingii - mature										
Salix gooddingii - adv										
SHRUBS										
Baccharis emoryi										
Baccharis glutinosa										
Berberis trifoliolata										
Ceanothus fendleri										
Chilopsis linearis										
Chrysothamnus nauseosus										
Chrysothamnus viscidiflorus										
Gutierrezia sarothrae					2	50				
Juglans microcarpa										
Rhus copallina										
Rhus microphylla										
Robinia neomexicana										
Salix exigua					48	100	<1	25	1	100
Salix interior	<1	25								
Salix taxifolia										
Tamarix pentandra										
Vitis arizonica										
Vitis vulpina										
GRAMINOIDS										
Bothriochloa saccharoides										
Buchloe dactyloides										
Cinna latifolia	<1	50								
Cladium jamaicense										
Cortaderia selloana										
Cynodon dactylon										
Cyperus esculentus										
Cyperus uniflorus										
Distichlis stricta										
Echinochloa crus-galli										
Muhlenbergia asperifolia					<1	50				
Muhlenbergia rigens										
Panicum obtusum										
Paspalum distichum										
Phragmites australis										
Polypogon monspeliensis										
Scirpus acutus										

Data Addendum 5 (continued).

SOUTHWEST AND PLAINS RIPARIAN/WETLAND VEGETATION

TYPE NO:	1. 0		2. 0		3. 0		4. 0		5. 0	
NO. PLOTS:	(4)		(3)		(2)		(4)		(1)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
GRAMINOIDS, cont.										
Scirpus americanus										
Scirpus maritimus										
Scirpus microcarpus										
Scirpus olneyi										
Scirpus validus										
Sorghastrum nutans										
Sporobolus airoides										
FORBS										
Clematis drummondii										
Desmanthus illinoensis										
Epilobium hornemannii	<1	25			<1	50	<1	25	<1	100
Epilobium paniculatum							<1	25		
Flaveria campestris										
Flaveria chloraefolia										
Helianthus ciliaris										
Hydrocotyl verticillata										
Limonium limbatum										
Lythrum californicum										
Marrubium vulgare										
Melilotus alba					1	50				
Mentha arvensis					<1	100	1	25		
Phyla lanceolata										
Polygonum aviculare					<1	50				
Polygonum lapathifolium										
Polygonum persicaria										
Salicornia utahensis										
Typha latifolia										
Verbena macdougalii			<1	67	<1	50				

Data Addendum 5 (continued).

ROCKY MOUNTAIN MONTANE RIPARIAN/WETLAND VEGETATION

TYPE NO:	6- 0		7- 0		8- 0		9- 0		10- 0	
NO. PLOTS:	(1)		(3)		(1)		(1)		(3)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
TREES										
Abies concolor - mature										
Acer negundo - mature			5	33						
Acer negundo - adv			6	67					2	67
Alnus oblongifolia - mature										
Alnus oblongifolia - adv										
Picea pungens - mature										
Populus angustifolia - mature	70	100	24	100					2	67
Populus angustifolia - adv			4	67			2	100	2	67
Populus angustifolia - yng										
Pseudotsuga menziesii - mature										
SHRUBS										
Apocynum cannabinum									1	33
Berberis fendleri										
Berberis repens										
Cornus stolonifera			1	33						
Glycyrrhiza lepidota									<1	67
Juniperus monosperma - mature					10	100			1	67
Juniperus scopulorum - mature	1	100	3	33						
Lonicera involucrata										
Prunus virginiana	<1	100	2	33						
Ribes inerme	<1	100								
Rosa woodsii	10	100	2	67					6	67
Rubus leucodermis										
Rubus strigosus			1	33						
Symphoricarpos oreophilus			1	33						
Salix bebbiana										
Salix boothii										
Salix caudata										
Salix irrorata			4	100						
Salix lasiandra										
Salix lutea	2	100								
Salix monticola										
Salix subcoerulea										
GRAMINOIDS										
Agropyron smithii									<1	33
Agropyron trachycaulum									1	67
Agrostis alba			23	100					2	67
Agrostis stolonifera	8	100	13	67					25	67
Beckmannia syzigachne										
Calamagrostis canadensis										
Calamovilfa longifolia										
Carex aquatilis			2	33			2	100		
Carex disperma										
Carex emoryi										
Carex festivella										
Carex geophila									2	33
Carex hystricina										
Carex microptera										
Carex nebraskensis										

Data Addendum 5 (continued).

ROCKY MOUNTAIN MONTANE RIPARIAN/WETLAND VEGETATION

TYPE NO:	6- 0		7- 0		8- 0		9- 0		10- 0	
NO. PLOTS:	(1)		(3)		(1)		(1)		(3)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
GRAMINOIDS, cont.										
Carex occidentalis										
Carex praegracilis										
Carex rostrata										
Carex simulata										
Carex stipata										
Carex vulpinoidea			<1	67						
Cyperus fendlerianus										
Deschampsia caespitosa										
Dactylis glomerata			5	33					<1	67
Eleocharis atropurpurea										
Eleocharis macrostachya			<1	33					2	33
Elymus canadensis			<1	33	<1	100	1	100	3	67
Elymus glaucus										
Festuca pratensis	15	100	2	67					1	100
Glyceria elata										
Glyceria striata										
Juncus acuminatus										
Juncus balticus			<1	33					1	33
Juncus bufonius			1	33						
Juncus longistylis										
Juncus saximontanus			<1	33					2	33
Juncus tenuis			<1	33					<1	33
Juncus torreyi			<1	67						
Phalaris arundinacea										
Phleum pratensis	8	100	<1	100					1	67
Poa pratensis	15	100							3	33
FORBS										
Aconitum columbianum										
Actaea arguta										
Adiantum nigrum										
Agrimonia striata			<1	33						
Anemone cylindrica										
Aster foliaceus										
Bacopa rotundifolia										
Berula erecta									10	33
Besseya plantaginea										
Campanula rotundifolia										
Cardamine cordifolia										
Cicuta douglasii										
Circaea alpina										
Clematis ligusticifolia	3	100	10	67					7	67
Conium maculatum										
Equisetum arvense	1	100							<1	33
Equisetum laevigatum	8	100	2	67			<1	100	3	67
Fragaria americana	<1	100								
Galium aparine										
Galium boreale										
Geranium atropurpurea	1	100	1	33						
Geranium caespitosum										

Data Addendum 5 (continued).

ROCKY MOUNTAIN MONTANE RIPARIAN/WETLAND VEGETATION

TYPE NO:	6- 0		7- 0		8- 0		9- 0		10- 0	
NO. PLOTS:	(1)		(3)		(1)		(1)		(3)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
FORBS, cont.										
Geranium richardsonii										
Geum macrophyllum										
Habenaria hyperborea										
Heracleum lanatum			1	33						
Iris missouriensis										
Mertensia franciscana										
Mimulus guttatus										
Oenothera strigosa			<1	67					<1	33
Oxypolis fendleri										
Parthenocissus inserta					2	100			1	67
Pastinaca sativa										
Prunella vulgaris			<1	33						
Ranunculus aquatilis										
Ranunculus cymbalaria			1	33					5	33
Ranunculus uncinatus										
Rorippa nasturtium-aquaticum										
Rorippa sinuata										
Rudbeckia laciniata			3	33					3	33
Samolus cuneatus										
Sidalcea candida										
Sida neomexicana										
Sisyrinchium montanum										
Smilacina stellata			1	33						
Solidago canadensis			3	67					17	67
Trifolium repens	<1	100	3	67	<1	100			<1	33
Veratrum californicum										
Veronica americana										
Veronica connata			<1	33						
Vicia americana	<1	100								
Viola canadensis										
Viola missouriensis										

Data Addendum 5 (continued).

SOUTHWEST AND PLAINS RIPARIAN/WETLAND VEGETATION

TYPE NO:	6- 0		7- 0		8- 0		9- 0		10- 0	
NO. PLOTS:	(1)		(3)		(1)		(1)		(3)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
TREES										
Populus fremontii - mature			4	33	75	100	4	100	47	100
Populus fremontii - adv										
Populus fremontii - yng			1	33			15	100	4	67
Populus x acuminata - mature										
Celtis reticulata										
Elaeagnus angustifolia - mature			4	33					2	33
Elaeagnus angustifolia - adv			1	33	<1	100			3	33
Juglans major - mature										
Salix amygdaloides - adv							6	100	2	33
Salix babylonica - mature										
Salix gooddingii - mature										
Salix gooddingii - adv										
SHRUBS										
Baccharis emoryi										
Baccharis glutinosa										
Berberis trifoliolata										
Ceanothus fendleri										
Chilopsis linearis										
Chrysothamnus nauseosus										
Chrysothamnus viscidiflorus										
Gutierrezia sarothrae					1	100				
Juglans microcarpa										
Rhus copallina										
Rhus microphylla										
Robinia neomexicana										
Salix exigua			13	100			3	100	2	100
Salix interior										
Salix taxifolia										
Tamarix pentandra							15	100		
Vitis arizonica									3	33
Vitis vulpina									<1	33
GRAMINOIDS										
Bothriochloa saccharoides									2	67
Buchloe dactyloides										
Cinna latifolia										
Cladium jamaicense										
Cortaderia selloana										
Cynodon dactylon										
Cyperus esculentus										
Cyperus uniflorus					<1	100				
Distichlis stricta										
Echinochloa crus-galli					<1	100	1	100		
Muhlenbergia asperifolia			<1	33	<1	100			3	67
Muhlenbergia rigens										
Panicum obtusum										
Paspalum distichum										
Phragmites australis										
Polypogon monspeliensis									1	67
Scirpus acutus									5	33

Data Addendum 5 (continued).

SOUTHWEST AND PLAINS RIPARIAN/WETLAND VEGETATION

TYPE NO:	6- 0		7- 0		8- 0		9- 0		10- 0	
NO. PLOTS:	(1)		(3)		(1)		(1)		(3)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
GRAMINOIDS, cont.										
Scirpus americanus			13	67					25	33
Scirpus maritimus										
Scirpus microcarpus										
Scirpus olneyi										
Scirpus validus			<1	67						
Sorghastrum nutans										
Sporobolus airoides										
FORBS										
Clematis drummondii										
Desmanthus illinoensis										
Epilobium hornemannii									<1	33
Epilobium paniculatum										
Flaveria campestris										
Flaveria chloraefolia										
Helianthus ciliaris										
Hydrocotyl verticillata										
Limonium limbatum										
Lythrum californicum										
Marrubium vulgare										
Melilotus alba			16	67	1	100	3	100	8	67
Mentha arvensis					<1	100				
Phyla lanceolata										
Polygonum aviculare										
Polygonum lapathifolium										
Polygonum persicaria										
Salicornia utahensis										
Typha latifolia			1	33						
Verbena macdougalii										

Data Addendum 5 (continued).

ROCKY MOUNTAIN MONTANE RIPARIAN/WETLAND VEGETATION

TYPE NO:	11- 0		12- 0		13- 0		14- 0		15- 0	
NO. PLOTS:	(3)		(4)		(1)		(1)		(5)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
TREES										
Abies concolor - mature										
Acer negundo - mature									5	40
Acer negundo - adv									25	20
Alnus oblongifolia - mature										
Alnus oblongifolia - adv										
Picea pungens - mature										
Populus angustifolia - mature										
Populus angustifolia - adv										
Populus angustifolia - yng										
Pseudotsuga menziesii - mature										
SHRUBS										
Apocynum cannabinum									10	20
Berberis fendleri										
Berberis repens										
Cornus stolonifera										
Glycyrrhiza lepidota										
Juniperus monosperma - mature	5	33	2	25						
Juniperus scopulorum - mature										
Lonicera involucrata										
Prunus virginiana										
Ribes inerme										
Rosa woodsii										
Rubus leucodermis										
Rubus strigosus										
Symphoricarpos oreophilus										
Salix bebbiana										
Salix boothii										
Salix caudata										
Salix irrorata										
Salix lasiandra										
Salix lutea										
Salix monticola										
Salix subcoerulea										
GRAMINIODS										
Agropyron smithii	<1	33								
Agropyron trachycaulum										
Agrostis alba										
Agrostis stolonifera										
Beckmannia syzigachne										
Calamagrostis canadensis										
Calamovilfa longifolia										
Carex aquatilis										
Carex disperma										
Carex emoryi										
Carex festivella										
Carex geophila										
Carex hystricina										
Carex microptera										
Carex nebraskensis										

Data Addendum 5 (continued).

ROCKY MOUNTAIN MONTANE RIPARIAN/WETLAND VEGETATION

TYPE NO:	11- 0		12- 0		13- 0		14- 0		15- 0	
NO. PLOTS:	(3)		(4)		(1)		(1)		(5)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
GRAMINOIDS, cont.										
Carex occidentalis										
Carex praegracilis										
Carex rostrata										
Carex simulata										
Carex stipata										
Carex vulpinoidea										
Cyperus fendlerianus										
Deschampsia caespitosa										
Dactylis glomerata										
Eleocharis atropurpurea										
Eleocharis macrostachya					2	100			5	20
Elymus canadensis	10	67	<1	25			2	100	<1	40
Elymus glaucus										
Festuca pratensis									57	60
Glyceria elata										
Glyceria striata										
Juncus acuminatus										
Juncus balticus							<1	100	5	20
Juncus bufonius										
Juncus longistylis										
Juncus saximontanus							1	100		
Juncus tenuis										
Juncus torreyi										
Phalaris arundinacea										
Phleum pratensis										
Poa pratensis										
FORBS										
Aconitum columbianum										
Actaea arguta										
Adiantum nigrum					5	100				
Agrimonia striata										
Anemone cylindrica										
Aster foliaceus										
Bacopa rotundifolia										
Berula erecta					3	100				
Besseya plantaginea										
Campanula rotundifolia										
Cardamine cordifolia										
Cicuta douglasii									5	20
Circaea alpina										
Clematis ligusticifolia	2	33	3	25					5	20
Conium maculatum										
Equisetum arvense										
Equisetum laevigatum							10	100	5	20
Fragaria americana										
Galium aparine										
Galium boreale										
Geranium atropurpurea										
Geranium caespitosum										

Data Addendum 5 (continued).

ROCKY MOUNTAIN MONTANE RIPARIAN/WETLAND VEGETATION

TYPE NO:	11- 0		12- 0		13- 0		14- 0		15- 0	
NO. PLOTS:	(3)		(4)		(1)		(1)		(5)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
FORBS, cont.										
Geranium richardsonii										
Geum macrophyllum										
Habenaria hyperborea										
Heracleum lanatum										
Iris missouriensis										
Mertensia franciscana										
Mimulus guttatus										
Oenothera strigosa										
Oxypolis fendleri										
Parthenocissus inserta	3	33			1	100			11	60
Pastinaca sativa										
Prunella vulgaris										
Ranunculus aquatilis										
Ranunculus cymbalaria										
Ranunculus uncinatus										
Rorippa nasturtium-aquaticum					4	100				
Rorippa sinuata										
Rudbeckia laciniata										
Samolus cuneatus										
Sidalcea candida										
Sida neomexicana										
Sisyrinchium montanum										
Smilacina stellata										
Solidago canadensis					1	100				
Trifolium repens										
Veratrum californicum										
Veronica americana										
Veronica connata										
Vicia americana										
Viola canadensis										
Viola missouriensis										

Data Addendum 5 (continued).

SOUTHWEST AND PLAINS RIPARIAN/WETLAND VEGETATION

TYPE NO:	11- 0		12- 0		13- 0		14- 0		15- 0	
NO. PLOTS:	(3)		(4)		(1)		(1)		(5)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
TREES										
Populus fremontii - mature	23	67	33	100					53	100
Populus fremontii - adv	50	33							2	20
Populus fremontii - yng										
Populus x acuminata - mature									10	20
Celtis reticulata					20	100	10	100	3	40
Elaeagnus angustifolia - mature									5	20
Elaeagnus angustifolia - adv			2	25						
Juglans major - mature					25	100				
Salix amygdaloides - adv										
Salix babylonica - mature									10	20
Salix gooddingii - mature							10	100	25	100
Salix gooddingii - adv									41	40
SHRUBS										
Baccharis emoryi	25	33	2	50			30	100		
Baccharis glutinosa									5	20
Berberis trifoliolata					1	100				
Ceanothus fendleri										
Chilopsis linearis										
Chrysothamnus nauseosus			10	25						
Chrysothamnus viscidiflorus	1	33								
Gutierrezia sarothrae			2	75						
Juglans microcarpa									1	20
Rhus copallina					20	100	<1	100	25	20
Rhus microphylla										
Robinia neomexicana									5	20
Salix exigua									5	20
Salix interior										
Salix taxifolia										
Tamarix pentandra	7	100	15	100					6	60
Vitis arizonica					1	100				
Vitis vulpina										
GRAMINOIDS										
Bothriochloa saccharoides	20	33	11	50			5	100	1	20
Buchloe dactyloides	<1	67	4	25						
Cinna latifolia										
Cladium jamaicense										
Cortaderia selloana										
Cynodon dactylon					10	100	40	100	28	40
Cyperus esculentus										
Cyperus uniflorus					2	100				
Distichlis stricta										
Echinochloa crus-galli										
Muhlenbergia asperifolia			1	25			2	100	25	20
Muhlenbergia rigens										
Panicum obtusum	10	33	<1	75			1	100		
Paspalum distichum										
Phragmites australis										
Polypogon monspeliensis					2	100	2	100		
Scirpus acutus										

Data Addendum 5 (continued).

SOUTHWEST AND PLAINS RIPARIAN/WETLAND VEGETATION

TYPE NO:	11- 0		12- 0		13- 0		14- 0		15- 0	
NO. PLOTS:	(3)		(4)		(1)		(1)		(5)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
GRAMINOIDS, cont.										
Scirpus americanus									1	20
Scirpus maritimus										
Scirpus microcarpus										
Scirpus olneyi							2	100		
Scirpus validus									2	20
Sorghastrum nutans										
Sporobolus airoides	21	100	7	100			2	100	5	40
FORBS										
Clematis drummondii					1	100	<1	100		
Desmanthus illinoensis							<1	100		
Epilobium hornemannii										
Epilobium paniculatum										
Flaveria campestris										
Flaveria chloraefolia					2	100				
Helianthus ciliaris										
Hydrocotyl verticillata					2	100			<1	20
Limonium limbatum										
Lythrum californicum										
Marrubium vulgare									25	40
Melilotus alba	<1	67	<1	25			1	100		
Mentha arvensis										
Phyla lanceolata					1	100	1	100	1	20
Polygonum aviculare										
Polygonum lapathifolium										
Polygonum persicaria										
Salicornia utahensis										
Typha latifolia					3	100	<1	100		
Verbena macdougalii										

Data Addendum 5 (continued).

ROCKY MOUNTAIN MONTANE RIPARIAN/WETLAND VEGETATION

TYPE NO:	16- 0		17- 0		18- 0		19- 0		20- 0	
NO. PLOTS:	(1)		(2)		(2)		(4)		(6)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
TREES										
Abies concolor - mature					<1	50				
Acer negundo - mature									9	33
Acer negundo - adv					2	50			2	50
Alnus oblongifolia - mature			13	100			22	50		
Alnus oblongifolia - adv					24	100	23	50	5	17
Picea pungens - mature					<1	50				
Populus angustifolia - mature										
Populus angustifolia - adv									4	33
Populus angustifolia - yng										
Pseudotsuga menziesii - mature										
SHRUBS										
Apocynum cannabinum									<1	17
Berberis fendleri										
Berberis repens					<1	50				
Cornus stolonifera					38	100	2	25		
Glycyrrhiza lepidota									4	17
Juniperus monosperma - mature										
Juniperus scopulorum - mature										
Lonicera involucrata					10	100	4	75		
Prunus virginiana										
Ribes inerme			1	50			2	50	<1	33
Rosa woodsii			1	50	20	50	<1	50	1	50
Rubus leucodermis					<1	50	<1	25		
Rubus strigosus			3	50	10	50				
Symphoricarpos oreophilus							2	25		
Salix bebbiana			4	50	1	50	1	75		
Salix boothii										
Salix caudata										
Salix irrorata			6	50			5	50		
Salix lasiandra			8	50			<1	25		
Salix lutea							5	50	3	83
Salix monticola							5	25		
Salix subcoerulea							4	75		
GRAMINOIDS										
Agropyron smithii									1	17
Agropyron trachycaulum					<1	100	<1	25	2	33
Agrostis alba							2	75	8	17
Agrostis stolonifera			13	100					15	83
Beckmannia syzigachne										
Calamagrostis canadensis			25	100						
Calamovilfa longifolia										
Carex aquatilis										
Carex disperma										
Carex emoryi										
Carex festivella			2	50			<1	25		
Carex geophila			1	100			<1	25	2	33
Carex hystricina										
Carex microptera							4	25		
Carex nebraskensis										

Data Addendum 5 (continued).

ROCKY MOUNTAIN MONTANE RIPARIAN/WETLAND VEGETATION

TYPE NO:	16- 0		17- 0		18- 0		19- 0		20- 0	
NO. PLOTS:	(1)		(2)		(2)		(4)		(6)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
GRAMINOIDS, cont.										
Carex occidentalis							1	25		
Carex praegracilis										
Carex rostrata										
Carex simulata										
Carex stipata			1	100			1	50		
Carex vulpinoidea										
Cyperus fendlerianus										
Deschampsia caespitosa			<1	50			10	25		
Dactylis glomerata			<1	50					1	33
Eleocharis atropurpurea										
Eleocharis macrostachya	2	100							1	33
Elymus canadensis			1	50					4	100
Elymus glaucus					<1	50				
Festuca pratensis							1	25	5	67
Glyceria elata			30	50						
Glyceria striata			25	50			3	50		
Juncus acuminatus										
Juncus balticus							2	25	2	17
Juncus bufonius										
Juncus longistylis										
Juncus saximontanus			<1	50			5	50	30	17
Juncus tenuis									1	17
Juncus torreyi										
Phalaris arundinacea							2	25	3	67
Phleum pratensis			2	100	<1	100	12	75	3	50
Poa pratensis			<1	100	<1	100	19	75	13	50
FORBS										
Aconitum columbianum			<1	100	1	50	1	75		
Actaea arguta							<1	25		
Adiantum nigrum										
Agrimonia striata			2	100	<1	50				
Anemone cylindrica					<1	50				
Aster foliaceus			<1	50	2	50	<1	75	<1	33
Bacopa rotundifolia							<1	25		
Berula erecta	<1	100								
Besseya plantaginea										
Campanula rotundifolia			<1	100			<1	25		
Cardamine cordifolia									<1	17
Cicuta douglasii			<1	100					1	33
Circaea alpina										
Clematis ligusticifolia									1	50
Conium maculatum			<1	50					8	33
Equisetum arvense			4	100	<1	100	21	100	8	100
Equisetum laevigatum			3	50					3	33
Fragaria americana			<1	100	1	50	<1	25		
Galium aparine							<1	50		
Galium boreale			<1	50	<1	50				
Geranium atropurpurea									<1	17
Geranium caespitosum										

ROCKY MOUNTAIN MONTANE RIPARIAN/WETLAND VEGETATION

Data Addendum 5 (continued).

TYPE NO:	16- 0		17- 0		18- 0		19- 0		20- 0	
NO. PLOTS:	(1)		(2)		(2)		(4)		(6)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
FORBS, cont.										
Geranium richardsonii			1	100	<1	100	<1	50		
Geum macrophyllum					<1	50	<1	50		
Habenaria hyperborea			<1	100			1	25		
Heracleum lanatum			2	100	2	100	2	50		
Iris missouriensis							<1	25	<1	17
Mertensia franciscana			<1	100	<1	50	1	50		
Mimulus guttatus			<1	50						
Oenothera strigosa	<1	100							<1	67
Oxypolis fendleri					<1	50	<1	100		
Parthenocissus inserta									<1	83
Pastinaca sativa									<1	17
Prunella vulgaris			<1	50	2	50			<1	50
Ranunculus aquatilis										
Ranunculus cymbalaria										
Ranunculus uncinatus					<1	50				
Rorippa nasturtium-aquaticum										
Rorippa sinuata									<1	17
Rudbeckia laciniata			<1	100	<1	100	3	50	1	83
Samolus cuneatus										
Sidalcea candida							1	50		
Sida neomexicana										
Sisyrinchium montanum										
Smilacina stellata			<1	100	<1	50	2	50		
Solidago canadensis			3	100					4	83
Trifolium repens					<1	100	<1	25	<1	50
Veratrum californicum			7	100						
Veronica americana							<1	25		
Veronica connata							<1	25		
Vicia americana										
Viola canadensis							<1	50		
Viola missouriensis			1	100			<1	25		

Data Addendum 5 (continued).

SOUTHWEST AND PLAINS RIPARIAN/WETLAND VEGETATION

TYPE NO:	16- 0		17- 0		18- 0		19- 0		20- 0	
NO. PLOTS:	(1)		(2)		(2)		(4)		(6)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
TREES										
Populus fremontii - mature										
Populus fremontii - adv									<1	33
Populus fremontii - yng									10	17
Populus x acuminata - mature										
Celtis reticulata										
Elaeagnus angustifolia - mature										
Elaeagnus angustifolia - adv										
Juglans major - mature										
Salix amygdaloides - adv									2	17
Salix babylonica - mature										
Salix gooddingii - mature										
Salix gooddingii - adv	5	100								
FORBS										
Baccharis emoryi										
Baccharis glutinosa	5	100								
Berberis trifoliolata										
Ceanothus fendleri										
Chilopsis linearis										
Chrysothamnus nauseosus									<1	33
Chrysothamnus viscidiflorus										
Gutierrezia sarothrae									<1	50
Juglans microcarpa										
Rhus copallina										
Rhus microphylla										
Robinia neomexicana									<1	17
Salix exigua									67	100
Salix interior					2	50				
Salix taxifolia										
Tamarix pentandra										
Vitis arizonica									<1	33
Vitis vulpina										
GRAMINOIDS										
Bothriochloa saccharoides	1	100							2	17
Buchloe dactyloides										
Cinna latifolia										
Cladium jamaicense	50	100								
Cortaderia selloana										
Cynodon dactylon										
Cyperus esculentus										
Cyperus uniflorus										
Distichlis stricta										
Echinochloa crus-galli										
Muhlenbergia asperifolia	1	100								
Muhlenbergia rigens	10	100								
Panicum obtusum										
Paspalum distichum										
Phragmites australis										
Polypogon monspeliensis										
Scirpus acutus										

Data Addendum 5 (continued).

SOUTHWEST AND PLAINS RIPARIAN/WETLAND VEGETATION

TYPE NO:	16- 0		17- 0		18- 0		19- 0		20- 0	
NO. PLOTS:	(1)		(2)		(2)		(4)		(6)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
GRAMINOIDS, cont.										
Scirpus americanus									<1	33
Scirpus maritimus										
Scirpus microcarpus										
Scirpus olneyi										
Scirpus validus										
Sorghastrum nutans										
Sporobolus airoides										
FORBS										
Clematis drummondii										
Desmanthus illinoensis	<1	100								
Epilobium hornemannii			<1	50					<1	33
Epilobium paniculatum							<1	25		
Flaveria campestris										
Flaveria chloraefolia										
Helianthus ciliaris									<1	17
Hydrocotyl verticillata										
Limonium limbatum										
Lythrum californicum										
Marrubium vulgare										
Melilotus alba									11	67
Mentha arvensis									<1	67
Phyla lanceolata										
Polygonum aviculare										
Polygonum lapathifolium										
Polygonum persicaria									<1	17
Salicornia utahensis										
Typha latifolia										
Verbena macdougalii									<1	33

Data Addendum 5 (continued).

ROCKY MOUNTAIN MONTANE RIPARIAN/WETLAND VEGETATION

TYPE NO:	21- 0		22- 0		23- 0		24- 0		25- 0	
NO. PLOTS:	(4)		(2)		(6)		(1)		(1)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
TREES										
Abies concolor - mature										
Acer negundo - mature										
Acer negundo - adv										
Alnus oblongifolia - mature									4	100
Alnus oblongifolia - adv										
Picea pungens - mature										
Populus angustifolia - mature										
Populus angustifolia - adv										
Populus angustifolia - yng										
Pseudotsuga menziesii - mature										
SHRUBS										
Apocynum cannabinum										
Berberis fendleri										
Berberis repens										
Cornus stolonifera										
Glycyrrhiza lepidota	1	25								
Juniperus monosperma - mature										
Juniperus scopulorum - mature										
Lonicera involucrata										
Prunus virginiana										
Ribes inerme										
Rosa woodsii									<1	100
Rubus leucodermis										
Rubus strigosus									1	100
Symphoricarpos oreophilus										
Salix bebbiana									1	100
Salix boothii										
Salix caudata										
Salix irrorata										
Salix lasiandra										
Salix lutea									3	100
Salix monticola									1	100
Salix subcoerulea										
GRAMINOIDS										
Agropyron smithii										
Agropyron trachycaulum										
Agrostis alba									10	100
Agrostis stolonifera										
Beckmannia syzigachne										
Calamagrostis canadensis										
Calamovilfa longifolia										
Carex aquatilis										
Carex disperma										
Carex emoryi										
Carex festivella										
Carex geophila										
Carex hystricina									5	100
Carex microptera										
Carex nebraskensis										

Data Addendum 5 (continued).

ROCKY MOUNTAIN MONTANE RIPARIAN/WETLAND VEGETATION

TYPE NO:	21- 0		22- 0		23- 0		24- 0		25- 0	
NO. PLOTS:	(4)		(2)		(6)		(1)		(1)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
GRAMINOIDS, cont.										
Carex occidentalis										
Carex praegracilis										
Carex rostrata										
Carex simulata										
Carex stipata									2	100
Carex vulpinoidea										
Cyperus fendlerianus										
Deschampsia caespitosa										
Dactylis glomerata									<1	100
Eleocharis atropurpurea										
Eleocharis macrostachya	1	25								
Elymus canadensis	<1	50	1	100	2	50				
Elymus glaucus										
Festuca pratensis	5	25	<1	50						
Glyceria elata										
Glyceria striata									20	100
Juncus acuminatus										
Juncus balticus	5	25	20	50						
Juncus bufonius										
Juncus longistylis										
Juncus saximontanus									2	100
Juncus tenuis										
Juncus torreyi										
Phalaris arundinacea									40	100
Phleum pratensis									1	100
Poa pratensis										
FORBS										
Aconitum columbianum										
Actaea arguta										
Adiantum nigrum										
Agrimonia striata									1	100
Anemone cylindrica										
Aster foliaceus										
Bacopa rotundifolia										
Berula erecta										
Besseya plantaginea										
Campanula rotundifolia										
Cardamine cordifolia										
Cicuta douglasii									1	100
Circaea alpina										
Clematis ligusticifolia										
Conium maculatum										
Equisetum arvense									1	100
Equisetum laevigatum	1	50								
Fragaria americana										
Galium aparine										
Galium boreale										
Geranium atropurpurea										
Geranium caespitosum										

Data Addendum 5 (continued).

ROCKY MOUNTAIN MONTANE RIPARIAN/WETLAND VEGETATION

TYPE NO:	21- 0		22- 0		23- 0		24- 0		25- 0	
NO. PLOTS:	(4)		(2)		(6)		(1)		(1)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
FORBS, cont.										
Geranium richardsonii									1	100
Geum macrophyllum										
Habenaria hyperborea									<1	100
Heracleum lanatum									1	100
Iris missouriensis										
Mertensia franciscana										
Mimulus guttatus										
Oenothera strigosa			<1	50					1	100
Oxypolis fendleri										
Parthenocissus inserta										
Pastinaca sativa										
Prunella vulgaris									<1	100
Ranunculus aquatilis										
Ranunculus cymbalaria										
Ranunculus uncinatus										
Rorippa nasturtium-aquaticum										
Rorippa sinuata										
Rudbeckia laciniata									3	100
Samolus cuneatus										
Sidalcea candida										
Sida neomexicana										
Sisyrinchium montanum										
Smilacina stellata										
Solidago canadensis									2	100
Trifolium repens										
Veratrum californicum										
Veronica americana										
Veronica connata										
Vicia americana										
Viola canadensis										
Viola missouriensis										

Data Addendum 5 (continued).

SOUTHWEST AND PLAINS RIPARIAN/WETLAND VEGETATION

TYPE NO:	21- 0		22- 0		23- 0		24- 0		25- 0	
NO. PLOTS:	(4)		(2)		(6)		(1)		(1)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
TREES										
Populus fremontii - mature					28	33				
Populus fremontii - adv	5	25								
Populus fremontii - yng	<1	50	2	100	<1	17				
Populus x acuminata - mature										
Celtis reticulata										
Elaeagnus angustifolia - mature					3	17				
Elaeagnus angustifolia - adv	4	50								
Juglans major - mature										
Salix amygdaloides - adv										
Salix babylonica - mature										
Salix gooddingii - mature										
Salix gooddingii - adv										
SHRUBS										
Baccharis emoryi	26	100	33	100	26	100				
Baccharis glutinosa										
Berberis trifoliolata										
Ceanothus fendleri										
Chilopsis linearis										
Chrysothamnus nauseosus					1	17				
Chrysothamnus viscidiflorus					2	33				
Gutierrezia sarothrae	1	25			1	17				
Juglans microcarpa										
Rhus copallina										
Rhus microphylla										
Robinia neomexicana										
Salix exigua	21	100			3	17			4	100
Salix interior										
Salix taxifolia					<1	17				
Tamarix pentandra	8	50	18	100	38	100	2	100		
Vitis arizonica										
Vitis vulpina										
GRAMINOIDS										
Bothriochloa saccharoides	<1	50	2	50	13	83				
Buchloe dactyloides										
Cinna latifolia										
Cladium jamaicense										
Cortaderia selloana										
Cynodon dactylon	3	25								
Cyperus esculentus	1	25								
Cyperus uniflorus										
Distichlis stricta			50	50	2	17				
Echinochloa crus-galli	10	25								
Muhlenbergia asperifolia	8	50	1	100	1	50				
Muhlenbergia rigens										
Panicum obtusum	1	25								
Paspalum distichum										
Phragmites australis										
Polypogon monspeliensis	1	25								
Scirpus acutus										

Data Addendum 5 (continued).

SOUTHWEST AND PLAINS RIPARIAN/WETLAND VEGETATION

TYPE NO:	21- 0		22- 0		23- 0		24- 0		25- 0	
NO. PLOTS:	(4)		(2)		(6)		(1)		(1)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
GRAMINOIDS, cont.										
Scirpus americanus	7	100	2	100	9	67				
Scirpus maritimus			1	50						
Scirpus microcarpus									2	100
Scirpus olneyi										
Scirpus validus									3	100
Sorghastrum nutans										
Sporobolus airoides	1	25	2	50	28	100	1	100		
FORBS										
Clematis drummondii										
Desmanthus illinoensis										
Epilobium hornemannii									3	100
Epilobium paniculatum										
Flaveria campestris					1	17				
Flaveria chloraefolia										
Helianthus ciliaris										
Hydrocotyl verticillata										
Limonium limbatum										
Lythrum californicum										
Marrubium vulgare										
Melilotus alba			<1	50	5	50	10	100		
Mentha arvensis									1	100
Phyla lanceolata										
Polygonum aviculare										
Polygonum lapathifolium										
Polygonum persicaria										
Salicornia utahensis										
Typha latifolia			1	50					<1	100
Verbena macdougalii										

Data Addendum 5 (continued).

ROCKY MOUNTAIN MONTANE RIPARIAN/WETLAND VEGETATION

TYPE NO:	26- 0		27- 0		28- 0		29- 0		30- 0	
NO. PLOTS:	(1)		(2)		(1)		(2)		(2)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
TREES										
Abies concolor - mature										
Acer negundo - mature										
Acer negundo - adv										
Alnus oblongifolia - mature										
Alnus oblongifolia - adv										
Picea pungens - mature										
Populus angustifolia - mature										
Populus angustifolia - adv										
Populus angustifolia - yng										
Pseudotsuga menziesii - mature										
SHRUBS										
Apocynum cannabinum	2	100								
Berberis fendleri										
Berberis repens										
Cornus stolonifera										
Glycyrrhiza lepidota										
Juniperus monosperma - mature					1	100				
Juniperus scopulorum - mature										
Lonicera involucrata										
Prunus virginiana										
Ribes inerme										
Rosa woodsii	2	100								
Rubus leucodermis										
Rubus strigosus										
Symphoricarpos oreophilus										
Salix bebbiana			1	50						
Salix boothii										
Salix caudata										
Salix irrorata										
Salix lasiandra			8	50						
Salix lutea	<1	100	1	50						
Salix monticola										
Salix subcoerulea										
GRAMINOIDS										
Agropyron smithii										
Agropyron trachycaulum					4	100				
Agrostis alba					25	100				
Agrostis stolonifera	10	100	3	50						
Beckmannia syzigachne										
Calamagrostis canadensis										
Calamovilfa longifolia										
Carex aquatilis										
Carex disperma										
Carex emoryi	60	100								
Carex festivella										
Carex geophila										
Carex hystricina										
Carex microptera										
Carex nebraskensis			20	100						

Data Addendum 5 (continued).

ROCKY MOUNTAIN MONTANE RIPARIAN/WETLAND VEGETATION

TYPE NO:	26- 0		27- 0		28- 0		29- 0		30- 0	
NO. PLOTS:	(1)		(2)		(1)		(2)		(2)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
GRAMINOIDS, cont.										
Carex occidentalis										
Carex praegracilis			15	50	3	100				
Carex rostrata			15	50						
Carex simulata			20	50						
Carex stipata										
Carex vulpinoidea										
Cyperus fendlerianus					<1	100				
Deschampsia caespitosa										
Dactylis glomerata										
Eleocharis atropurpurea										
Eleocharis macrostachya	<1	100	10	100					3	50
Elymus canadensis	3	100								
Elymus glaucus										
Festuca pratensis	3	100	3	50						
Glyceria elata										
Glyceria striata			3	50						
Juncus acuminatus										
Juncus balticus			10	50	3	100				
Juncus bufonius										
Juncus longistylis			10	50						
Juncus saximontanus			1	50						
Juncus tenuis			10	50						
Juncus torreyi										
Phalaris arundinacea	2	100								
Phleum pratensis										
Poa pratensis			2	100						
FORBS										
Aconitum columbianum										
Actaea arguta										
Adiantum nigrum										
Agrimonia striata	<1	100	<1	50						
Anemone cylindrica										
Aster foliaceus										
Bacopa rotundifolia										
Berula erecta										
Besseya plantaginea										
Campanula rotundifolia										
Cardamine cordifolia										
Cicuta douglasii										
Circaea alpina										
Clematis ligusticifolia	<1	100								
Conium maculatum										
Equisetum arvense	5	100	1	50						
Equisetum laevigatum	5	100	5	50	1	100				
Fragaria americana										
Galium aparine										
Galium boreale										
Geranium atropurpurea			<1	50						
Geranium caespitosum										

Data Addendum 5 (continued).

ROCKY MOUNTAIN MONTANE RIPARIAN/WETLAND VEGETATION

TYPE NO:	26- 0		27- 0		28- 0		29- 0		30- 0	
NO. PLOTS:	(1)		(2)		(1)		(2)		(2)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
FORBS, cont.										
Geranium richardsonii										
Geum macrophyllum										
Habenaria hyperborea			2	50						
Heracleum lanatum										
Iris missouriensis										
Mertensia franciscana										
Mimulus guttatus										
Oenothera strigosa			<1	50						
Oxypolis fendleri										
Parthenocissus inserta	2	100								
Pastinaca sativa										
Prunella vulgaris			<1	50						
Ranunculus aquatilis										
Ranunculus cymbalaria										
Ranunculus uncinatus										
Rorippa nasturtium-aquaticum										
Rorippa sinuata										
Rudbeckia laciniata			2	50						
Samolus cuneatus										
Sidalcea candida										
Sida neomexicana			<1	50						
Sisyrinchium montanum	<1	100	1	50						
Smilacina stellata										
Solidago canadensis										
Trifolium repens	<1	100								
Veratrum californicum										
Veronica americana			<1	50						
Veronica connata										
Vicia americana	<1	100								
Viola canadensis										
Viola missouriensis			<1	50						

Data Addendum 5 (continued).

SOUTHWEST AND PLAINS RIPARIAN/WETLAND VEGETATION

TYPE NO:	26- 0		27- 0		28- 0		29- 0		30- 0	
NO. PLOTS:	(1)		(2)		(1)		(2)		(2)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
TREES										
Populus fremontii - mature										
Populus fremontii - adv										
Populus fremontii - yng										
Populus x acuminata - mature										
Celtis reticulata										
Elaeagnus angustifolia - mature										
Elaeagnus angustifolia - adv										
Juglans major - mature										
Salix amygdaloides - adv										
Salix babylonica - mature										
Salix gooddingii - mature										
Salix gooddingii - adv										
SHRUBS										
Baccharis emoryi										
Baccharis glutinosa										
Berberis trifoliolata										
Ceanothus fendleri										
Chilopsis linearis										
Chrysothamnus nauseosus										
Chrysothamnus viscidiflorus										
Gutierrezia sarothrae										
Juglans microcarpa										
Rhus copallina										
Rhus microphylla										
Robinia neomexicana										
Salix exigua	5	100	20	50						
Salix interior										
Salix taxifolia										
Tamarix pentandra							<1	50	45	100
Vitis arizonica	<1	100			<1	100				
Vitis vulpina										
GRAMINOIDS										
Bothriochloa saccharoides										
Buchloe dactyloides										
Cinna latifolia										
Cladium jamaicense										
Cortaderia selloana										
Cynodon dactylon									3	50
Cyperus esculentus										
Cyperus uniflorus			5	50						
Distichlis stricta							40	100	30	100
Echinochloa crus-galli										
Muhlenbergia asperifolia					<1	100			10	50
Muhlenbergia rigens										
Panicum obtusum										
Paspalum distichum										
Phragmites australis									1	50
Polypogon monspeliensis										
Scirpus acutus			5	50						

Data Addendum 5 (continued).

SOUTHWEST AND PLAINS RIPARIAN/WETLAND VEGETATION

TYPE NO:	26- 0		27- 0		28- 0		29- 0		30- 0	
NO. PLOTS:	(1)		(2)		(1)		(2)		(2)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
GRAMINOIDS, cont.										
Scirpus americanus									20	100
Scirpus maritimus									7	50
Scirpus microcarpus										
Scirpus olneyi										
Scirpus validus										
Sorghastrum nutans										
Sporobolus airoides										
FORBS										
Clematis drummondii										
Desmanthus illinoensis										
Epilobium hornemannii			16	100						
Epilobium paniculatum										
Flaveria campestris										
Flaveria chloraefolia										
Helianthus ciliaris										
Hydrocotyl verticillata										
Limonium limbatum							<1	50		
Lythrum californicum										
Marrubium vulgare					<1	100				
Melilotus alba	<1	100			1	100				
Mentha arvensis			<1	50						
Phyla lanceolata										
Polygonum aviculare									1	50
Polygonum lapathifolium										
Polygonum persicaria										
Salicornia utahensis							38	100		
Typha latifolia			15	50						
Verbena macdougalii										

Data Addendum 5 (continued).

ROCKY MOUNTAIN MONTANE RIPARIAN/WETLAND VEGETATION

TYPE NO:	31- 0		32- 0		33- 0		34- 0		35- 0	
NO. PLOTS:	(1)		(2)		(2)		(1)		(1)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
TREES										
Abies concolor - mature										
Acer negundo - mature										
Acer negundo - adv										
Alnus oblongifolia - mature										
Alnus oblongifolia - adv										
Picea pungens - mature										
Populus angustifolia - mature										
Populus angustifolia - adv										
Populus angustifolia - yng										
Pseudotsuga menziesii - mature										
SHRUBS										
Apocynum cannabinum										
Berberis fendleri										
Berberis repens										
Cornus stolonifera										
Glycyrrhiza lepidota										
Juniperus monosperma - mature										
Juniperus scopulorum - mature										
Lonicera involucrata										
Prunus virginiana										
Ribes inerme										
Rosa woodsii										
Rubus leucodermis										
Rubus strigosus										
Symphoricarpos oreophilus										
Salix bebbiana										
Salix boothii										
Salix caudata										
Salix irrorata										
Salix lasiandra										
Salix lutea										
Salix monticola										
Salix subcoerulea										
GRAMINOIDS										
Agropyron smithii										
Agropyron trachycaulum						<1	50			
Agrostis alba			3	50						
Agrostis stolonifera										
Beckmannia syzigachne										
Calamagrostis canadensis										
Calamovilfa longifolia										
Carex aquatilis										
Carex disperma										
Carex emoryi										
Carex festivella										
Carex geophila										
Carex hystricina										
Carex microptera										
Carex nebraskensis										

Data Addendum 5 (continued).

ROCKY MOUNTAIN MONTANE RIPARIAN/WETLAND VEGETATION

TYPE NO:	31- 0		32- 0		33- 0		34- 0		35- 0	
NO. PLOTS:	(1)		(2)		(2)		(1)		(1)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
GRAMINOIDS, cont.										
Carex occidentalis										
Carex praegracilis										
Carex rostrata										
Carex simulata										
Carex stipata										
Carex vulpinoidea										
Cyperus fendlerianus										
Deschampsia caespitosa										
Dactylis glomerata										
Eleocharis atropurpurea										
Eleocharis macrostachya	15	100	2	50						
Elymus canadensis					1	50				
Elymus glaucus										
Festuca pratensis										
Glyceria elata										
Glyceria striata										
Juncus acuminatus										
Juncus balticus										
Juncus bufonius									1	100
Juncus longistylis										
Juncus saximontanus			5	50						
Juncus tenuis									2	100
Juncus torreyi					<1	50				
Phalaris arundinacea										
Phleum pratensis										
Poa pratensis										
FORBS										
Aconitum columbianum										
Actaea arguta										
Adiantum nigrum										
Agrimonia striata										
Anemone cylindrica										
Aster foliaceus										
Bacopa rotundifolia										
Berula erecta	3	100								
Besseya plantaginea										
Campanula rotundifolia										
Cardamine cordifolia										
Cicuta douglasii										
Circaea alpina										
Clematis ligusticifolia										
Conium maculatum										
Equisetum arvense			20	50						
Equisetum laevigatum			3	50						
Fragaria americana										
Galium aparine										
Galium boreale										
Geranium atropurpurea										
Geranium caespitosum										

Data Addendum 5 (continued).

ROCKY MOUNTAIN MONTANE RIPARIAN/WETLAND VEGETATION

TYPE NO:	31- 0		32- 0		33- 0		34- 0		35- 0	
NO. PLOTS:	(1)		(2)		(2)		(1)		(1)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
FORBS, cont.										
Geranium richardsonii										
Geum macrophyllum										
Habenaria hyperborea										
Heracleum lanatum										
Iris missouriensis										
Mertensia franciscana										
Mimulus guttatus										
Oenothera strigosa										
Oxypolis fendleri										
Parthenocissus inserta										
Pastinaca sativa										
Prunella vulgaris										
Ranunculus aquatilis										
Ranunculus cymbalaria										
Ranunculus uncinatus										
Rorippa nasturtium-aquaticum	5	100								
Rorippa sinuata			<1	100						
Rudbeckia laciniata										
Samolus cuneatus	<1	100								
Sidalcea candida										
Sida neomexicana										
Sisyrinchium montanum										
Smilacina stellata										
Solidago canadensis										
Trifolium repens			5	50						
Veratrum californicum										
Veronica americana			1	50						
Veronica connata										
Vicia americana										
Viola canadensis										
Viola missouriensis										

Data Addendum 5 (continued).

SOUTHWEST AND PLAINS RIPARIAN/WETLAND VEGETATION

TYPE NO:	31- 0		32- 0		33- 0		34- 0		35- 0	
NO. PLOTS:	(1)		(2)		(2)		(1)		(1)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
TREES										
Populus fremontii - mature									5	100
Populus fremontii - adv									<1	100
Populus fremontii - yng			1	50	3	50				
Populus x acuminata - mature										
Celtis reticulata										
Elaeagnus angustifolia - mature										
Elaeagnus angustifolia - adv										
Juglans major - mature										
Salix amygdaloides - adv										
Salix babylonica - mature										
Salix gooddingii - mature										
Salix gooddingii - adv										
SHRUBS										
Baccharis emoryi					5	50				
Baccharis glutinosa										
Berberis trifoliolata										
Ceanothus fendleri										
Chilopsis linearis										
Chrysothamnus nauseosus										
Chrysothamnus viscidiflorus										
Gutierrezia sarothrae										
Juglans microcarpa										
Rhus copallina										
Rhus microphylla										
Robinia neomexicana										
Salix exigua										
Salix interior										
Salix taxifolia										
Tamarix pentandra			<1	50	5	50				
Vitis arizonica										
Vitis vulpina										
GRAMINOIDS										
Bothriochloa saccharoides	<1	100								
Buchloe dactyloides										
Cinna latifolia										
Cladium jamaicense	1	100								
Cortaderia selloana										
Cynodon dactylon	15	100							2	100
Cyperus esculentus	<1	100								
Cyperus uniflorus										
Distichlis stricta										
Echinochloa crus-galli			2	50	3	50				
Muhlenbergia asperifolia	15	100			2	50	1	100		
Muhlenbergia rigens										
Panicum obtusum										
Paspalum distichum	5	100	18	100	2	50				
Phragmites australis										
Polypogon monspeliensis			2	100	2	50				
Scirpus acutus	35	100	1	50						

Data Addendum 5 (continued).

SOUTHWEST AND PLAINS RIPARIAN/WETLAND VEGETATION

TYPE NO:	31- 0		32- 0		33- 0		34- 0		35- 0	
NO. PLOTS:	(1)		(2)		(2)		(1)		(1)	
	D/C	CON	D/C	CON	D/C	CON	D/C	CON	D/C	CON
GRAMINOIDS, cont.										
Scirpus americanus			18	100	20	100				
Scirpus maritimus										
Scirpus microcarpus										
Scirpus olneyi							99	100	15	100
Scirpus validus										
Sorghastrum nutans			15	50						
Sporobolus airoides										
FORBS										
Clematis drummondii										
Desmanthus illinoensis									<1	100
Epilobium hornemannii										
Epilobium paniculatum										
Flaveria campestris										
Flaveria chloraefolia	25	100								
Helianthus ciliaris										
Hydrocotyl verticillata										
Limonium limbatum										
Lythrum californicum	1	100								
Marrubium vulgare										
Melilotus alba			<1	100						
Mentha arvensis										
Phyla lanceolata										
Polygonum aviculare										
Polygonum lapathifolium										
Polygonum persicaria	<1	100	<1	100	<1	50				
Salicornia utahensis										
Typha latifolia	10	100	1	50	38	100			50	100
Verbena macdougalii										