CENTRAL PLATTE RIVER
1998 LAND COVER/USE
MAPPING PROJECT
NEBRASKA

OCTOBER 20, 2000

Technical Report of the Platte River EIS Team
U.S. Department of the Interior
Bureau of Reclamation
Fish and Wildlife Service

U.S. Department of the Interior
Mission Statement

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Denver, CO 80225-0007
303-445-2096 (voice)
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CENTRAL PLATTE RIVER 1998 LAND COVER/USE MAPPING PROJECT NEBRASKA

This report was prepared for the Platte River EIS Office by the Remote Sensing and Geographic Information Group (RSGIG) of the Bureau of Reclamation's Technical Service Center as Technical Memorandum No. 8260-00-08.

Beverly Friesen
Bureau of Reclamation
Jim Von Loh
ACS Government Solutions Group
Joyce Schrott
ACS Government Solutions Group
Jack Butler
Central Missouri State University
Doug Crawford
Bureau of Reclamation
Mike Pucherelli
Bureau of Reclamation

U.S. Department of the Interior
Bureau of Reclamation
Denver Office
Technical Service Center

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Acronyms and Abbreviations

AML	Arc Macro Language
BOR	U.S. Bureau of Reclamation (Also USBR)
CFS	Cubic Feet per Second
CPRV	Central Platte River Valley
DEM	Digital Elevation Model
DLG	Digital Line Graph
DRG	Digital Raster Graphic
DOQQ	Digital Orthophoto Quarter Quadrangle
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FGDC	Federal Geographic Data Committee
FWS	U.S. Fish and Wildlife Service
GIS	Geographic Information System(s)
GPS	Global Positioning System
MMU	Minimum mapping unit
NAD	North American Datum (Cartography)
NBII	National Biological Information Infrastructure
NRCS	Natural Resources Conservation Service (formerly the Soil Conservation Service)
NVCS	National Vegetation Classification System
PLGR	Precision Light-weight GPS Receiver
PREISO	Platte River EIS Office
Program	The Recovery Implementation Program
RSGIG	Remote Sensing and Geographic Information Group (of the USBR)
TNC	The Nature Conservancy
UNL	University of Nebraska, Lincoln
USBR	United States Bureau of Reclamation (Also BOR)
USDA-SCS	United States Dept. of Agriculture—Soil Conservation Service.
USDOI	United Stated Dept. of Interior
USFS	United States Forest Service
USGS	United States Geological Survey
UTM	Universal Transverse Mercator (Cartography)
WELUT	Western Energy and Land Use Team

Executive summary

The Platte River Endangered Species Partnership has been formed to implement a Cooperative Agreement among the states of Nebraska, Wyoming, and Colorado, and the U. S. Department of the Interior. The *Cooperative Agreement for Platte River Research and Other Efforts Relating to Endangered Species Habitat Along the Central Platte River, Nebraska,* guides this effort; it is implemented by a Governance Committee with members from the three states, water users, environmental groups, and two federal agencies. This partnership was formed to address endangered species issues within the Platte River Basin and serves two main purposes:

1) To develop and implement a Recovery Implementation Program to improve and conserve habitat for four threatened and endangered species that use the Platte River in Nebraska: the whooping crane, piping plover, least tern, and pallid sturgeon.

2) To enable existing and new water users in the Platte River Basin to proceed on new activities without additional actions required, beyond the Recovery Implementation Program, for the four species under the Endangered Species Act.

The U.S. Department of the Interior's preparation of a programmatic environmental impact statement associated with implementing the Platte River Recovery Program will use spatial geographic information system (GIS) data to partially fulfill National Environmental Policy Act (NEPA) and Endangered Species Act (ESA) analyses. As part of the NEPA analysis, the U. S. Bureau of Reclamation's (Reclamation's) Remote Sensing and Geographic Information Group has classified and created a digital GIS database for land-cover and land-use of the 630 square mile (7- × 90-mile) river corridor between Lexington and Chapman, Nebraska. Twelve natural vegetation and seven agricultural land-cover types, five surface hydrology, fourteen land-use classifications, and the floodplain boundary were interpreted from 1998 color-infrared aerial photography and transferred into a GIS database by on-screen digitizing and scanning methods. The GIS database is registered to 1998 color-infrared digital orthophotos specifically produced for this project.

The overall map classification (thematic) accuracy was evaluated using a modification of the National Vegetation Classification Standard protocol and was determined to be 88.8%. Final geographic information system products comply with the national standards (Federal Geographic Data Committee and National Biological Information Infrastructure) and are described in this report. The final project deliverables are as follow:

- Results of Basinwide Data Development
- Summary of ArcView Training
- Results of Field Evaluations and 1998 Central Platte River Database Development
- Habitat and Land Use Classification System and Descriptions
- Accuracy Assessment
- Results of Data Analyses
- Metadata
- Final Report

The Partnership maintains a website at: www.platteriver.org

1. Introduction

The Platte River Endangered Species Partnership was formed to resolve issues related to endangered wildlife species within the Platte River Basin (Platte River EIS Office 1998). This partnership consists of three states (Nebraska, Wyoming, and Colorado), two Federal agencies of the U. S. Department of the Interior (Fish and Wildlife Service and Bureau of Reclamation), a number of water users, and environmental organizations. The Partnership is guided by a Cooperative Agreement entitled *Cooperative Agreement for Platte River Research and Other Efforts Relating to Endangered Species Habitat Along the Central Platte River, Nebraska* (1997) (Appendix A). The Partnership maintains a website at: www.platteriver.org. Two main purposes have been defined for the Partnership:

- To develop and implement a "Recovery Implementation Program" (Program) to improve and conserve habitat for four threatened and endangered species that use the Platte River in Nebraska: the whooping crane, piping plover, least tern, and pallid sturgeon.

- To enable existing and new water users in the Platte River Basin to proceed on new activities without additional actions required (beyond the Program) for the four species under the Endangered Species Act (ESA).

The goals established to implement the Cooperative Agreement are:

- Secure sufficient improvements to the Platte River habitat for the target species so that current and future water use in the Platte River Basin is not likely to jeopardize any of the species.

- Provide compliance with the Endangered Species Act for these existing and any new water uses.

- Help prevent additional species in the Platte River Basin from becoming threatened or endangered.

- Ensure that any impacts on the Central Platte habitat from future development in each state are prevented or offset within that state.

In general, the Program objectives are to make more water available in the river at times when it is most useful for wildlife and provide or protect additional lands for habitat along the river. The long-term Program goal of sufficient flows to support the four threatened or endangered wildlife species focuses on determining how much water is needed. For the first 10–12 years, a goal of 130,000 to 150,000 acre-feet of water annually will supplement existing flows that are considered less than target wildlife species requirements. Acquisition of 10,000 acres of habitat between Lexington and Chapman, Nebraska, is also a Program objective for the first 10–12 years. Approximately 3,000 acres have been acquired to date (Nebraska Public Power District: Cottonwood Ranch between Overton and Elm Creek, Nebraska, totals 2,650 acres). The long-term objective is to acquire 29,000 acres of habitat (this amount could change if justified by new

research and management methods). Typical habitat to be acquired will have a wide, shallow river channel and adjacent wet meadows.

To better define this Program, an accurate land cover/use database that serves as the baseline for future trend analyses was needed. The U. S. Bureau of Reclamation (Reclamation) Remote Sensing and Geographic Information Group (RSGIG) was contracted to review existing land coverages, assess their value, and recommend actions based on the reviews, including preparing a new land cover/use database, if necessary.

Prior to this study, two land cover/use databases had been prepared: 1) 1983 Western Energy and Land Use Team (WELUT) prepared a coverage for the Platte River Whooping Crane Habitat Maintenance Trust, and 2) 1995 University of Nebraska at Lincoln (UNL) prepared a coverage commonly referred to as the CALMIT database. Because thematic accuracy could not be established for the CALMIT database and data prepared by WELUT were not statistically verified, neither of these databases were deemed appropriate to use as a baseline dataset representing the present study (Appendix B). The new database prepared by BOR-RSGIG will now serve as the baseline dataset for trend analyses in the Central Platte River corridor, representing conditions that existed on August 19, 21, and 24, 1998.

Several tasks were identified and contracted to BOR-RSGIG to prepare a baseline land coverage and create a digital, spatial database representative of the habitats and land use occurring along this 7- × 90-mile reach of the Central Platte River (USDOI-BOR 1999). Specifically, these tasks, divided into two phases, are described below.

Phase I - GIS Database Development

Land and Resource Mapping Methodology

, Basinwide Data Development
  - Collect digital baseline data for the Platte River drainage basin
  - Provide this data to Woodward-Clyde consultants for baseline reporting

, 1998 Central Platte River Database
  - Acquire color-infrared aerial photography at 1:24,000 scale
  - Enlarge every other print to a 1:12,000 scale for photo-interpretation
  - Perform field reconnaissance to determine land cover photo signatures
  - Perform photo-interpretation
  - Digitize interpreted data using scanning or on-screen techniques
  - Use a classification system similar to that prepared in 1983 (WELUT coverage).
  - Format GIS data for ArcView (ESRI, Inc.)
  - Conduct an accuracy assessment
  - Prepare metadata to comply with both FGDC and NBII standards

, Observation Sites
  - Produce 1:4800-scale aerial photographs for 8 three-mile river reaches
  - Provide one-foot contours through photogrammetric analysis
  - Schedule 3 additional overflights during 1999, at1 600, 2000, 3200 cfs

[Note: this task, Observation Sites, was not performed because of flow levels exceeding the requirements deemed appropriate for biological analyses and budgetary constraints, but should be considered in the future as a basis for long-term monitoring and adaptive management].

Training

, ArcView 3.1 Training
- Conduct 3 two-day training sessions in ArcView 3.1 (one in Grand Island, Nebraska, and two in Denver, Colorado)
- Limit training to six participants per session

Archiving

, Geographically-referenced data
- Archive field data for wildlife and vegetation
- Archive reports and tabular data

Phase II - Analysis

Proposals

, GIS analysis proposals will be prepared as individual analyses are identified.

An additional proposal, *Vegetation Classification of the Central Platte River* (Butler 1999), was prepared and funded. Important elements of this study are described below.

, Collect observation point, sample plot, and accuracy assessment point data for each vegetation type (excluding agricultural crops) in the study corridor.
- Observation points provide basic information on biological and physical features for use by photo-interpreters and for initial assessments of accuracy.
- Sample plots are 20- × 20-meters (woodlands) or 10- × 10-meters (shrublands and herbaceous types) and provide detailed vegetation composition and structure information for vegetation type descriptions.
- Accuracy assessment points are used to evaluate the classification (determine errors of omission and commission) following digitization of photo-interpreted vegetation data.

, Incorporate processed field data into the National Vegetation Classification Standard and prepare a final report.

2. Project Area

The study area addressed by BOR–RSGIG covers approximately 678 square miles (434,199 acres) and occupies portions of nine counties in central Nebraska. Principal cities located in this corridor include Lexington, Kearney, and Grand Island; the GIS study begins just west of Lexington and terminates near the town of Chapman, Nebraska. For convenience of analysis, particularly comparative analyses with earlier land cover databases, the project corridor has been divided into 13 segments or reaches defined by bridge crossings of the Platte River (Figure 2.1).

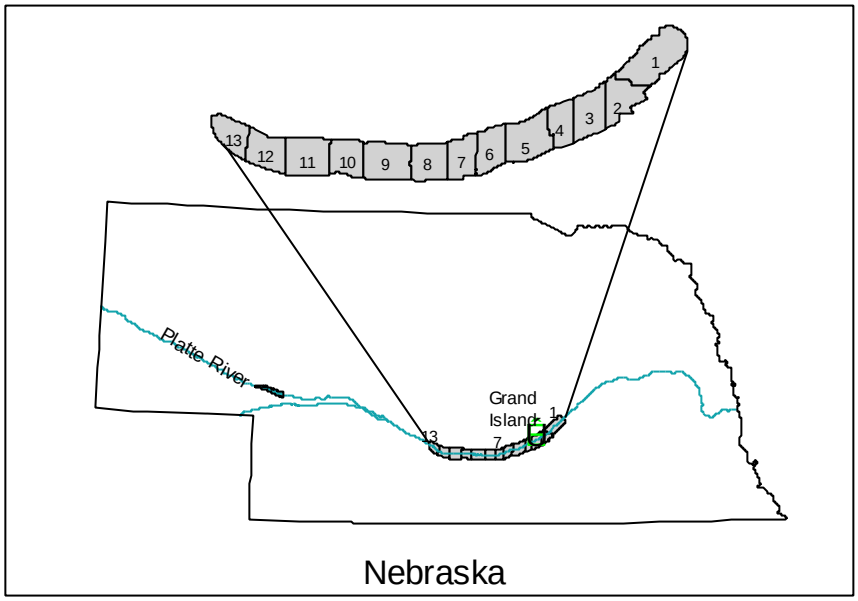


Figure 2.1. GIS project study area location map with bridge segments

Two urban development map units have been interpreted and entered into a digital database for this study: (31) development commercial, and (42) barren surface. The total area occupied by urban, developed/cleared land was approximately 3,484 acres or 0.8% of the study corridor. Figure 2.2 illustrates examples of urban development in the study corridor.

Figure 2.2. Photos of urban development sites representing map classes 31 and 42

Three additional development-related map units have been interpreted and entered into a digital database for this study: (34) powerline, (40) sand/gravel areas, and (41) sand/gravel operation. The total area occupied by these land uses was approximately 1,708 acres or 0.4% of the study corridor. Figure 2.3 illustrates examples of rural development in the study corridor.

Figure 2.3. Photos of rural development sites representing classes 34, 40, and 41

This portion of Nebraska is agrarian; the local agribusinesses focus primarily on small grain, hay, and livestock production. Two residential map units, (32) development multiple dwellings and (33) development single dwelling, have been interpreted and entered into a digital data base for this study. The total area occupied by rural farmsteads and housing tracts with more than one dwelling was approximately 8,601 acres or 2.0% of the study corridor (Fig. 2.4).

Figure 2.4. Photos of rural residence sites representing map classes 32 and 33

Generally, habitats that are not in crop production include the river valley and major tributary drainages; their associated riparian woodlands, shrublands, and wetlands; sub-irrigated soils adjacent to the river and major drainages (some native grasses on these soils are used for hay production); and sand hills.

2.1 Location and Regional Setting

The Central Platte River Valley (CPRV) is situated in the Great Plains between Lexington and Chapman, Nebraska. The study corridor includes portions of Adams, Buffalo, Dawson, Gosper, Hall, Hamilton, Kearney, Merrick, and Phelps Counties. Travel within the corridor is enhanced by Interstate Highway 80; U. S. Highways 30, 34, 183, 281, and 283; and Nebraska Highways 10, 11, 21, 40, and 44 for primary access, and by a number of county roads for secondary access (Fig. 2.5). Even further access is possible, using farm, ranch, state park, and other local roads and trails as a tertiary network.

Five travel corridor map units have been interpreted and entered into a digital database for this study: (30) bridge, (35) road gravel, (36) road interstate, (37) road paved, (38) railroad, and (39) other road. The total area occupied by travel corridors was approximately

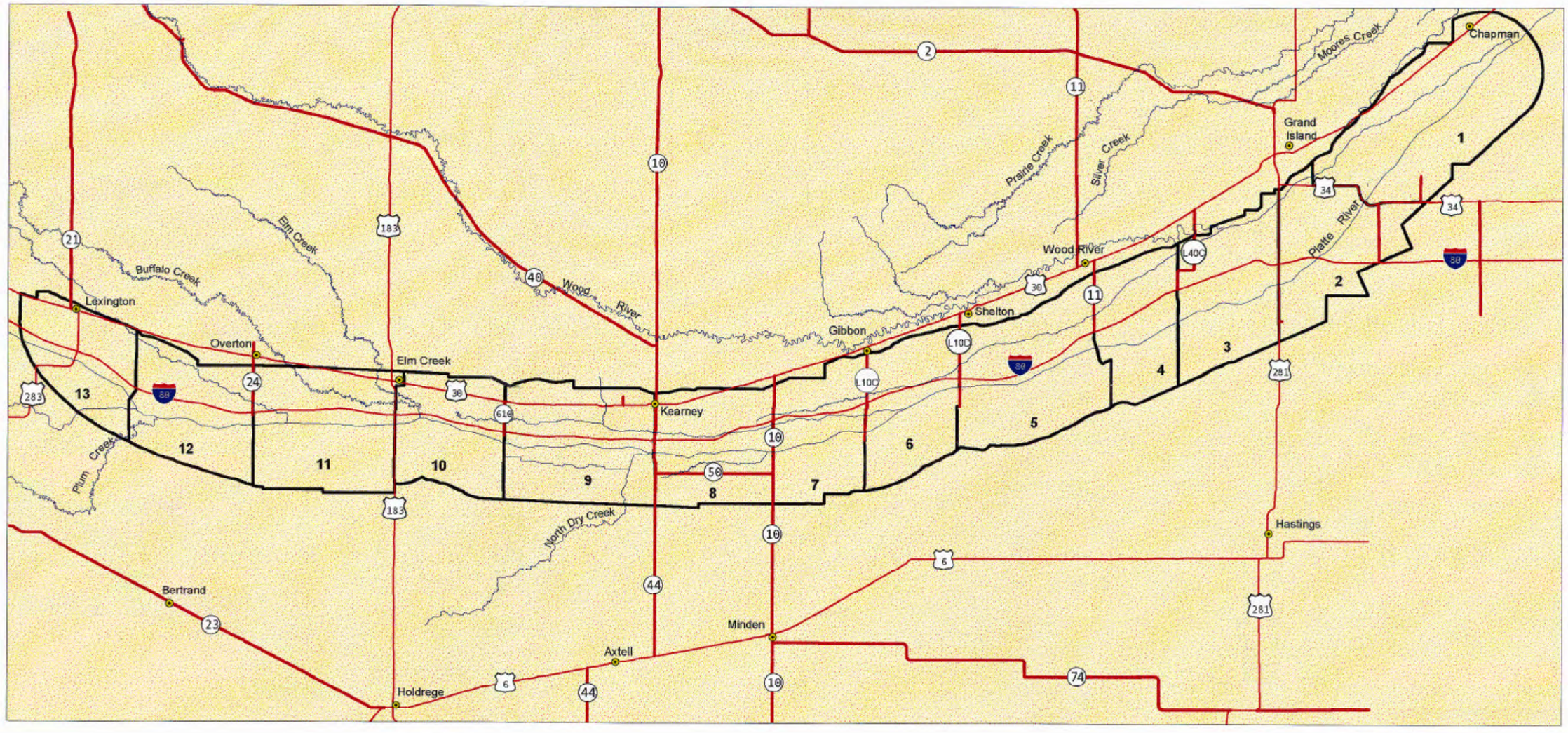


Figure 2.5. Interstate, U.S., and Nebraska highways within study corridor

14,903 acres or 3.4% of the study corridor. Figure 2.6 illustrates examples of travel-related land use units that occur in the study corridor.

Figure 2.6. Photos for travel corridor map units from upper left to lower right: (30) bridge, (35) road gravel, (36) road interstate), (37) road paved, (38) railroad, and (39) other road

2.2 Climate

This portion of the Central Great Plains normally records warm summers and moderately cold winters. A semi-arid, continental climate that includes long, hot, and dry summers, moderately long, cold, and dry winters, and precipitation events occurring mostly in late spring and early summer typify the area. CPRV is influenced by the regional climatic effects of the Rocky Mountains, most notably reduced precipitation, which results in mixed-grass prairie formation rather than woodlands (woodlands grow as a result of increased precipitation east of the corridor).

Precipitation for this region typically originates in the Gulf of Mexico. Average annual precipitation is 21.6, 24.3, and 24.6 inches at Gothenburg, Kearney, and Grand Island, Nebraska (near the western, central, and eastern portions of the study corridor, respectively) (USDA–SCS 1978, 1984, and 1962) (Appendix C). The highest amount of precipitation falls as rain between the months of April and June, and approximately 80% falls between April and September. Average temperatures recorded for Gothenburg, Kearney, and Grand Island, Nebraska, range from 25, 23, and 24 degrees F° for the low (January) and 76, 77, and 78 degrees F° for the high (July). The lowest temperature recorded within the corridor was -33 degrees F° and the highest was 117 degrees F°. The growing season is moderate, averaging approximately 160 days above freezing (32 degrees F°) (USDA-SCS 1978, 1984, and 1962).

2.3 Geology, Soils, and Topography

Geology

CPRV surface geology consists primarily of recent alluvial deposits and wind-distributed (eolian) loess and sand layers deposited over older sandstone, limestone, and shale formations (USDA-SCS 1981b). Loess is predominantly silt (i.e., fine particles deposited by wind), typically in a "blanket", while sand particles are larger and more coarse, typically deposited as hills or dunes. Sand hills from material blown out of the Platte River occupy the southern border of the study corridor.

The Platte River Valley, islands, and adjacent terraces are characterized by sand and gravel beds (mixed alluvium) and silty alluvium deposited during recent times. These beds overlie Quaternary silts, clays, sands, and gravels, which in turn are deposited directly on Tertiary Ogallala Formation sandstones (also the primary source of ground water) (USDA-SCS 1984).

North of the Platte River, a thick deposit of Quaternary Peoria Loess forms the low hills and ridges and is the parent material for developed soils. In Gosper and Hamilton Counties, there are also some deposits of Quaternary Bignell Loess, which is only a few feet thick near the Platte River (USDA-SCS 1981). Peoria Loess varies from 15–100+ feet thick and blankets the underlying Loveland Formation (also of Quaternary age), a bed of reddish-brown siltstone that may reach 100 feet thick. Loveland Formation siltstone sparingly outcrops on valley sides and deeply entrenched drainages in the study corridor.

Beneath the Loveland Formation siltstone lies a thick bed (up to 100 feet) of undifferentiated Pleistocene silts, sands and clays that create a layer between the Loveland Formation and the Tertiary Ogallala Formation. Ogallala Formation sandstones range from 50–300+ feet thick and are an important ground water aquifer. The Ogallala Formation outcrops at only one location near the study corridor, in the vicinity of Miller, Nebraska (USDA-SCS 1974). Cretaceous shales underlie the entire project region, but do not outcrop within the corridor. Cretaceous deposits are from 150–400 feet below the ground surface and include the Niobrara and Carlisle Formation.

Soils

Most soil associations within the study corridor formed from eolian loess and sand on uplands and alluvial deposits on floodplains. Soils, in general, relate to specific geologic landforms, topographic relief, climate, and the corresponding natural vegetation. One way to assess regional soil patterns and either existing or potential natural vegetation communities is to use Range Site classifications provided by the United States Department of Agriculture—Natural Resources Conservation Service (formerly the Soil Conservation Service) in their county-wide soil surveys.

A Range Site is a distinctive kind of habitat, or group of soils, that is capable of supporting similar kinds, proportions, and amounts of native vegetation. Each Range Site also includes soil properties important to the distribution of plant communities including moisture supply, nutrient availability, salt content, soil reaction, and seasonal high water levels. Appendix D contains

Range Site names and descriptions, the major soil associations present in the nine-county area, and the habitats mapped during this study that are typically expected to occur. Farming occurs on many of the soil types listed, and an attempt was made to address this land use. Some plant communities can be found on any soil if other parameters exist (such as sufficient hydrology to support wetlands). Note that each soil association consists of a variety of major and minor soil units that are sometimes combined to form soil complexes.

Topography

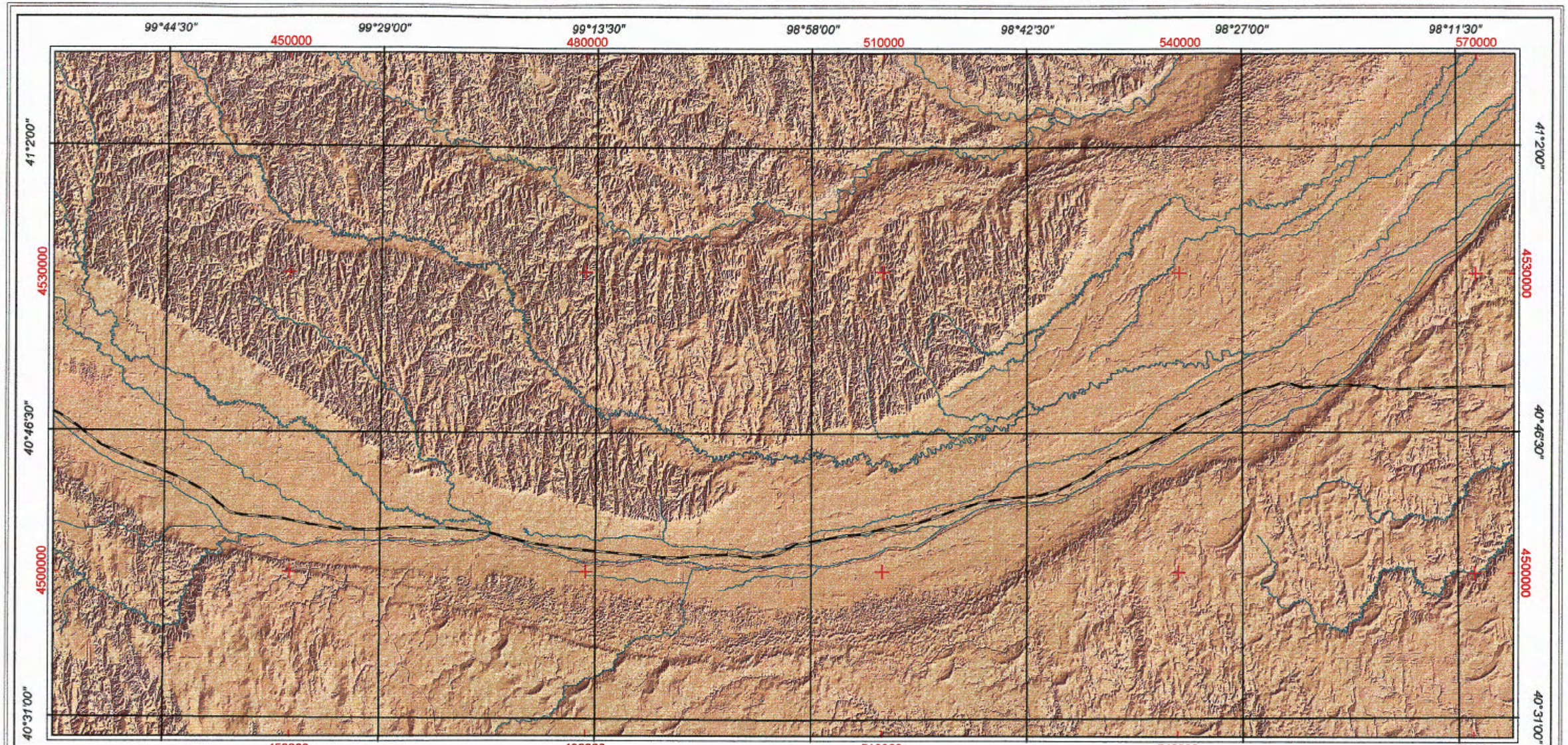
Corridor topography is a mixture of low sand and loess hills, intermittent and perennial drainageways, relatively flat, loess plains, and a wide floodplain associated with the Platte River (Fig. 2.7). Central Nebraska, including the CPRV, is a portion of the Central Loess Plains Major Land Resource Area, Central Plains Section, Great Plains physiographic province (USDA-SCS 1984 and 1981). Elevations are higher on the west end of the corridor, averaging approximately 2,400 feet above mean sea level (Lexington, Nebraska, is 2,389 feet) and lower on the east end, averaging approximately 1,600 feet above mean sea level (Central City, Nebraska, elevation is 1,700 feet).

2.4 Hydrology

Approximately 90,000 square miles in Colorado, Wyoming, and Nebraska contribute surface runoff and ground water to the Platte River, resulting in an average annual surface flow of approximately 1.3 million acre-feet (Ring 1999). The Platte River is a tributary to the Missouri River, joining the larger drainage near Omaha, Nebraska (Fig. 2.8). Surface water and the connected ground water aquifers of the Platte River and its tributaries are used for water projects (15 major dams/storage reservoirs), domestic water supplies (3.5 million people), irrigation (millions of acres of farmland), industrial water supplies, and hydroelectric power generation (PREISO 1997). Other factors associated with water projects include flood control, recreation, and wildlife habitat/fisheries support.

Major (named) tributary drainages contributing surface water flows to the river within the study corridor include Spring, Plum, Turkey, Elm, Dry, Beaver, and Lincoln Creeks and the Wood River. Additionally, the Dawson County, Kearney, Tri-County Supply, E-65 Lateral, and Phelps County Canals withdraw and distribute water within or near the study corridor, and a number of large ditches and drains were observed throughout the associated agricultural lands. Johnson Lake and Elwood Reservoir are the only large water storage structures adjacent to this study corridor.

Five surface hydrology map units have been interpreted and entered into a digital database for this study: (2) wetted channel, (3) open water large canal, (4) open water slough, (5) open water pit, pond, or lake, and (7) open water creek, small canal. While not a hydrology map unit directly, map unit (6) barren beach/bar is included in this discussion because these areas are inundated at higher flows. The total area covered by surface water or barren features such as sand bars was approximately 15,901 acres or 3.7% of the study corridor. Figure 2.9 illustrates examples of hydrology map units that occur in the study corridor.



Key to Features

Interstate 80

Rivers

N

W E

S

Scale 1:400,000

10 0 10 Miles

20 0 20 Kilometers

Universal Transverse Mercator Projection, Zone 14, NAD83

Map Date:10/15/00

Figure 2.7. Shaded relief map of the Central Platte River area

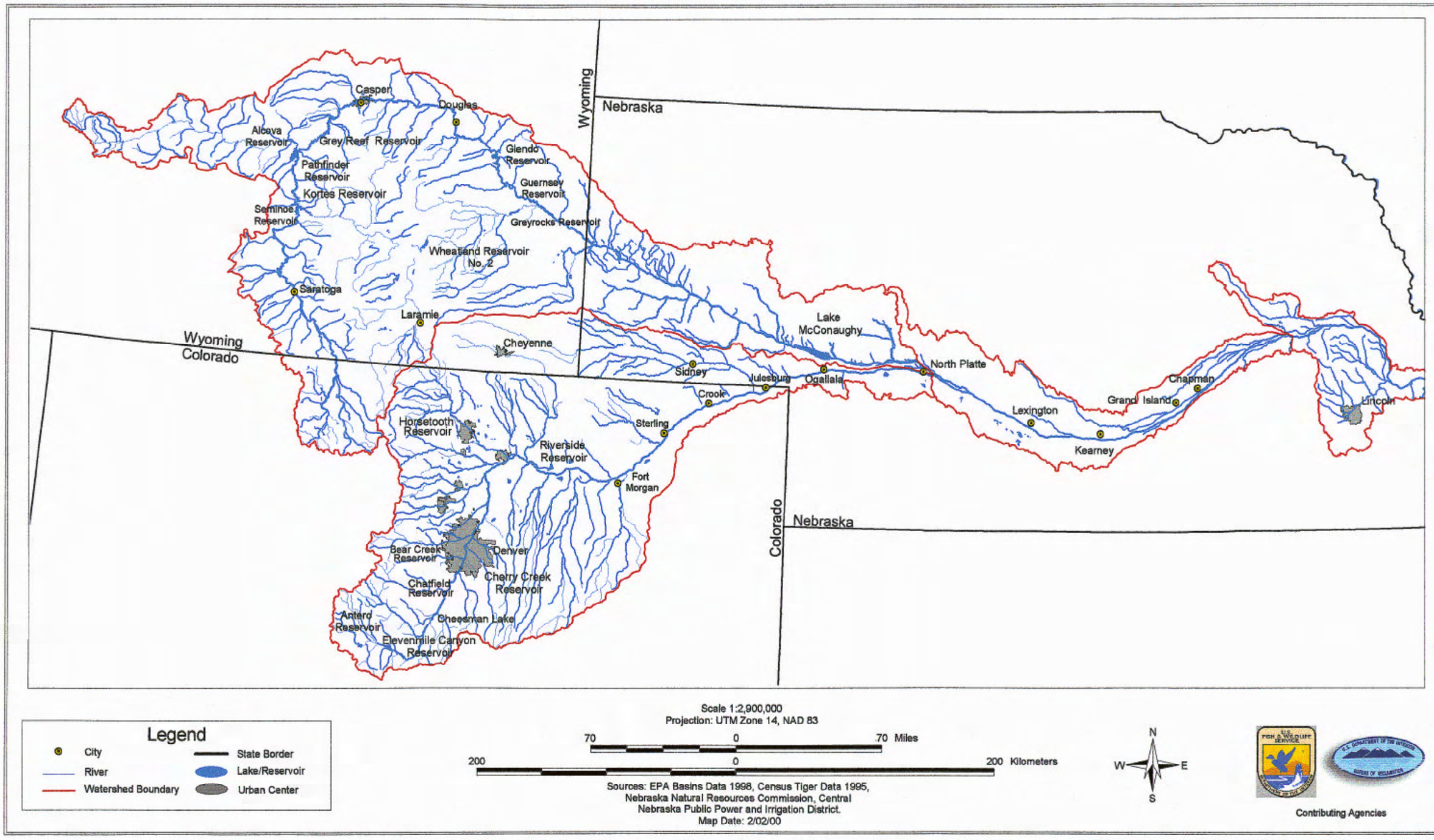


Figure 2.8. Platte River watershed

Figure 2.9. Ground photos of hydrology map units from upper left to lower right: (2) wetted channel, (3) open water canal, (4) open water slough, (5) open water pit, pond, or lake, (6) barren beach/bar, and (7) open water creek, small canal

2.5 Vegetation

CPRV vegetation is present in both native or naturalized stands and on agricultural lands. By far the largest area of use within the study corridor is irrigated agricultural land, particularly row crops, including corn (*Zea mays*), soy beans (*Glycine max*), sunflowers (*Helianthus annuus*), and potatoes (*Solanum tuberosum*). Smaller acreages are used to irrigate alfalfa (*Medicago sativa*) and exotic grasses for hay and to grow dry-farmed winter wheat (*Triticum aestivum*). Winter wheat acreages usually are associated with fallow or bare ground, due to preservation of soil moisture and nutrients in alternate years. Areas that are not farmed or otherwise altered by land use practices, support the grassland, wetland, shrubland, and woodland vegetation types, described in the ensuing discussion.

Seven agricultural map units have been interpreted and entered into a digital database for this study: (20) alfalfa, (21) corn, (22) other crops, (23) bare ground/fallow, (24) soy bean, (25) mown field, and (26) winter wheat. The total area covered by agricultural land was approximately 264,652 acres, or 61.0 % of the study corridor. Figure 2.10 illustrates examples of agricultural map units that occur in the study corridor.

Figure 2.10. Ground photos of agricultural crop types from upper left to lower right: 20) alfalfa, (21) corn, (22) other crops (e.g., potatoes), (23) bare ground/fallow, (24) soy beans, (25) mown field (harvested winter wheat), and (26) winter wheat during growing season

Upland grasslands are a combination of mixed-grass prairie growing on loess soils and tall-grass prairie growing on sandy ridges and sand hills. Nearly all upland grasslands are grazed by cattle, and associated drainages are dammed for run-off water capture and storage. Mixed-grass prairie occupies the highest terraces along the Platte River and low, loess-covered ridges and hills. Dominant grasses include western wheatgrass and buffalograss in swales and shallow depressions, and blue grama (*Bouteloua gracilis*), needle-and-thread grass (*Stipa comata*), little bluestem (*Schizachyrium scoparium*), threadleaf sedge (*Carex filifolia*), and species of sand dropseed (*Sporobolus* spp.) on drier sites. Sandy ridges and hills are dominated by sand bluestem (*Andropogon hallii*), prairie sandreed grass (*Calamovilfa longifolia*), sandhills muhly (*Muhlenbergia pungens*), species of sand dropseed, purple threeawn (*Aristida purpurea*), blowout grass (*Redfieldia flexuosa*), and Indian ricegrass (*Oryzopsis micrantha*). A few scattered shrubs are often present in upland grasslands, including soapweed yucca *(Yucca glauca),* wild buckwheat *(Eriogonum spp.),* prickly-pear cactus *(Opuntia polyacantha*), and sand sagebrush (*Artemisia filifolia*).

Figure 2.11. Cattle grazing on grasslands

Tall-grass prairie occupies the lower terraces of the Platte River Valley, growing to near the river's edge where ground water is not too near the soil surface. Somewhat drier sites in the tall-grass prairie support big bluestem (*Andropogon gerardii*), little bluestem, and western wheatgrass (*Pascopyrum smithii*). More moist sites are dominated by switchgrass (*Panicum virgatum*), prairie cordgrass (*Spartina pectinata*), redtop (*Agrostis* spp.), Kentucky bluegrass (*Poa pratensis*), and Indiangrass (*Sorghastrum nutans*). Common forbs and shrubs present in lowland tall-grass prairies include annual sunflower (*Helianthus annuus*), beggar's tick (*Bidens* spp.), white aster (*Aster ericoides*), leadplant (*Amorpha* spp.), and species of currant (*Ribes* spp.). These grasslands are commonly mown for grass hay and are also grazed annually by cattle. It is common to observe small dugout ponds excavated in this habitat to provide water for livestock.

The lowest and wettest sites within tall-grass prairie communities form a mosaic with the tall grasses and support wetlands; these occupy old channels, depressions, deep swales, cut-off oxbows, slow-flowing streams, pond margins, etc. Common wetland plant species include both broad- and narrow-leaved cattail (*Typha latifolia* and *T. angustifolia*), softstem, river, and three-square bulrush (*Scirpus validus, S. fluviatalis*, and *S. pungens*), species of sedge (*Carex* spp.) (including Nebraska sedge (*Carex nebrascensis*)), flatsedge (*Cyperus* spp.), spikerush (*Eleocharis* spp.), reed-canarygrass (*Phalaris arundinacea*), and smartweed (*Polygonum* spp.). Often, a fringe of tall prairie grasses and wetland shrubs are present, including prairie cordgrass, switchgrass, sandbar and peachleaf willow (*Salix exigua* and *S. amygdaloides*), and leadplant. Wetland habitats are usually grazed annually by cattle (*Bos taurus*).

Adjacent to the river and on vegetated islands, wetland grasses and forbs are present in very dense stands. Typically associated with these habitats are common reedgrass (*Phragmites communis*), reed-canarygrass, smooth brome (*Bromus inermis*), three-square bulrush, smooth horsetail (*Equisetum hyemale*), wild licorice (*Glycyrhiza lepidota*), cocklebur (*Xanthium strumarium*), yellow- and white-sweetclover (*Melilotus officianalis* and *M. alba*), and short-statured sandbar willow shrubs.

Introduced grasslands are present, occupying small parcels of farmland and some sprinkler corners. These are typically planted to smooth brome and intermediate wheatgrass (*Agropyron intermedium*) stands, to be harvested as grass hay, and are placed under map unit 22 (agriculture

other crops). One abandoned field was observed to be dominated by the exotic annual, bristlegrass (*Setaria* sp.).

Six herbaceous vegetation map units have been interpreted and entered into a digital database for this study: (1) emergents, (11) upland grasses, (12) lowland grasses, (17) mown lowland grasses, and (18) herbaceous riparian. The total area covered by herbaceous communities was approximately 84,278 acres, or 19.4% of the study corridor. Figure 2.12 illustrates examples of herbaceous vegetation map units that occur in the study corridor.

Figure 2.12. Ground photos of herbaceous vegetation types from upper left to lower right: (1) emergents, (11) upland grasses, (12) lowland grasses, (17) mown lowland grasses, and (18) herbaceous riparian

Upland shrublands, consisting primarily of stands of soapweed yucca and sand sagebrush within the tall-grass prairie of sandy soils, are uncommon within the study corridor. Some stands of American plum (*Prunus americana*) were observed growing in deeply incised draws and drainageways. Conversely, dense stands of shrubs, primarily sandbar willow, red-osier dogwood (*Cornus stolonifera*), and small peachleaf willow and eastern cottonwood (*Populus deltoides*) trees are common on some islands, along the river's edge, and along side channels. A few openings among trees and along disturbed roadsides were dominated by rabbitbrush (*Chrysothamnus nauseosus*) shrubs.

Two shrub-dominated vegetation map units have been interpreted and entered into a digital data base for this study: (10) shrubs inside floodplain, and (13) shrubs outside floodplain. The total area covered by shrub communities was approximately 5,710 acres, or 1.3% of the study corridor. Figure 2.13 illustrates examples of shrub-dominated vegetation map units that occur in the study corridor.

Figure 2.13. Ground photos of shrubby vegetation types: (10) shrubs on islands and inside floodplain, and (13) shrubs outside floodplain

Upland woodlands are rare in the study corridor; only stands of eastern red cedar (*Juniperus virginiana*) were observed on loess hills south of Kearney, Nebraska, and a few draws supported stands of green ash (*Fraxinus pennsylvanica*), American elm (*Ulmus americana*), and chokecherry (*Prunus virginiana*). Included with upland woodlands are stands of trees planted as shade trees or windbreaks around farmsteads and as windbreaks within agricultural fields. These stands often include eastern cottonwood, boxelder (*Acer negundo*), and green ash, but may also have introduced species, including Russian-olive (*Elaeagnus angustifolia*), Siberian elm *(Ulmus pumila*), Lombardy poplar (*Populus nigra*), ponderosa pine (*Pinus ponderosa*), blue spruce (*Picea pungens*), weeping willow (*Salix babylonica*), apple (*Pyrus malus*), cherry (*Prunus cerasus*), honey locust (*Gleditsia triacanthos*), and black locust (*Robinia pseudo-acacia*).

Riparian woodlands, however, are common within the Platte River Valley where they occupy elevated islands, point bars, and terraces. Typically, riparian woodlands have an emergent canopy of eastern cottonwood trees with shorter-statured green ash, American elm, peachleaf willow, mulberry (*Morus alba*), Russian-olive, and eastern red cedar in the sub-canopy. The liana, wild grape (*Vitis riparia*) was observed in several riparian woodland stands, as was a shrubby understory of American plum, red-osier dogwood, Arkansas rose (*Rosa arkansana*), and species of currants. Salt-cedar (*Tamarix ramosissima*), an invasive exotic tall shrub or short tree, was also present as a rare to common species in some stands.

Two tree-dominated vegetation map units have been interpreted and entered into a digital data base for this study: (15) wooded islands and river within floodplain and (16) woody outside floodplain. The total area covered by tree communities was approximately 34,963 acres or 8.1% of the study corridor. Figures 2.14 illustrates examples of tree-dominated vegetation map units that occur in the study corridor.

Figure 2.14. Ground photos of woodland vegetation types: (15) wooded islands and woody within floodplain, and (16) woody outside floodplain

2.6 Wildlife

The main focus or "target species" of the Platte River Endangered Species Partnership are four threatened or endangered species of wildlife: whooping crane (*Grus americana*), piping plover (*Charadrius melodus*), interior least tern (*Sterna antillarum athalassos*), and pallid sturgeon (*Scaphirhynchus albus*) as illustrated in Figure 2.15. Under the Endangered Species Act, all projects that require federal licenses, permits, or funding must address the habitat needs of endangered species. Many water projects in the Platte River Basin have recently, or soon will be, subject to review under the Endangered Species Act. Uses of the Central Platte River area by each target species are:

- Whooping crane — Migrates through central Nebraska in the spring and fall seasons and uses habitats for resting/roosting and foraging.
- Piping plover — Nesting, rearing young, and foraging.
- Interior least tern — Nesting, rearing young, and foraging.
- Pallid sturgeon — Occasionally found in the lower Platte River up to the mouth of the Elkhorn River and downriver to the Missouri and Mississippi Rivers.

Figure 2.15. Whooping crane, interior least tern, piping plover, and pallid sturgeon photos from the collection of the USFWS in Grand Island, Nebraska

Wildlife, particularly migratory waterfowl and shorebirds, are common to abundant in the CPRV. This area is a major resting and feeding area for sandhill cranes (*Grus canadensis*), Canada and snow geese (*Branta canadensis* and *Chen caerulescens*); a variety of ducks, including mallards (*Anas platyrhynchos*), mergansers (*Mergus americana*), green-winged teal (*Anas crecca*), northern shovelers (*Anas clypeata*); and shorebirds (e.g., American avocet (*Recurvirostra americana*), killdeer (*Charadrius vociferus*), sandpipers (*Calidrus* spp.)). Raptors such as the rare bald eagle (*Haliaeetus leucocephalus*) winter in this area, and more common species, including the Cooper's hawk (*Accipiter cooperi*), northern harrier (*Circus cyaneus*), and red-tailed hawk (*Buteo jamaicensis*) use the area nearly year-around. Large flocks of smaller avian species, including red-winged blackbirds (*Agelaius phoeniceus*) and common grackles (*Quiscalus quiscula*), are often observed.

Figure 2.16. Photos of some of the birds and wildlife in the Central Platte River Valley

Upland grasslands provide habitat for the large mammals such as mule deer (*Odocoileus hemionus*) and pronghorn (*Antilocapra americana*), while smaller mammals such as the coyote (*Canis latrans*), red fox (*Vulpes velox*), striped skunk (*Mephitis mephitis*), and raccoon (*Procyon lotor*) use many habitats in the region. A few small colonies of black-tailed prairie dogs (*Cynomys ludovicianus*) were observed, burrowing in deeper clay and silt soils on mid-level terraces and pocket gopher (*Thomomys* spp.) activity was observed in nearly every grassland community. White-tailed deer (*Odocoileus virginiana*), fox squirrel (*Sciurus niger*), muskrat (*Ondatra zibethicus*), and beaver (*Castor canadensis*) are more common in the riparian habitats along the river, and the river also supports snapping turtles, bull- and northern leopard frogs (*Rana catesbiana* and *R. pipiens*), and a warm-water fishery. The riparian woodlands are excellent habitat for cavity-nesting birds such as woodpeckers, owls, and wood ducks (*Aix sponsa*), particularly where decadent stands of eastern cottonwood and peachleaf willow trees are present.

3. Materials and Methods

The organization of this project is based on decisions made in preliminary scoping and planning meetings and written into the plan of study presented in the *Proposal for GIS Database Development for the Central Platte River* (BOR 1999). Some decisions, particularly the selection of mapping units, and methods incorporated in this study were predicated by the desire to use previously developed GIS databases to the extent possible. Principal steps to provide CPRV deliverables included:

- Planning and Scoping
- Review of Existing Information
- Training
- Aerial Photography Acquisition and Orthophoto Basemap Development
- Field Work and Vegetation Classification
- Basinwide Database Development
- Map Production
- Accuracy Assessment
- Metadata

3.1 Planning and Scoping

The GIS database project for the Central Platte River incorporates the combined expertise and oversight of FWS-Denver, FWS-Platte River EIS Office, BOR-Remote Sensing and Geographic Information Group (RSGIG) staff, and contractors to satisfy the proposed study objectives and elements listed in the introduction. Supporting GIS data layers were provided by participating members of the Platte River Endangered Species Partnership. Oversight and programmatic considerations were managed by the FWS-Denver, CO while FWS-Grand Island, Nebraska, personnel provided guidance on site-specific management activities and needs. BOR-RSGIG and its contractors provided aerial photo-interpretation, technical mapping, field data collection to support the land cover/use study, and this final report. Horizons, Incorporated of Rapid City, SD, was subcontracted to acquire aerial photography and to prepare digital and hard-copy orthophoto coverage of the Central Platte River corridor.

RSGIG technical responsibilities and deliverables included the following:

- Acquire color-infrared photographs photography from Horizons, Inc.; provide two extra copies and reproduce flight line index maps for the Platte River EIS office.
- Collect observation point data to refine the preliminary classification and familiarize investigators with community characteristics and their range of variation.
- Meet with Grand Island USFWS personnel to refine pre-determined mapping classes and provide local support and access to field sites in the study area.
- Interpret aerial photographs.
- Transfer interpreted information to a digital spatial database.
- Create digital vegetation coverages, including relevant attribute information.
- Produce hard copy (paper) vegetation maps.
- Conduct field verification trip to assess visual accuracy of draft vegetation maps.

- Produce ArcView hard copy maps using random point program for accuracy, observation, and PLOT points for field use; create EXCEL spreadsheet with xy coordinates for each point.
- Create a spreadsheet and contingency table comparing the mapped classes with the AA classes to determine map accuracy.
- Document FGDC-compliant metadata files for combined and individual bridge segments.
- Create CD-ROM with digital files of ArcView layouts for each bridge segment.
- Prepare final report and CD-ROM describing procedures used in preparing all products**.**

A meeting was held 10/19/98 with FWS personnel in the Grand Island, Nebraska, office. The purpose of this meeting was to introduce RSGIS and FWS staff and discuss site-specific management activities and needs, (e.g., access to private landholdings and managed lands, and availability of previously acquired imagery). FWS biologists initially accompanied RSGIG staff in the field to provide orientation to the study area (see Section 3.4 for information on the subsequent field inventory).

3.2 Review of Existing Information

To aid in the land cover/use mapping project, existing databases and reports were obtained and evaluated to determine their utility to serve as a project baseline, in lieu of creating a new database. Two applicable databases, listed here, were known to exist and are further evaluated under the Results section:

> 1) Western Energy and Land Use Team (WELUT), USFWS, 1983: produced a land cover/use map of three Platte River sections comprising approximately 110 river miles and including the Big Bend reach, located between Overton and Chapman, Nebraska (bridge segments 1–11), two reaches of the North Platte River: a) North Platte to Sutherland, Nebraska, (Bridge segments 12 and 13) and b) Clear Creek to Lewellyn, Nebraska (bridge segment 14).
>
> 2) University of Nebraska at Lincoln (UNL) prepared a land-cover update of the 1983 WELUT mapping effort in 1995. This updated version became known as the CALMIT database.

The mapping units developed for the WELUT and CALMIT studies guided map unit selection for the current study. Only minor modifications were made to the land-cover and land-use units selected in 1983 and revised in 1995. To further describe natural and semi-natural vegetation occurring in the study corridor, NVCS associations and alliances were developed to crosswalk with the habitat types used for data analysis. In most instances one map unit corresponded to two or more NVCS plant associations and alliances.

3.3 Aerial Photography and Orthophoto Basemap

Aerial Photography

For the 1998 land cover/use mapping effort, aerial photography was acquired by Horizons, Incorporated using a river-centered flight line, flown west to east, to capture the entire seven-mile-wide Platte River corridor between Lexington and Chapman, Nebraska. The flight line was flown and photos taken on August 19, 21, and 24, 1998, using Kodak 2443 color-infrared (CIR) film and a Zeiss RMK TOP 15 camera. Photos were taken at 1:24,000 scale (1"=2,000') and printed as 9- × 9-inch contact glass positive prints. Overlap for these photos was approximately 50–60%. Platte River flows at the time of aerial overflight were recorded between 446 cubic feet per second (cfs) at the Overton, Nebraska, gauge and 1,030 cfs at the Grand Island, Nebraska, gauging station. A 2× enlargement of every other photo to 18- × 18-inch or approximately 1:12,000 scale (1"=1,000') was also printed for possible use in photo-interpretation.

The WELUT database for the Central Platte River in Nebraska was developed in 1983 and relied on 1:24,000-scale, color-infrared aerial photographs flown on August 15, 1982. The photography was obtained at recorded Platte River flows of 395 cfs at Overton and 262 cfs at Grand Island. Aerial photography used for the 1995 CALMIT update of the 1983 WELUT database consisted of two overflights in different years. Both overflights produced 1:24,000 scale, color-infrared photographs and were flown on May 13, 1993 and on October 25, 1995, respectively. Platte River flows on these two dates were measured at 755 cfs and 2,000 cfs at Overton, and 1,810 cfs and 2,170 cfs at Grand Island. The CALMIT dataset does not include the Overton to Lexington river reach, but it is unknown if aerial photographs were acquired for this area during aerial overflights.

Digital Orthophoto Quarter Quadrangles

Orthophoto Quarter Quadrangles (DOQQs) were provided in digital format from the USGS in Rolla, Missouri. These DOQQs were prepared from photography dated 5/13/93, when river flows ranged from 755 cfs at Overton to 1810 cfs at Grand Island. The orthophotos were used as source imagery for the CALMIT update analysis and initial work on bridge segments 3, 4, 5, 6, and 7 in the 1998 land cover/use database before the color-infrared digital orthophotos became available (see section below).

Color Digital Orthophotos

Color-infrared digital and hardcopy orthophotos were specially produced for this project. A planimetric basemap image was prepared by Horizons, Incorporated by registering the August 1998 aerial photographs. The orthophotos produced were at a scale of 1:12,000 and measured 36- × 36-inches each. The 1:12,000-scale, 36- × 36-inch orthophotos were used for photo-interpretation and were cut into more manageable sizes for the photo-interpreters (~12- × 12-inches). Each orthophoto portion had an identification number assigned corresponding to the bridge segment number, the photo sheet number, the photo sheet portion, and the total number of

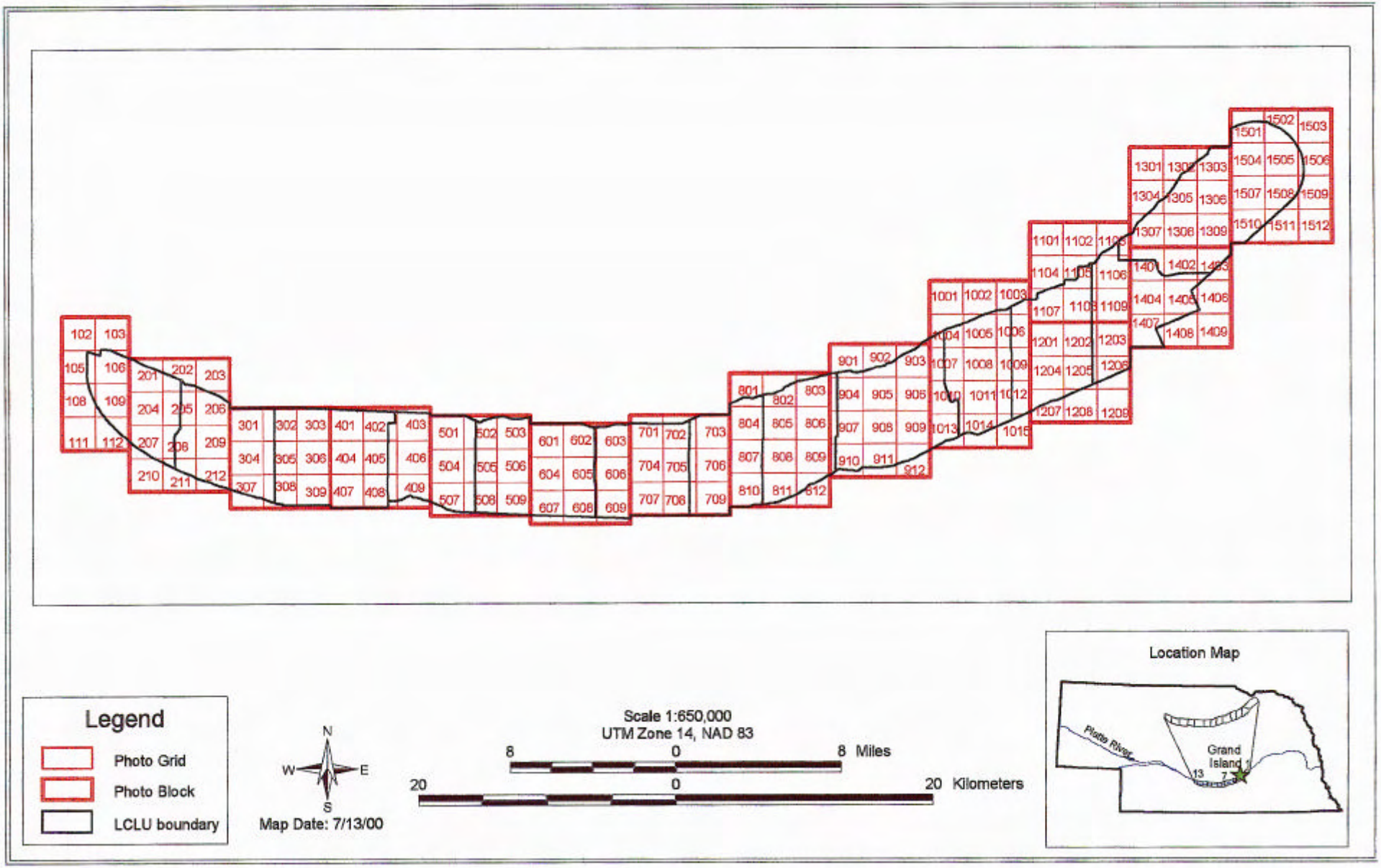


Figure 3.1. Index to color-infrared digital orthophotography

portions into which the sheet was cut (e.g., Bridge Segment 08, Sheet 6, 2/9). Figure 3.1 is a location map showing the orthophoto portions and their identifying numbers overlain on top of the project border.

3.4 Field Work and Vegetation Classification

An initial field inventory was conducted by BOR–RSGIG biologists and GIS specialists in October 1998, to examine land-cover and land-use elements, review the CALMIT mapping effort, assess the quality of 1998 CIR aerial photography, determine aerial photo signatures for the various mapping units, and become familiar with access within the corridor (BOR–RSGIG 1998). A more detailed Field Survey effort (described below), conducted during the summer of 1999, focused on describing the non-agricultural vegetation sufficiently to meet the National Vegetation Classification Standard (NVCS) (Butler 1999, TNC–ESRI 1994).

Methods used to classify the vegetation of the Central Platte River Valley were based on a modification of the standards presented in *Field Methods for Vegetation Mapping* (TNC-ESRI 1994). Modifications were necessary because of limited access to potential sample sites, as most of the study corridor lies on private land. Vegetation classification involved two levels of intensity for collection of mapping data: 1) observation points and 2) sample plots. All data points obtained for vegetation type descriptions also served as accuracy assessment points because they were collected independently of the photo-interpretation and digital transfer efforts (see Section 3.5).

Field Survey

Field surveys began in the first week of June 1999. Data collection included plot, observation points, and accuracy assessments. These allowed the field investigator to simultaneously record typical vegetation types and assess the variation in the plant communities across larger areas. A second survey was conducted during the middle of July 1999. To facilitate the logistics of conducting the field survey, the project area was divided up into 12 bridge segments. Plot data, observation point data, and accuracy assessment point data were collected from selected random points within each bridge segment. A total of 200 random points were generated for each bridge segment; however, access to these points was a significant challenge for the field investigator.

Access to areas was often limited because of land ownership, high water flows of the Platte River, and high rainfall in the project area during the field survey. With due considerations to access, the field investigator made every attempt to record data from the random points. However, in several instances, the field investigator substituted a subjectively placed point in place of a random point. Observation point and accuracy assessment data on cultivated land were collected by reviewing the 1998 records provided by the County Farm Service Agency in each county of the project area. Also, slope, aspect, elevation, and landscape position, which are normally recorded, were not recorded for this project because all of the points (plots, observation points, and accuracy assessments) occurred within the floodplain of the river on relatively level ground.

Observation Points

Observation points were used to quickly become familiar with plant community characteristics, plant community ranges of variation, and to field check preliminary classification. Observation points also provided an opportunity to crosswalk the 1998 Central Platte River vegetation classification with the NVCS (i.e., verify the presence or absence of plant associations currently listed versus those not currently listed). Sampling observation points included basic information on habitat and vegetation composition and structure. Specific information recorded included UTM x,y coordinates (using NAD83 datum), dominant species cover data, and brief environmental characteristics. The form used to record Observation Points is presented in Appendix F. Limitations of observation point data included no measurement of delineation of the sampling area, and cover was estimated only for the common species in each stratum. In addition, the name of the plant communities located within 50 meters of the observation point was recorded on the form. Data from 82 observation points were collected during the field survey.

Plot Samples

Intensive plot samples (with more detailed information on vegetation composition and structure than for Observation Points) were collected from 116 points selected either randomly or subjectively by the field investigator depending on access. Sampling was conducted in June and July of 1999. The specific locations of sample plots were identified using standard methodology (Mueller-Dumbois 1974). Detailed sampling plots were subjectively placed in vegetation that was representative of an area, relatively homogeneous, and which covered more than 0.5 hectare (the minimum mapping unit). Thus, ecotones and small patches of vegetation were avoided. Forest and woodland communities were sampled with 20- $\times$ 20-meter plots, while shrubland and herbaceous communities were sampled with 10- $\times$ 10-meter plots. Collected data included primarily soil characteristics (e.g., soil texture and drainage), vegetation composition and structure, and other site features such as wildlife use or human disturbance (Appendix G).

To characterize vegetation structure, all species found within a plot were recorded and foliar cover for each species by stratum was estimated using methods modified from Daubenmire (1959). Because cover was estimated independently for both species and strata, total coverage for some of the plots was greater than 100%. The UTM coordinates of all plots were recorded using a hand-held Global Positioning System (GPS) receiver (Garmin 12XL) connected to a portable differential GPS receiver. The differential reference receiver used to differentially correct the coordinates is located in Kansas City, Missouri. Atmospheric conditions and dense canopy cover often disrupted reception of the differential signal, thus reducing the accuracy of the hand-held GPS receiver. Thirty-five (35) millimeter (mm) slides were taken for each plot, and representative images are included in this report.

Vegetation Classification

The procedure for classifying vegetation followed guidelines set forth in the Vegetation Classification Standard (FGDC 1997), which was developed from the Standardized National Vegetation Classification System (NVCS) (TNC–ESRI 1994). The national system contains

seven classification levels with the two finest being the alliance and association (community) levels. Associations are separated from alliances using floristic composition and are named by the most dominant and/or indicator species. If two or more dominant species occur in the same stratum (tree - tree, shrub - shrub, or grass - grass) a dash symbol is used (*Pascopyrum smithii* - *Nassella viridula*). If the species occur in different strata (tree / shrub, shrub / grass) then a slash is used (*Artemisia cana* / *Pascopyrum smithii*). Parentheses are used when the diagnostic species are not consistently present in the plant association (*Bromus inermis* - (*Pascopyrum smithii*).

3.5 Basinwide Database Development

Data were collected to provide baseline information for the Central Platte River study area, as well as for the North and South Platte River basins. Several websites were excellent sources for digital information that could be incorporated into the GIS at no cost. This information ranged from base map layers (e.g., watershed boundaries, lakes and reservoirs, cities, counties, and states) to soil survey, National Wetland Inventory, and digital elevation model (DEM) data. The websites listed below were particularly useful sources of geospatial information.

- http://www.nrc.state.ne.us/databank/spat.html
- ftp://ftp.ncwcd.org/pub/platte/

Other datasets required processing to make them usable for the project (e.g., digital raster graphics (DRGs)) were processed to clip off collar information and register them to the NAD 83 datum). Digital data developed at the Denver office of the U.S. Bureau of Reclamation for the Central Platte River include:

- river miles
- managed lands from public and private agencies (e.g., Nebraska Game and Parks Commission, The Nature Conservancy, and the National Audubon Society)
- digital 1:24,000 color-infrared images from August 1998 photography
- preliminary 1998 land cover/use database
- well locations
- county agricultural statistics and basin economic conditions
- power and hydro plant locations (in addition to those from CNPP&ID)
- tern, plover, and whooping crane databases

Digital data acquired from other agencies include:

- 1993 1:12,000-scale digital orthophoto quarter-quadrangles (DOQQs) from the USGS
- 1982 land cover/use database produced for the Platte River Whooping Crane Maintenance Trust
- surface water irrigation boundaries and power plants (CNPP&ID)
- digital U.S. Geological Survey (USGS) quadrangles (DRGs)
- digital elevation model (DEM) data
- digital line graph (DLG) data

3.6 Map Production

Photo-interpretation

The orthophoto portions mentioned above were used for photo-interpretation of the map classes. Each orthophoto portion was covered with drafting film (Mylar) overlays, and registration points corresponding to the tic marks on the orthophotos (points representing known surface coordinates) were traced onto each overlay. Aerial photo portions with the overlays were backlit on a light table and visually scanned for photographic signatures using magnification. The entire photograph portion was systematically interpreted, delineated, and each polygon labeled with the appropriate map unit number. A stereoscope was used to investigate vegetation, land use, and topographic position on the related 9- × 9-inch (1:24,000-scale) aerial photographs, as an interpretive aid for the smaller-scale (1:12,000) base photographs. Interpreted linework marked on the overlays was then transferred into the GIS database to create land cover/use polygons.

The actual interpretation of aerial photography for the Central Platte River involved three basic steps. First, all of the photos were initially interpreted into broad land-cover and land-use classes based solely on standard photo-interpretation signature characteristics. These included tone, texture, color, pattern, topographic position, size, and shadow. Second, field note overlays and observation point locations were used, if available, to refine the preliminary delineation into the appropriate map units. Using the broad interpretation and site-specific data points, the final interpretation into map units was performed. Finally, in order to ensure completeness and accuracy, digital transfer specialists reviewed all of the interpreted photos for consistency and recommended further review and/or changes where necessary.

Map Units

Final map units used for photo-interpretation were based on land-cover (habitat and agricultural crop classifications) and land-use classes developed in the WELUT and CALMIT databases. These map units were modified somewhat during scoping and planning meeting discussions with FWS personnel. Crosswalk tables are presented in Appendix B showing relationships between the various database mapping units.

Digital Transfer

Transfer of information from the interpreted aerial photographs to a digital, geo-referenced database involved scanning the Mylar overlays using two scanners and software systems. ANATech Scansmith Scan-C software (version 4.1) was used to run an Eagle 3640C scanner; each resulting raster image was converted to a vector (line) coverage using the Arc/Info GRIDLINE command in the GRID module for bridge segments 3, 4, 5, 6, and 7. The remaining bridge segments (1, 2, 8–13) were scanned using another vectorizing software, PROVEC (version 3.0), to run a black-and-white Eagle 4080ET scanner. The resulting raster images were vectorized within the PROVEC environment. Each registration point on the interpreted photo was matched electronically to the corresponding registration point on the digital orthophoto for both transfer methods. The line/vector coverage of each photo was then edited to correct

scanning flaws using the ARCEDIT module in Arc/Info. Each polygon was attributed according to the features identified during photo-interpretation along with other relevant data as follows:

veg_code	classification number (i.e., map unit)
photo	orthophoto portion number
veg_desc	description of the veg_code
fp_code	0 for outside 1998 floodplain, 1 for inside 1998 floodplain
welut_code	crosswalk code for comparing to 1982 database
welut_desc	description of welut_code
fp82_code	0 for outside 1982 floodplain, 1 for inside 1982 floodplain
tcode	trend analysis code based on fp82_code

The database consists of 13 land cover/use coverages named according to bridge segment for polygon features (e.g., lcu98_1, lcu98_2), for arc features (lca98_1, lca98_2), and one combined landcover/use coverage (lcu98) including all 13 bridge segments. The bridge segments are as follows (Fig. 3.1):

Segment 1	Grand Island (State Highway 2) to Chapman
Segment 2	Doniphan (State Highway 281) to Grand Island (State Highway 2)
Segment 3	Alda to Doniphan
Segment 8	Kearney to Minden (State Highway 10)
Segment 9	Odessa to Kearney
Segment 10	Elm Creek (State Highway 183) to Odessa
Segment 11	Overton to Elm Creek (State Highway 183)
*Segment 12a	3.5 miles west of Overton (river mile 243) to Overton
Segment 12	4.3 miles east of Lexington (river mile 247.4) to Overton
Segment 13	3.3 miles west of Lexington (river mile 247.4) to 4.3 miles east of Lexington (river mile 255)

*This is a special segment corresponding to the smaller boundary of the 1982 land cover/use database. The full segment is named segment 12 and includes all of segment12a plus additional lands extending to the west.

3.7 Training

Training for use of the ArcView 3.1 GIS (geographic information system) software was proposed to encompass three, 2-day sessions (one session in Grand Island, Nebraska, and two sessions in Denver, CO), and was to include up to six participants (BOR 1999). A training course for ArcView 3.1 GIS software was designed by BOR for selected Project personnel.

Principal areas covered in ArcView 3.1 training courses included a GIS overview, instruction in basic cartography, ArcView 3.1 lectures and exercises, data transfer techniques, and development of metadata. The course outline is presented as Appendix E.

ArcView software, available in both personal computer and workstation versions, is used to view and manipulate data stored in Arc/Info files. Arc/Info represents two separate software programs

that together form geographic information system (GIS) software. ARC is the main program and serves two functions: 1) record locational (x,y) information and 2) calls up other subprograms. INFO is a relational database (similar to dBASE II) used to store and manipulate attribute data applied to map units or polygons. Arcview and Arc/Info are owned and produced by Environmental Research Systems Institue, Inc. (ESRI) of Redlands, CA.

3.8 Map Validation and Accuracy Assessment

Map Validation

An attempt was made to validate CALMIT maps in the field and collect aerial photo signature information during an October 1998 verification trip. Because of the presence of many sliver polygons, unlabeled polygons, and the three year difference in aerial photography, this exercise was difficult to conduct. Collection of photo signature information for 1998 was successfully completed.

Prior to accuracy assessment, an additional verification or map validation trip was taken in early April 1999 to assess and refine the initial mapping effort. This trip focused on collecting observation points and field notes, ground-truthing aerial photographs using landmarks and global positioning system (GPS) way points, and acquiring digital photographs of map units from a field perspective.

Accuracy Assessment

The accuracy assessment (AA) for CPRV land-cover analyses consisted of two efforts, one to sample agricultural crops and the other to sample non-agricultural (natural and semi-natural) vegetation (Butler 1999). Because of timing of fieldwork and the photo-interpretation data transfer, all sample plots (116 points), observation points (82 points), and accuracy assessment points (76 points) could be and were used to determine accuracy. Figure 3.2 shows the distribution of accuracy assessment points, plus plot and observation point data for non-agricultural lands. Plot data points were combined with the accuracy assessment points for purposes of evaluating the accuracy of the non-agricultural data. A total of 68 points were examined for agricultural lands, to assess the ability to interpret a variety of crop types.

The first sampling approach for the accuracy assessment was applied to agricultural land-cover polygons. Cropping patterns are dynamic and change seasonally as well as annually due to rotation by agribusiness owners. Imagery for the study area was acquired in August of 1998, while accuracy assessment did not commence until the spring and summer of 1999. This meant that verification of accuracy occurred many months after the image acquisition date and could not be based on agricultural activities on the ground the previous year. To alleviate this problem, FSA (Farm Service Agency) certified crop acreages were used to provide an accurate base for 1998 crop production.

Due to the high dominance of agricultural land (61%) in the study area, the number of random sample points in agricultural areas was reduced to avoid over-sampling agricultural crops in the accuracy assessment process. A modified stratified random sampling technique was used, in

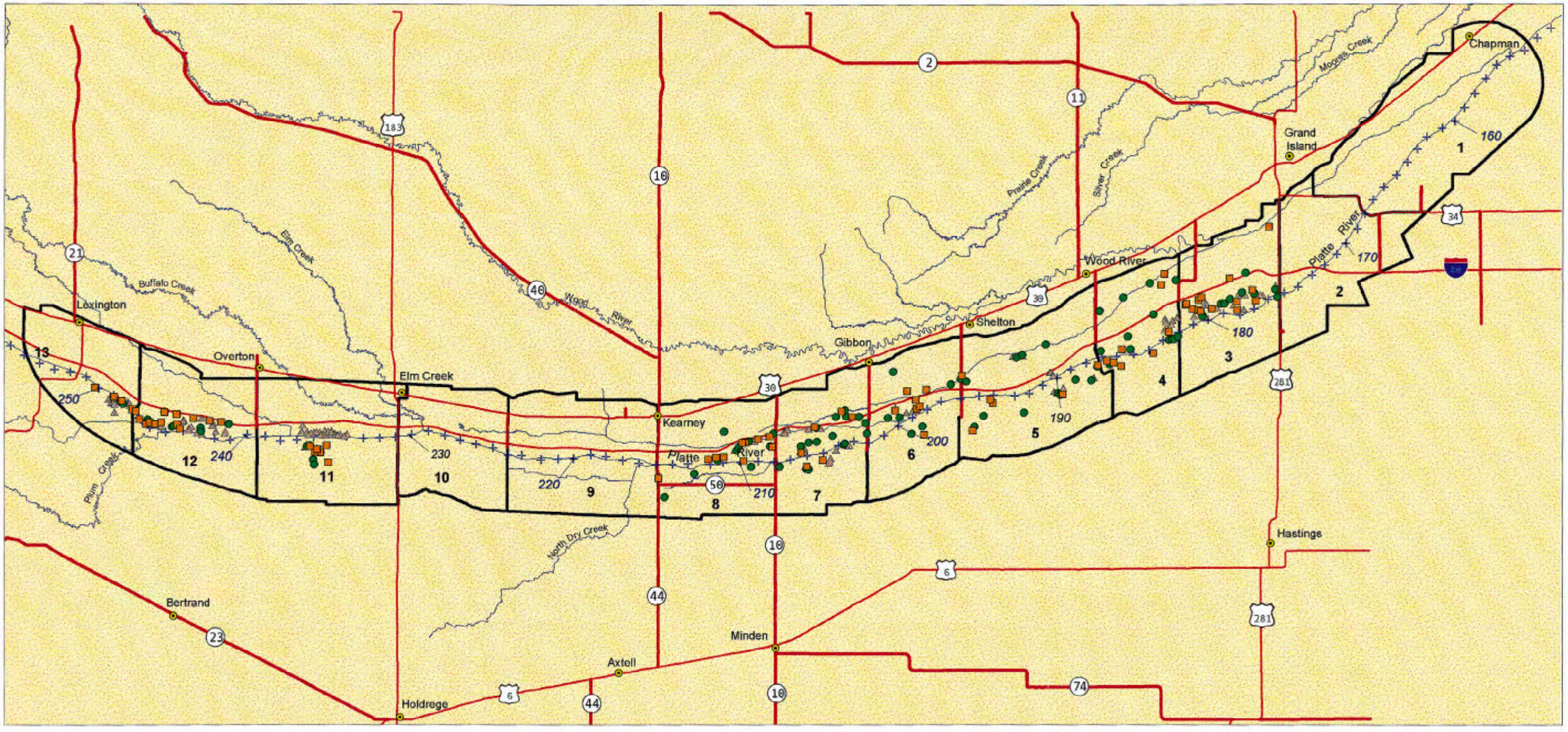


Figure 3.2. Accuracy assessment, plot, and observation points for non-agriculture lands

which each agricultural crop category was considered a separate stratum (Lillesand and Kiefer 1999). Only those random sampling points falling on verifiable cropland strata were considered for the accuracy assessment process. Random points were further subdivided into observation points and accuracy assessment points; this relative mix of points was maintained across the entire coverage area from west to east (Fig. 3.3. Accuracy Assessment and Observation Points for Agricultural Crops).

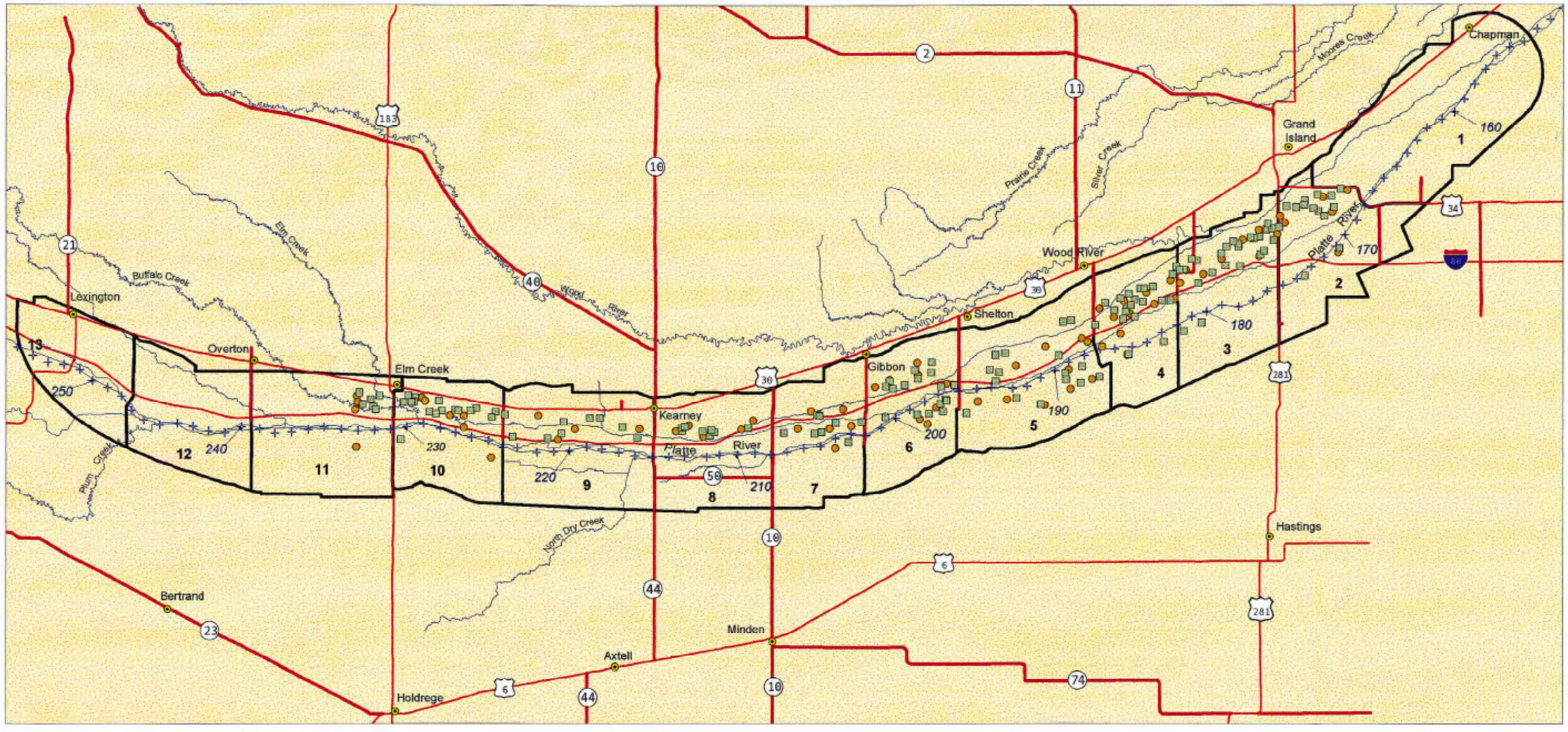
At the local FSA offices, locations of random sample points were identified on 1:24,000-scale aerial photographs. Landowner farm number was noted, and crop production type on the landowner's certified crop production report for 1998 was verified. Each random sample point was evaluated using interpretive judgment and knowledge of crop production in the coverage area. Sample points with possible registration errors (for example, points at least several pixels away from field boundaries) were eliminated as accuracy assessment points and were moved to the observation point category.

The second method used to collect AA data points involved visiting sites where access was available and recording information similar to the observation point data described in Section 3.4. For non-agricultural land-cover (natural and semi-natural vegetation) AA data collection, the following guidelines were followed:

- Vegetation observations were ground-based.
- AA ground data collection was to be similar to observation point data collection.
- The number of samples would vary depending on the abundance of a vegetation type on the landscape.
- AA point collection would depend on access availability.
- A maximum number of points to be collected were not assigned, although ten points per vegetation type were attempted.

All AA and other vegetation classification data were collected during June-August 1999. The weather at this time was unusually warm, there were many intense rainstorms, and vegetation was readily identifiable. Accuracy assessment of the CPRV was conducted in January and February 2000. This involved entering all accuracy data points into a coverage and overlaying them electronically on final vegetation maps. A contingency table was set up to record the reference data (field data) versus the sample data (vegetation map) for each map unit.

Errors of commission (i.e., user's errors) for each map unit were calculated by dividing the number of correctly classified samples by the total number of samples that were classified as belonging to that map unit. Errors of omission (i.e., producer's errors) for each map unit were calculated by dividing the number of samples that were classified correctly by the total number of reference samples in that class. Overall or total accuracy for CPRV is calculated across all sampled map units by dividing the number of correctly classified AA points by the total number of AA points. Confidence intervals for each map class were calculated using an appropriate method depending on the normality and size of the data. Confidence intervals for total accuracy were calculated using the formula for normally distributed data. Table 3.1 summarizes the statistical methods used for the confidence interval calculations. A Kappa Index (Foody 1992) was used to help account for any correct classification due to chance.



Legend

- City
- Observation point
- Accuracy point
- River mile
- LCLU boundary
- Primary road
- Secondary road
- River

N W E S

Map Date: 5/30/00

Scale 1:400,000
UTM Zone 14, NAD 83

8 0 8 Miles

20 0 20 Kilometers

Contributing Agencies

Location Map

Figure 3.3. Accuracy assessment and observation points for agricultural crops

3.9 Metadata

A legacy metadata file was created for the 1982 WELUT land cover/use mapping effort (Appendix H). The only metadata received for the 1995 CALMIT update study consisted of two land cover/use classification systems used for delineating the bridge segments. FGDC-compliant metadata for the current study, which include all 13 bridge segments in one dataset, were produced and are also included in Appendix H. Additional metadata for each separate bridge segment have also been created, but are not included in this report.

Table 3.1. Summarized procedure and equations used to calculate 90% confidence intervals for the accuracy assessment

For large sample sizes ($n > 30$), a normal distribution was assumed when $np \geq 5$ and $n(1-p) \geq 5$, and $0.2 < p < 0.8$ where n = sample size and p = (number of correct samples / total number of samples) (Zar 1984 and Hay 1979).
For normally distributed map classes the confidence intervals were calculated using the equation provided by Snedecor and Cochran (1967) in the Accuracy Assessment Procedures, Section 5.4 (TNC 1994).
When the normal approximation was not valid (as determined from the above criteria), equations obtained from Zar (1984) were used to determine the lower and upper confidence intervals.
For map classes containing small numbers of accuracy assessment points ($n \leq 30$), calculated tables of probabilities based on the underlying binomial distribution (Natrella 1963) were referenced for the upper and lower confidence limits.

4. Results

This section describes the results associated with GIS database preparation for the Central Platte River, supported by vegetation analyses in the field. The decisions made during planning and scoping meetings and analyses of existing databases guided preparation of the final GIS products.

4.1 Basinwide Data Development

Data have been collected for the Platte River basin to provide baseline information to assist with the Platte River EIS. Digital data developed by the Denver office of the U.S. Bureau of Reclamation to date include:

- managed lands from public and private agencies (e.g., Nebraska Game and Parks Commission, The Nature Conservancy, and the National Audubon Society)
- digital 1:24,000-scale color-infrared images from August 1998 photography
- well locations
- county agricultural statistics and basin economic conditions
- power and hydro plant locations (in addition to those from CNPP&ID)
- tern, plover, and whooping crane databases

Digital data acquired from other agencies include:

- 1993 1:12,000-scale digital orthophoto quarter-quadrangles (DOQQs) from the USGS
- 1982 land cover/use database produced for the Platte River Whooping Crane Maintenance Trust
- surface water irrigation boundaries and power plants (CNPP&ID)
- digital U.S. Geological Survey (USGS) quadrangles (DRGs)
- digital elevation model (DEM) data
- digital line graph (DLG) data

4.2 Training

Three ArcView 3.1 GIS software training courses were conducted for FWS-Platte River EIS, FWS-Denver, and BOR staff during January 1999. The first class was held in Grand Island, Nebraska, and included employees from the FWS and the BOR. Two training courses were held in Denver, CO. The first of these was attended by BOR economists from the Technical Service Center's Economics Group (D-8270), and the second included employees from the FWS-Platte River EIS, Denver-FWS, and BOR offices. The course outline is included in Appendix E. The USFWS trainees have used ArcView software extensively as part of their geographical analyses and to assist with EIS alternatives (e.g., creating scenarios of land acquisition, refining locations of endangered species sightings, analyzing species habitat).

4.3 Map Classification and Photo-interpretation

Map Unit Classification

Land-cover and land-use map units selected for this study combine the review of units used by WELUT in 1983, UNL in 1998, discussion of units during project scoping meetings, and field work. Appendix B illustrates and compares mapping units used for each of three databases prepared for the CPRV. Evaluation of the mapping units from the three studies indicates that they are very similar, although both later efforts make attempts to refine the data into more classes for open water, grassland, and agriculture. It is confusing to relate the CALMIT (UNL 1998) effort to the others because of more detailed map units for six bridge segments versus a broader classification for the other five segments.

This effort (the CPRV land cover/use database) has 35 map classes or units prepared by BOR-RSGIG and presented in Appendix I. These were divided into seven agricultural units, nine natural or semi-natural vegetation units, five hydrology units, four bare-ground units (not including fallow agricultural land which is included with the agricultural units), ten land-use units, and the floodplain boundary. This effort incorporates two new classes for which there are no clear comparisons or cross-walks with earlier databases, these are: 1) Herbaceous Riparian (Map Unit 18) and Barren Surface (Map Unit 42). The natural associations are comprised of two woodland, three shrubland, two herbaceous, and one emergent wetland vegetation types. The semi-natural associations are comprised of two grassland types and one association of exotic forbs mixed with grasses and short shrubs. As expected, many of the vegetation types are representative of tallgrass prairie found in the Central Great Plains physiographic region and the shrublands and woodlands found in floodplains. A field key to vegetation types is included under Appendix J, and detailed NVCS descriptions are provided in Appendix M.

Photo-interpretation

Interpretation of the color-infrared aerial photographs for the CPRV relied heavily on texture and color signatures because the landscape is relatively flat and heavily influenced by agricultural practices. A brief description of each map unit or class and its characteristic photo-signature is presented below. The associated figures illustrate typical photo signatures and the range of signature variability for selected map units. Note: the number in parentheses indicates the map unit/class number.

Natural/Semi-natural Vegetation (Habitat) Map Units 1, 10-13, & 15-18

Emergents (1)

Description: Occurs on saturated and inundated soils, where water depths do not exceed one meter. Wetland vegetation is found on/near seeps, springs, drainages, pond margins, swales, closed basins, riverbanks, and in ditches. Only emergent wetlands that meet the MMU for this study are delineated; linear wetlands are represented by a line coverage.

Photo signature: Color ranges from brown or dark green to bright pink or dull red, may have small pockets of black, indicating open water. Texture may range from a brushed appearance to nearly smooth, often with a rounded margin for clonal species and/or hydrology gradients. Emergents are located in topographic lows, including drainages, swales, or depressions, and along flowing/standing water in streams, ditches, and canals, and around ponds.

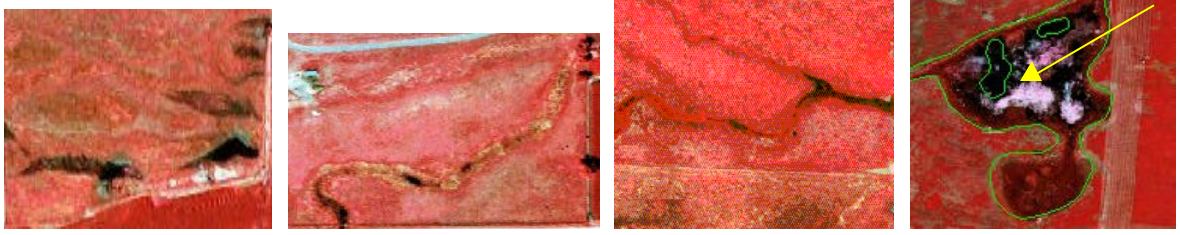


Figure 4.1. Representative photo signatures for Emergents (class 1)

Shrubs inside Floodplain (10)

Description: Occurs within floodplain (Map Unit 50) boundaries, including on the large permanent islands or more permanent depositions/accumulations in the Platte River, and the sites tend to be subirrigated. The vegetation is predominantly shrubs or sapling trees from 1–4 meters tall.

Photo Signature: Color ranges from orange to deep red depending on the dominant species present. Texture is brushy or roughened to pebbly indicating a range from medium-tall shrubs and tall herbs to tall shrubs and sapling trees.

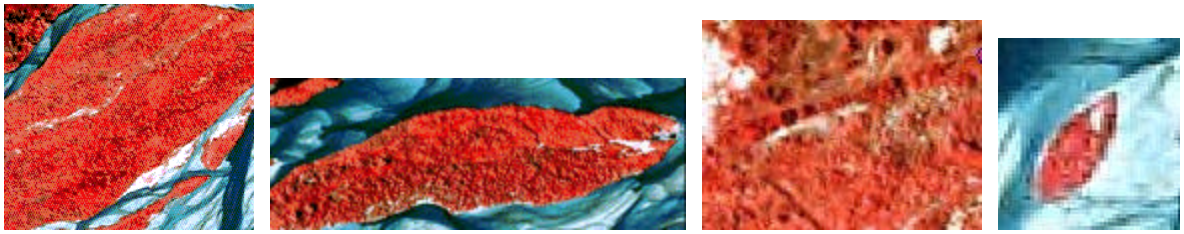


Figure 4.2. Representative photo signatures for Shrubs inside Floodplain (class 10)

Upland Grasses (11)

Description: Occurs on drier, often elevated soils that are not subirrigated, including sand hills and ridges, eolian flats, and tops of abandoned alluvial deposits. Topographic features are present which include drainages, sand hills with blowouts, and sandy bluffs, in addition to check dams in drainages to capture water for livestock.

Photo Signature: Color is predominantly pale pink to light gray-green, blowouts and check dams are white, and water bodies are blue to black depending on depth and turbidity. Texture is smooth unless scattered large shrubs or small trees are present.

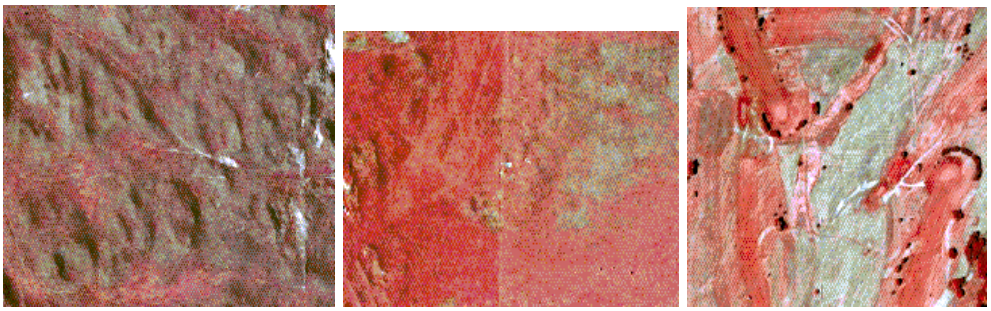


Figure 4.3. Representative photo signatures for Upland Grasses (class 11)

Lowland Grasses (12)

Description: Occupies subirrigated soils within the floodplain (Map Unit 50) boundaries that include shallow drainages and depressions. Mown sites of this habitat type are placed under Map Class 17. Exposed groundwater and saturated soils have emergent vegetation clusters that are placed in Map Unit 1 if they meet the MMU or are included in this class if smaller. The vegetation is predominantly herbaceous with many tall grasses, but some introduced grass species are dominant on many acres and included in the mapping unit.

Photo Signature: Color ranges from beige-brown to pink to dull orange, the drainages and depressions typically standing out as brighter pink to orange. Texture is smooth unless the site is very weedy or scattered shrubs or small trees are present.

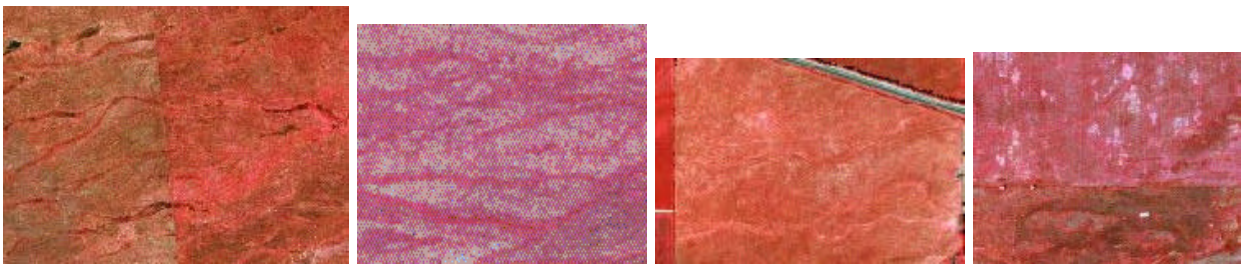


Figure 4.4. Representative photo signatures for Lowland Grasses (class 12)

Shrubs outside Floodplain (13).

Description: Occurs outside floodplain (Map Unit 50) boundaries on upland soils of drainages, swales, and hills. The vegetation is predominantly shrubs or sapling trees from 1–4 meters tall.

Photo Signature: Color ranges from orange to deep red depending on the dominant species present. Texture is brushy or roughened to pebbly indicating a range from medium-tall shrubs and tall herbs to tall shrubs and sapling trees.

Figure 4.5. Representative photo signatures for Shrubs outside Floodplain (class 13)

Wooded within Floodplain (15)

Description: Occupies river terraces and large and small islands within the floodplain (Map Unit 50) that have sufficient substrate over ground water to allow root development and sufficient aeration. Trees are over 4 meters in height, but range from 4–50 meters tall depending on age and species.

Photo Signature: Color ranges from dull orange to reddish-brown. Texture is rough and pebbly, sometimes interspersed with smooth or brushy orange to brown strips in canopy openings.

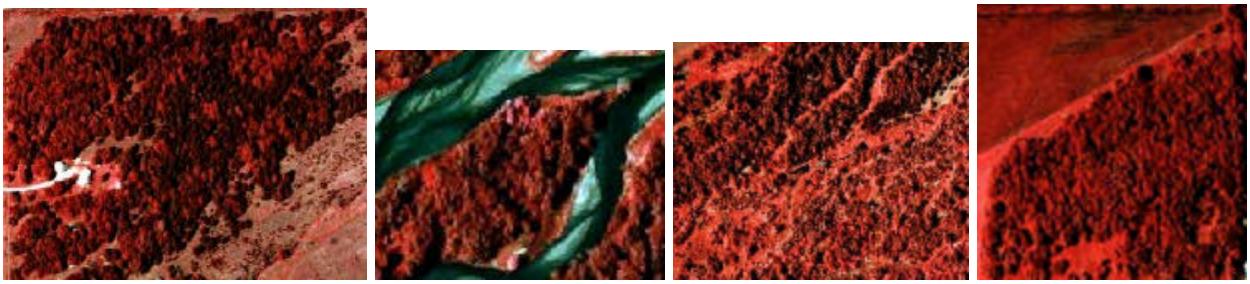


Figure 4.6. Representative photo signatures for Wooded within Floodplain (class 15)

Wooded outside Floodplain (16)

Description: Occupies hills, draws, farm fields and houses (windbreaks), as well as minor drainages outside the floodplain (Map Unit 50) boundaries. Trees are over 4 meters in height, but range from 4–15 meters tall depending on age and species.

Photo Signature: Color ranges from orange to reddish-brown, but some upland trees may appear black. Texture is rough and pebbly, sometimes interspersed with smooth strips in canopy openings or agricultural fields along windbreaks.

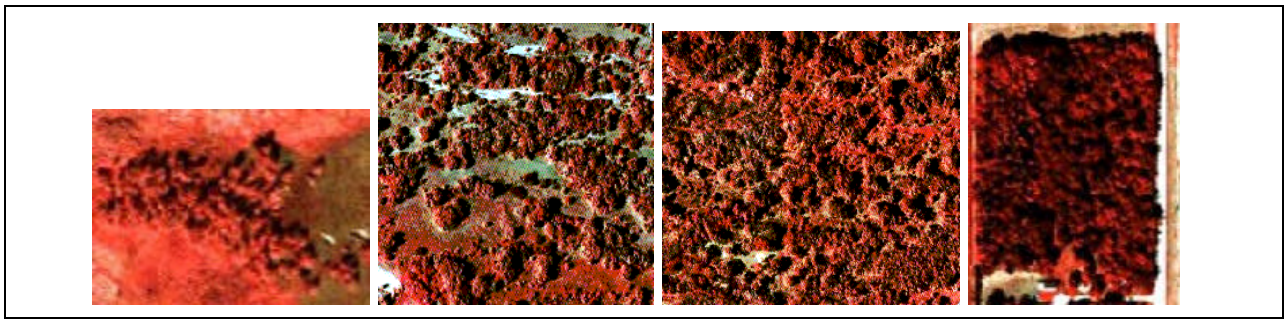


Figure 4.7. Representative photo signatures for Wooded outside Floodplain (class 16)

Mown Lowland Grasses (17)

Description: Occupies subirrigated soils within the floodplain (Map Unit 50) boundaries that include shallow drainages and depressions. Non-mown sites of this habitat type are placed under Map Unit 12. Exposed groundwater and saturated soils have emergent vegetation that is placed in Map Unit 1 if it meets the MMU or is included in this class if smaller.

Photo Signature: Color is predominantly gray-green to green, with gray stripes from wind-rows of hay. Texture is smooth, but some fields have raised windrows and appear corrugated or have individual pebbles (hay bales).

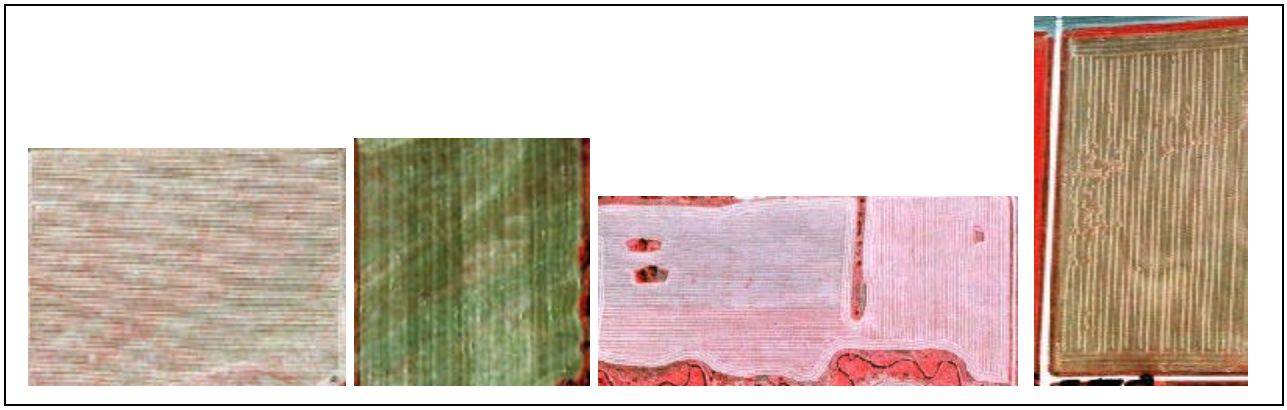


Figure 4.8. Representative photo signatures for Mown Lowland Grasses (class 17)

Herbaceous Riparian (18)

Description: Occupies terraces within floodplain (Map Unit 50) boundaries, typically with subirrigated soils. This type may have dense cover for grass species, but is overtopped by weedy, broad-leaved species and some short shrubs and/or tree seedlings.

Photo Signature: Color ranges from deep red to orange to pink depending on the dominant species. Texture is roughened to brushy and may be interspersed with woodland or grassland signatures.

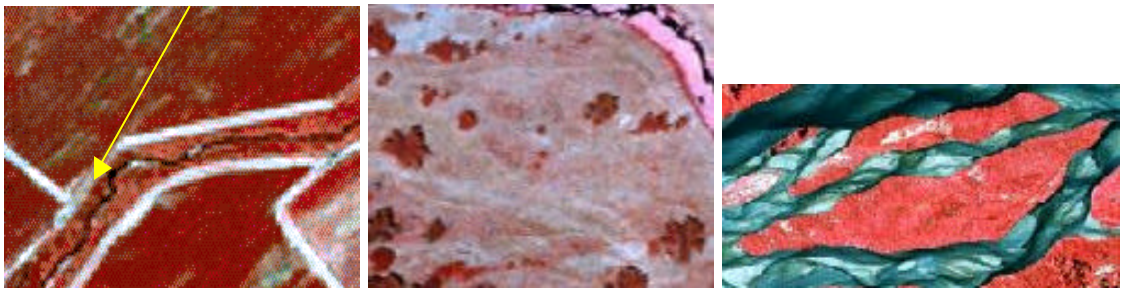


Figure 4.9. Representative photo signatures for Herbaceous Riparian (class 18)

Hydrology Map Units 2, 3, 4, 5, and 7

Channel (2)

Description: Occupies the center of the floodplain (Map Unit 50) boundaries as a single entity in some areas, but may be braided in several places. This is the active, inundated river from bank-to-bank.

Photo Signature: Color is light blue to black, depending on depth; may be tan if shallow water flows over inundated sand bars. Water will reflect sunlight on aerial photos and some sites may have silvery-white glare. Texture is smooth.

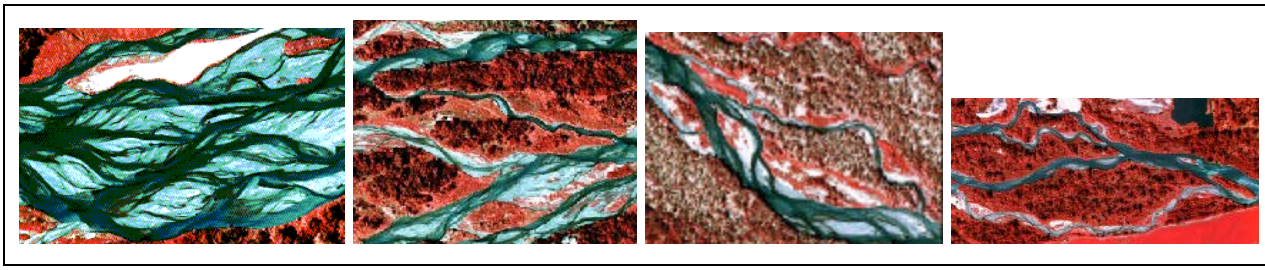


Figure 4.10. Representative photo signatures for Wetted Channel (class 2)

Open Water Canal (3)

Description: Constructed water conveyance channel located outside the river channel.

Photo Signature: Color is blue to black for water, white for linear spoil piles and access roads forming canal embankments, and deep red to pink strips of vegetation associated with the structure. Texture is smooth for water and bare ground, pebbly for trees, brushy for shrubs and coarse herbs, and smooth for grass species.

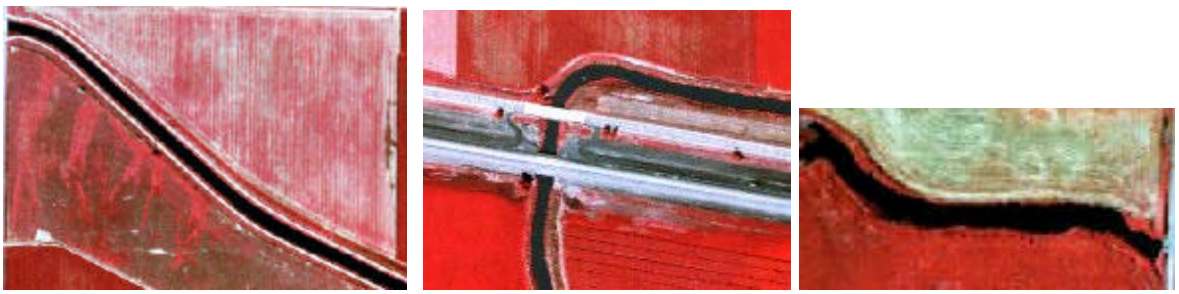


Figure 4.11. Representative photo signatures for Open Water Canal (class 3)

Open Water Slough (4)

Description: Occupies the first terrace within the floodplain (Map Unit 50) boundaries, and may consist of water-filled channel scars, cut-off oxbow bends, or abandoned channel segments. Water remains in sloughs because it is exposed ground water or trapped surface run-in.

Photo Signature: Color is usually black for water, and pink to orange for associated emergent (Map Unit 1) or shrub (Map Unit 10) habitats. Texture is smooth except for areas with associated vegetation (smooth to brushy).

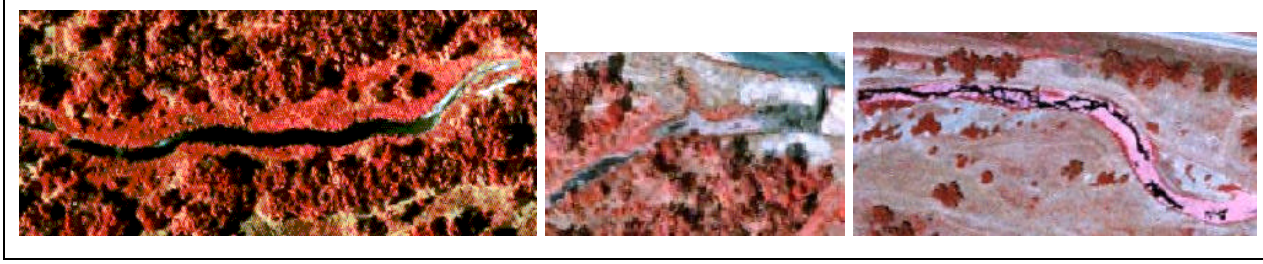


Figure 4.12. Representative photo signatures for Open Water Slough (class 4)

Open Water Pit, Pond, or Lake (5)

Description: Excavated or dammed water storage structures to provide livestock water, fisheries habitat, and recreation. Many structures are old gravel pits.

Photo Signature: Color of water in storage structures is black, although some shallower waters reflect light to medium blue. Associated emergent wetlands or other vegetation is usually dark brown to orange in color. Texture is smooth, unless the surface is windblown into large waves, when it is roughened.

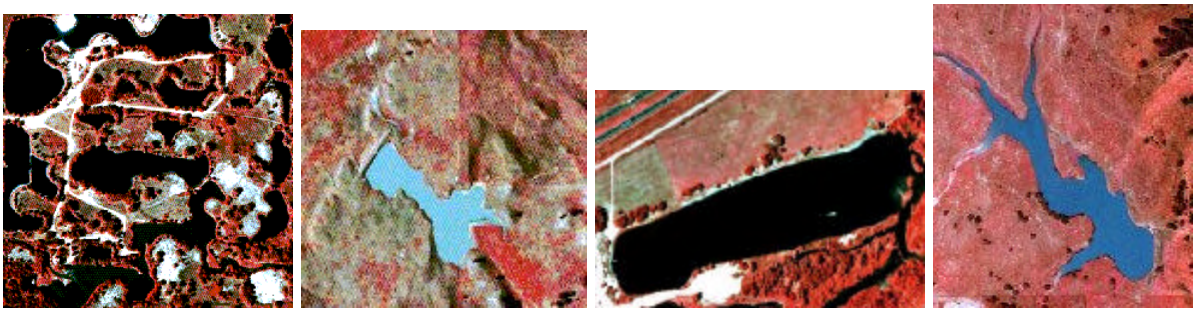


Figure 4.13. Representative photo signatures for Open Water Pit, Pond, or Lake (class 5)

Open Water (7)

Description: Occurs outside the river channel (Map Unit 2) and includes any open water not represented by Map Units 2, 3, 4, and 5.

Photo Signature: Color is typically black for deeper water and light to medium blue for shallower water.

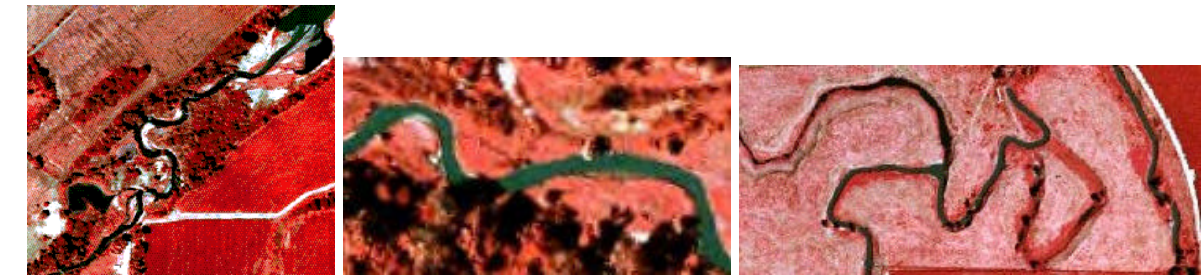


Figure 4.14. Representative photo signatures for Open Water (class 7)

Barren or Very Sparsely Vegetated Map Units 6, 40, 42, and 43

Barren Beach/Bar (6)

Description: Occupies the active channel (Map Unit 2) area as islands and point bars. Colonizing vegetation on these sites attains <30% cover.

Photo Signature: Color is white for barren sand and gravel to a light pink for sparsely vegetated areas. Texture is smooth.

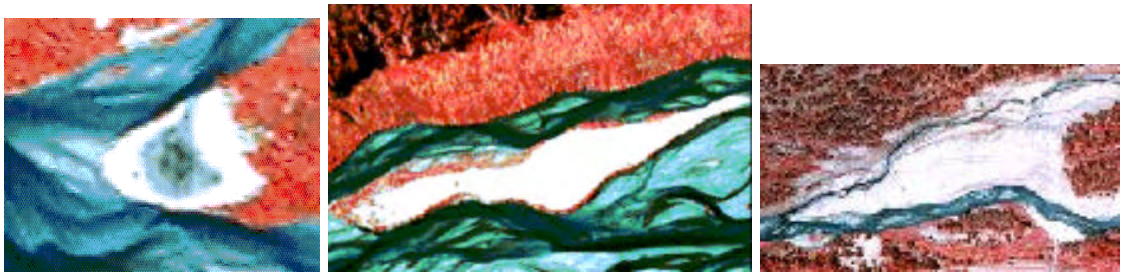


Figure 4.15. Representative photo signatures for Barren Beach/Bar (class 6)

Sand/Gravel Areas (40)

Description: Occupies sand and gravel mines, usually within the floodplain (Map Unit 50) boundary. This map unit contains the active area for equipment operation and piled material.

Photo Signature: Color is white for barren sand and gravel. Texture is smooth for flats and scalloped for piled material.

Figure 4.16. Representative photo signatures for Sand/Gravel Areas (class 40)

Barren Surface (42)

Description: Primarily associated with developed sites; includes berms, disturbed sites, rest stops, way stations, and pull-outs.

Photo Signature: Color is white for barren sand and gravel. Texture is smooth.

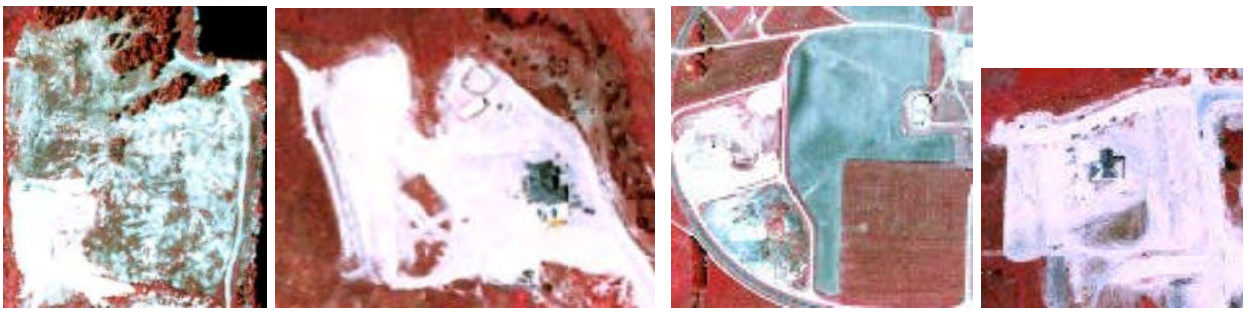


Figure 4.17. Representative photo signatures for Barren Surface (class 42)

Agricultural Map Units 20 thru 26

Agriculture Alfalfa (20)

Description: Occupies soils above the channel (Map Unit 2) and low valley terraces, typically, although this crop may occupy some subirrigated soils. May include both alfalfa and clover crops and attendant irrigation ditches, access lanes, and haystacks.

Photo Signature: Color is deep pink to light red for unmown crop, gray-green to green for recently mown fields (plus corduroy lines for windrows), and a deeper pinkish-red for recently irrigated fields. Texture is smooth for unmown crop, roughened for mown fields with windrows, and pebbly when hay bales are lying in the fields. Large, rectangular stacks of cured hay bales may be present.

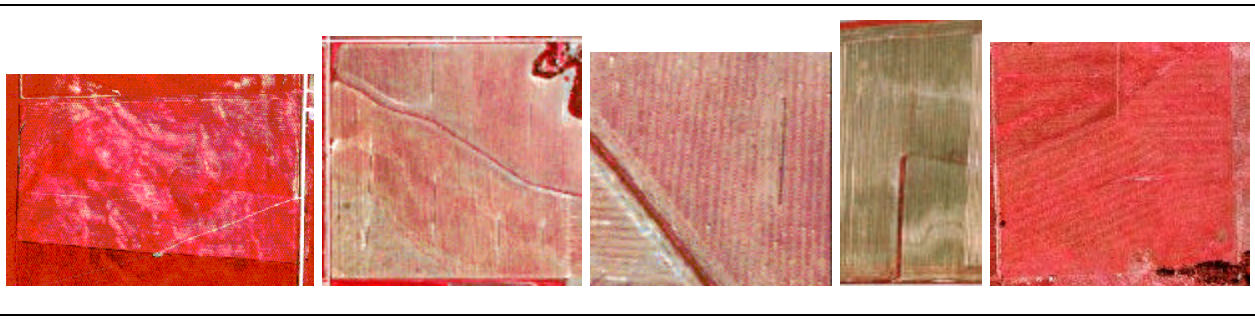


Figure 4.18. Representative photo signatures for Agriculture Alfalfa (class 20)

Agriculture Corn (21)

Description: Occupies soils above the channel (Map Unit 2) and low valley terraces. May include both corn and seed sorghum crops and attendant irrigation ditches, drainage ditches, and access lanes.

Photo Signature: Color is dull orange to dull orange-red. Texture is relatively smooth, but parallel rows can be seen in many fields.

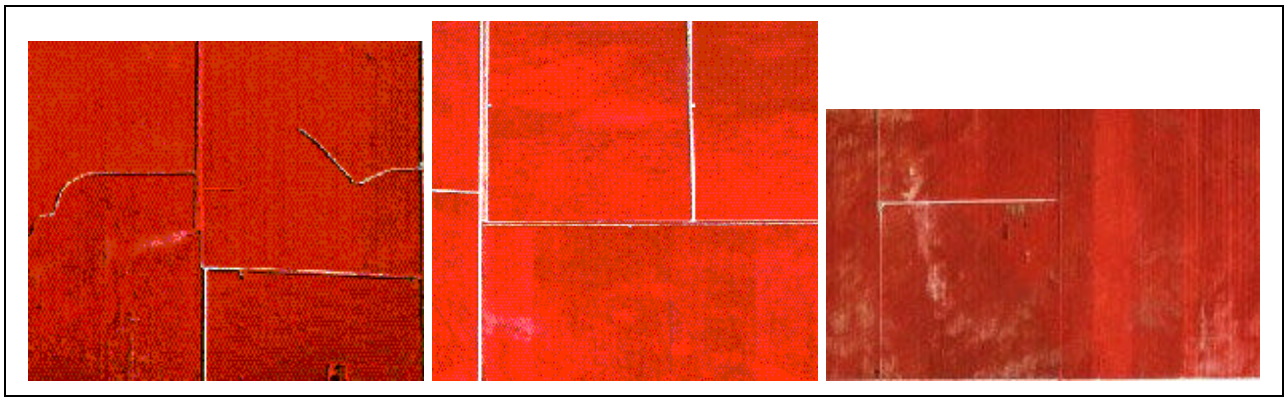


Figure 4.19. Representative photo signatures for Agriculture Corn (class 21)

Agriculture Other Crops (22)

Description: Occupies soils above the channel (Map Unit 2) and low valley terraces. May include milo, millet, annual weeds, and some introduced grasses.

Photo Signature: Color varies from pink to bright red. Texture is smooth for small grains, but rough for patches of annual weeds.

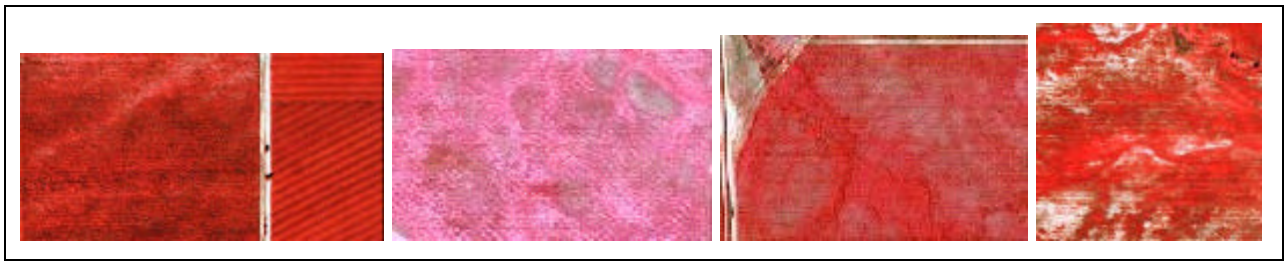


Figure 4.20. Representative photo signatures for Agriculture Other Crop (class 22)

Agriculture Bare Ground/Fallow (23)

Description: Occupies soils above the channel (Map Unit 2) and low valley terraces. Includes land that is fallow prior to planting winter wheat, and could include some land where corn silage was cut prior to aerial overflight, or feed lots.

Photo Signature: Color ranges from grayish-white to greenish-white for fallow fields to black for feedlots. Texture is generally smooth.

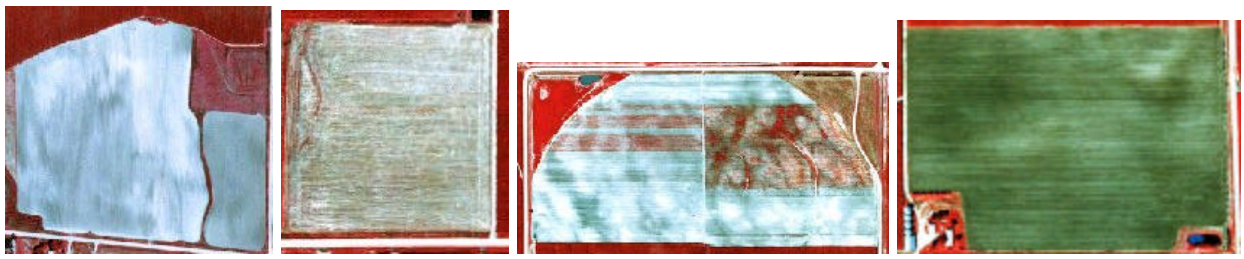


Figure 4.21. Representative photo signatures for Agriculture Bare Ground/Fallow (class 23)

Agriculture Soy Bean (24)

Description: Occupies soils above the channel (Map Unit 2) and low valley terraces. Small fields interspersed with corn and alfalfa.

Photo Signature: Color is deep to bright red. Texture is smooth.

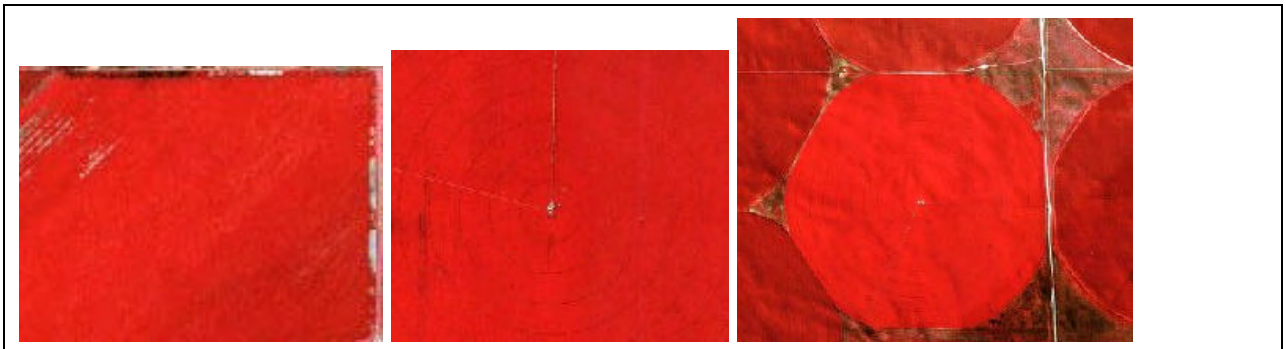


Figure 4.22. Representative photo signatures for Agriculture Soy Beans (class 24)

Agriculture Mown Field (25)

Description: May occur almost anywhere in the corridor, even large openings among floodplain trees. This map unit will typically relate to Map Unit 20 Agriculture Alfalfa and Map Unit 22 Agriculture Other Crop (grass hay from introduced species). The unit may include irrigation ditches, access lanes, and haystacks.

Photo Signature: Color is gray-green to green for mown fields, plus corduroy lines for windrows of curing hay. Texture is roughened with linear striations and pebbly when hay bales are distributed in a field.

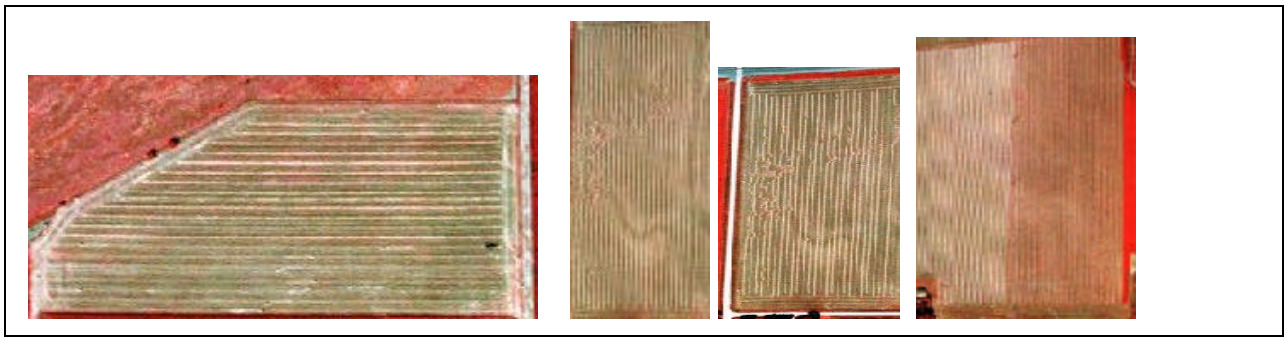


Figure 4.23. Representative photo signatures for Agriculture Mown Field (class 25)

Agriculture Winter Wheat (26)

Description: Occupies higher, drier soils, usually unirrigated and hilly areas, as this crop is often grown dry-land. Appears as fallow land on aerial photos, because the crop is not planted until September/October, and may be included with Map Unit 23 Agriculture Bare Ground.

Photo Signature: Color is grayish-white to green, depending on timing of weed control activities, may be pink to dark red if annual weeds have not been treated. Texture is smooth if soil has been worked, but may appear roughened if coarse annual weeds are abundant.

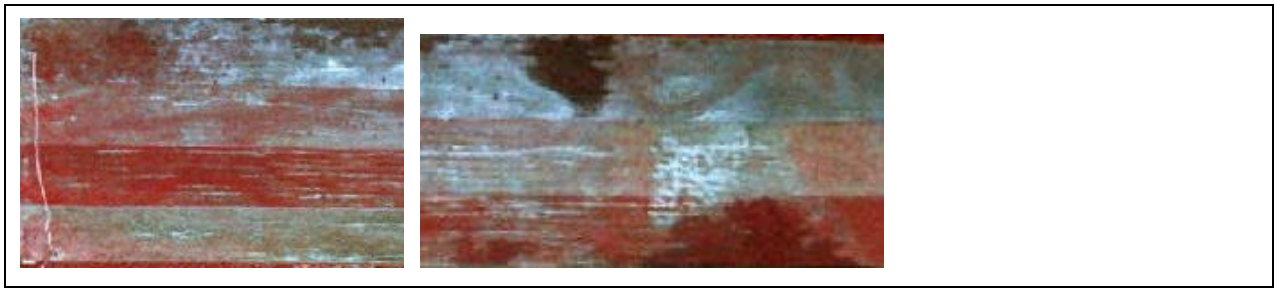


Figure 4.24. Representative photo signatures for Agriculture Winter Wheat (class 26)

Built-up Land, Gravel Extraction, and Utility Map Units 31 thru 34, and 41

Development Commercial (31)

Description: Areas that are built over and predominantly used for business or commercial activities. Examples include downtown businesses of cities, truck stops along the interstate highway, and large utilities.

Photo Signature: Color is predominantly white, with reflectance from large parking areas and buildings. Texture is smooth for flat surfaces and roughened for buildings, landscaping, vehicles, etc.

Figure 4.25. Representative photo signatures for Development Commercial (class 31)

Development Residential (32)

Description: Areas that are built-over and predominantly used for living quarters (e.g., parks and housing tracts). These sites include incorporated towns and cities and clusters of rural housing.

Photo Signature: Color is a mixture of white (due to reflectance from housing, streets, and parking areas) and pink to dark red (from the associated landscaping). Texture is roughened due to many buildings and trees.

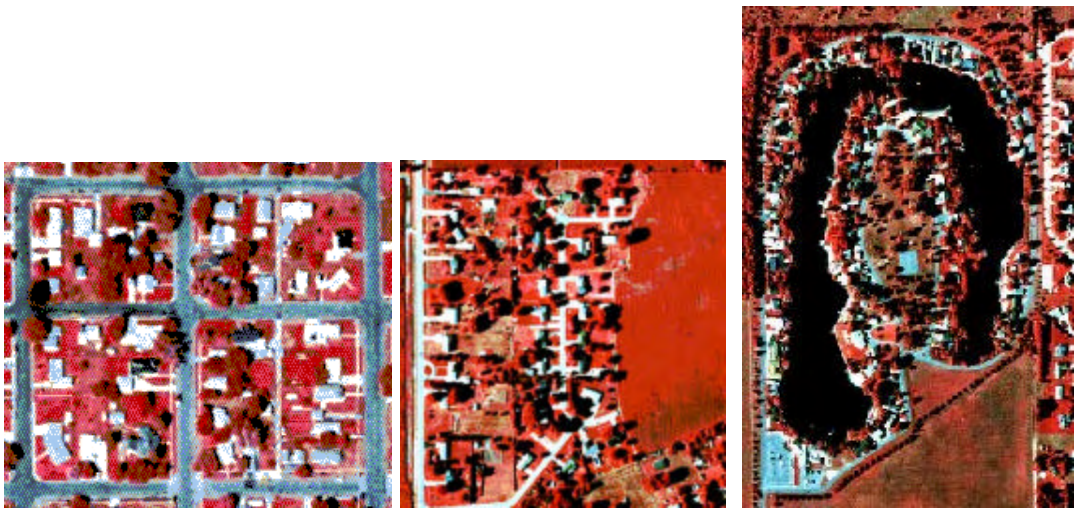


Figure 4.26. Representative photo signatures for Development Residential—more than one dwelling (class 32)

Development Residential (33)

Description: Any single residence within the study corridor and its attended yard and out-buildings.

Photo Signature: Color is a mixture of white (due to reflectance from houses and buildings) and pink to dark red from the associated landscaping. Texture is roughened due to the buildings and tree/shrub plantings.

Figure 4.27. Representative photo signatures for Development Residential—any single dwelling (class 33)

Powerline (34)

Description: Large powerlines cross the study corridor perpendicular to the Platte River and are placed in a separate line coverage. Only tower sites, substations, and maintenance areas are mapped with the land cover/use data.

Photo Signature: Color for the disturbed soils of substations is white; tower sites are usually pink to red because of coarse vegetative growth. Texture is roughened because of structures or coarse vegetation.

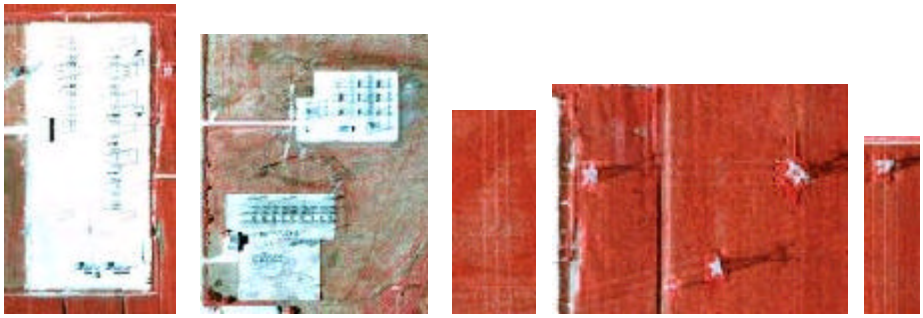


Figure 4.28. Representative photo signatures for Powerline (class 34)

Sand/Gravel Operations (41)

Description: Gravel pits are located mostly within the floodplain, on large islands and first terraces. They are usually represented by newly disturbed areas and areas undergoing recovery following sand and gravel extraction. This unit includes the operations area; associated with sand and gravel operations are barren lands placed in Map Unit 40.

Photo Signature: Color is predominantly white, but areas of blue and black are present when ground water is exposed, and pink to red vegetation signatures may also be present. Texture is roughened due to facilities and piles of sand/gravel.

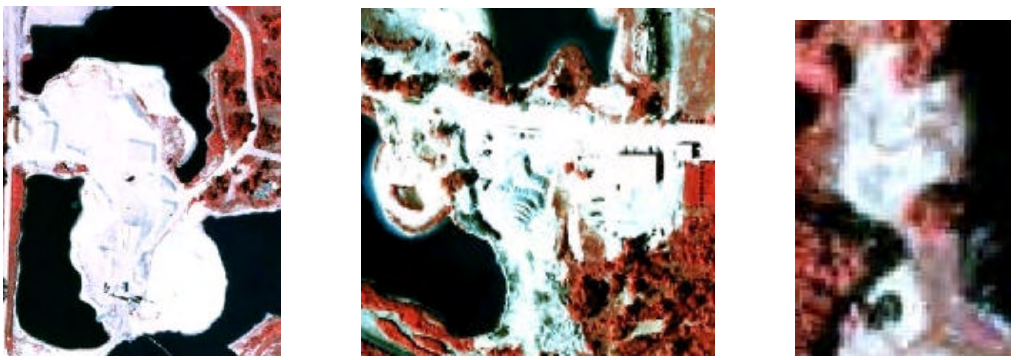


Figure 4.29. Representative photo signatures for Sand/Gravel Operation (class 41)

Transportation Map Units 30 and 35 thru 39

Bridge (30)

Description: Any structure providing passage for vehicles over the Platte River, its tributaries, or canals within the floodplain.

Photo Signature: Color is white or blue, shape is linear-rectangular over the blue to black background of flowing water. Texture is smooth.

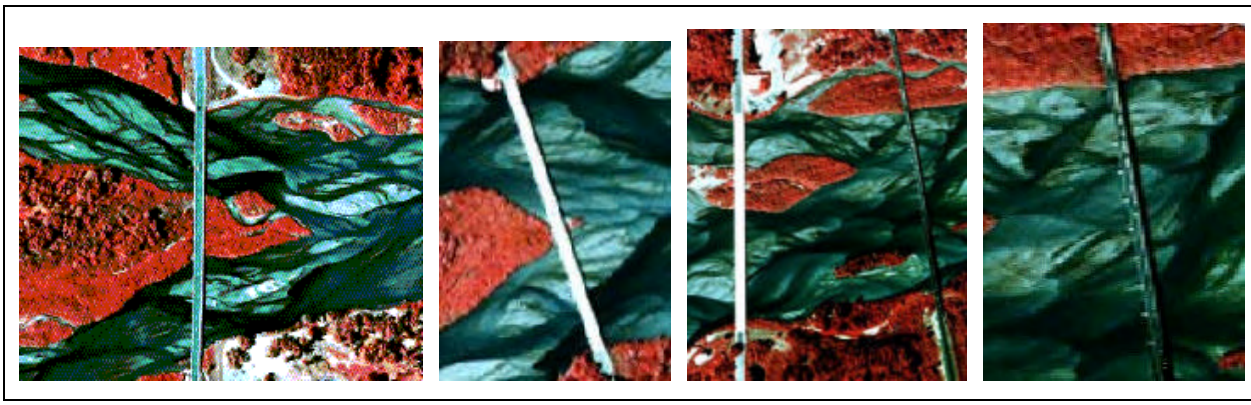


Figure 4.30. Representative photo signatures for Bridge (class 30)

Road Gravel (35)

Description: Maintained gravel roads are placed on nearly every section boundary above the riparian area of the Platte River.

Photo Signature: Color is white for the road surface and pink to red for the adjacent right-of-way. Texture is smooth for the road surface and roughened for the right-of-way, unless it has been recently mown.

Figure 4.31. Representative photo signatures for Road Gravel (class 35)

Road Interstate (36)

Description: Interstate Highway 80 parallels the north side of the Platte River through the study corridor and crosses the river south of Grand Island.

Photo Signature: Color is white for the road surfaces, weigh stations for commercial trucks, and way stations for travelers. Color is pink to dark brown or red for vegetation growing within the right-of-way. Texture is smooth for the travel and parking surfaces and typically smooth for the mown right-of-way. A few trees and shrubs roughen the texture of the right-of-way where they have not been removed.

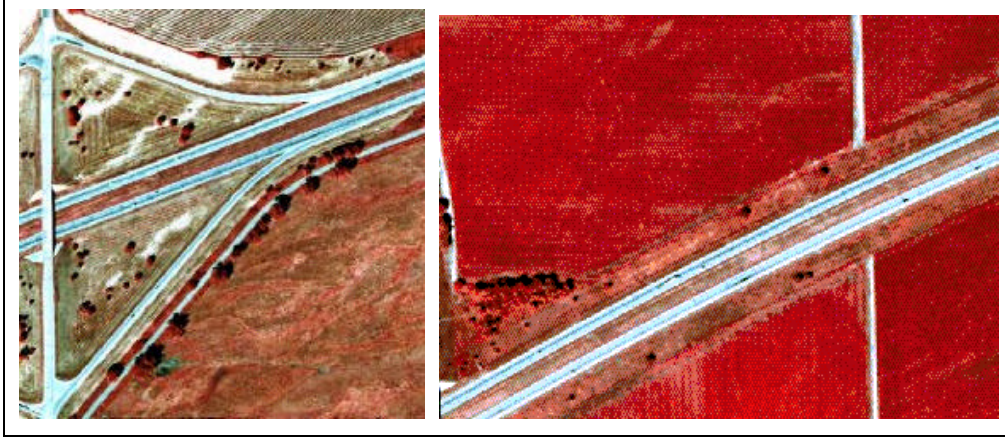


Figure 4.32. Representative photo signatures for Road Interstate (class 36)

Road Paved (37)

Description: Paved highways are two-laned and accept traffic from gravel roads or directly from private roads. Almost all bridge crossings of the Platte River are for paved, two-lane highways.

Photo Signature: Color is white for the road surface and pink to dark brown or red for vegetation growing within the right-of-way. Texture is smooth for the travel and parking surfaces and may be smooth for the right-of-way if mown, or roughened for coarse vegetation, including trees and shrubs.

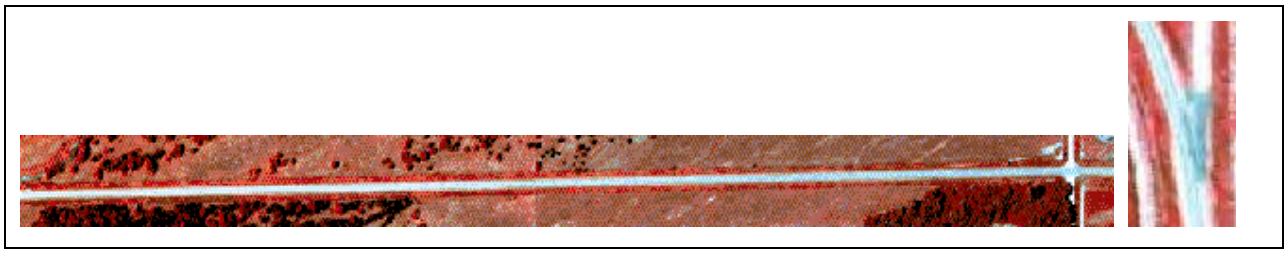


Figure 4.33. Representative photo signatures for Road Paved (class 37)

Railroad (38)

Description: The railroad line parallels U. S. Highway 30 north of the Platte River through the entire study corridor. Spur lines are in place to serve some utilities.

Photo Signature: Color is white for the rails and ballast and pink to dark brown or red for vegetation growing in the right-of-way. Texture is smooth for the rail bed and usually roughened for adjacent vegetation, which may include tree and shrub stands.

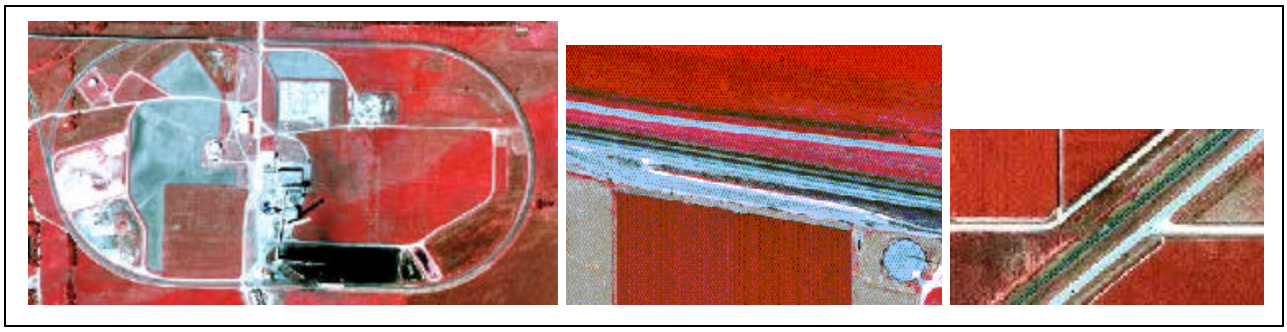


Figure 4.34. Representative photo signatures for Railroad (class 38)

Other Road (39)

Description: Small, private roads and lanes leading to residences and farm buildings. Map unit does not include travel lanes in agricultural fields and river floodplain.

Photo Signature: Color is white for private road surfaces. Texture is smooth.

Figure 4.35. Representative photo signatures for Other Road (class 39)

Floodplain Boundary

Floodplain (50)

Description: Approximate edge of floodplain as determined by GIS analysts with assistance from project hydrologists. Floodplain boundaries may be obvious where cliffs occur at the edge of the Platte River or the raised superelevation of Interstate Highway 80. Floodplain boundaries are not obvious in predominantly tilled farmland.

Photo Signature: Various, boundaries are determined by elevation and water volume analyses.

Figure 4.36. Representative photo signatures for Floodplain Boundary (class 50)

4.4 GIS Database and Maps

GIS Database

A total of 13 land cover/use coverages were created using Arc/Info UNIX-based software with filenames associated with bridge segments. The bridge segments are shown in Figure 2.1. The orthophoto portions that were photo-interpreted and entered into the GIS database are shown in Figure 3.1. The project has one overall FGDC-compliant metadata file which describes all the coverages created for this mapping effort. A copy of the metadata file is presented in Appendix H. Mapping totals of area and quantity of polygons are presented in Table 4.1. The table lists each land cover/use map unit, the total number of polygons, and the acreage total for each.

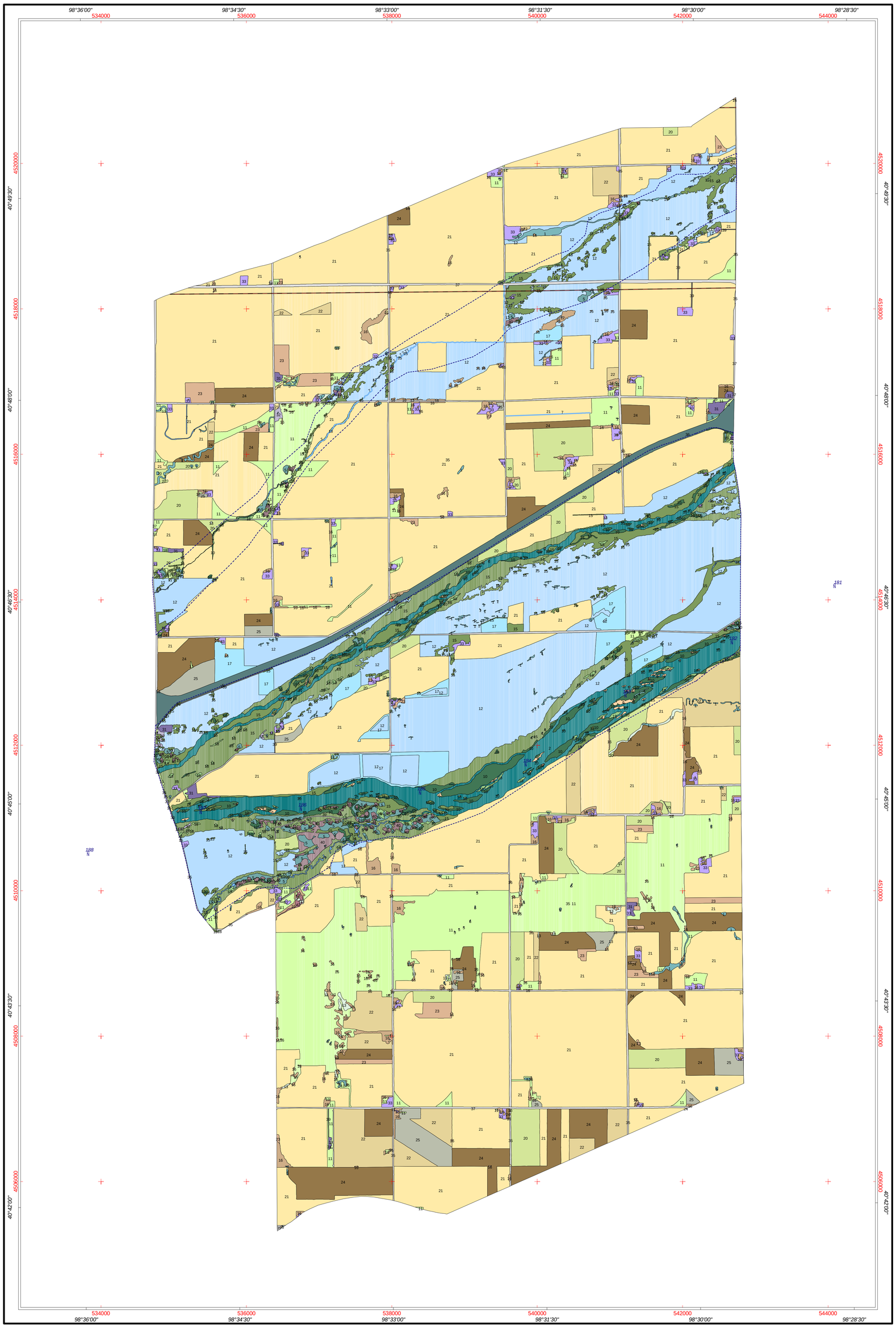
Table 4.1 Land cover/use information for CPRV study area

Code	Description	Number of polygons	Acreage
1	Emergents	1593	1405
2	Wetted Channel	82	9968
3	Open Water Canal	75	242
4	Open Water Slough	216	179
5	Open Water Pit, Pond, or Lake	1681	3763
6	Barren Beach/Bar	2128	1408
7	Open Water (e.g., creek)	231	341
10	Shrubs inside Floodplain	3331	5402
11	Upland Grasses	2955	35637
12	Lowland Grasses	615	38914
13	Shrubs outside Floodplain	310	308
15	Woody within Floodplain	6337	29315
16	Woody outside Floodplain	5659	5648
17	Mown Lowland Grasses	147	4121
18	Herbaceous Riparian	3009	4202
20	Agriculture Alfalfa	843	22171
21	Agriculture Corn	1493	204729
22	Agriculture Other Crops	412	8413
23	Agriculture Bare Ground/Fallow	736	4406
24	Agriculture Soy Bean	593	19631
25	Agriculture Mown Field	347	5259
26	Agriculture Winter Wheat	2	42
30	Bridge	59	20
31	Development Commercial	350	3246
32	Development Residential	313	5281
33	Development Single Dwelling	1812	3320
34	Powerline	8	36
35	Road Gravel	324	7153
36	Road Interstate	30	3440
37	Road Paved	126	2926
38	Railroad	39	1173
39	Other Road	151	192
40	Sand/Gravel Areas	641	1526
41	Sand/Gravel Operation	30	146
42	Barren Surface	162	238
Totals		36840	434199

Maps

Hardcopy maps were produced at a scale of 1:24,000 with an approximate size of 34- × 34-inches for each of the 13 bridge segments in the study area. These were created as layouts using ArcView 3.2 software. An example of this layout in an 8.5- × 11-inch format is included as Figure 4.37. A CD was also prepared with digital Adobe PDF files of each of the maps; these files were converted from the original ArcView layouts.

Central Platte River



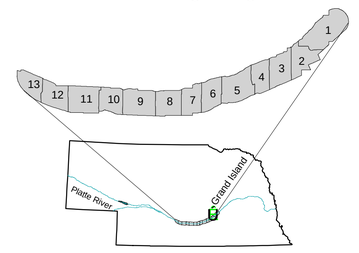
Key to Features

- Gaging Stations
- River Miles
- Floodplain
- 1 Emergents
- 2 Wetted channel
- 3 Open water, canal
- 4 Open water pit, slough
- 5 Open water pit, pond or lake
- 6 Barren beach/bar
- 7 Open water
- 10 Shrubs inside floodplain
- 11 Upland grasses
- 12 Lowland grasses
- 13 Shrubs outside floodplain
- 15 Wooded river within floodplain
- 16 Woody outside floodplain
- 17 Mown wet meadow
- 18 Herbaceous riparian
- 20 Agriculture alfalfa
- 21 Agriculture corn
- 22 Agriculture other crop
- 23 Agriculture bare ground
- 24 Agriculture soy bean
- 25 Agriculture mown field
- 26 Agriculture winter wheat
- 30 Bridge
- 31 Development commercial
- 32 Development residential
- 33 Development single dwelling
- 34 Powerline
- 35 Road gravel
- 36 Road interstate
- 37 Road paved
- 38 Railroad
- 39 Other Road
- 40 Sand/gravel areas within s/g operations
- 41 Sand/gravel operation: all operations
- 42 Barren surface

Discharge Information

Date	Overton (cfs)	Kearney (cfs)	Grand Island (cfs)
8/19/98	380	405	1030
8/21/98	325	327	767
8/24/98	496	400	423

Location of Bridge Segments



Nebraska

The spatial database used to create this map was prepared by the U.S. Bureau of Reclamation's Remote Sensing and Geographic Information Group in conjunction with the U.S. Fish and Wildlife Service.

Vegetation and land cover/use units were identified though stereoscopic examination of 1:24,000-scale color infrared (CIR) aerial photographs taken in August, 1998. Every other photograph was enlarged to a scale of 1:12,000 to provide a larger-scale image for the interpretation. Classification was in accordance with the Federal Geographic Data Committee's National Vegetation Classification Standard.

The vegetation boundaries were transferred to the GIS database using digital orthophoto quadrangles as the basemap. The mapped vegetation and land cover/use reflect conditions that existed during the time of photography. Subsequent changes that may have occurred are not reflected on the map. The GIS database and this map are in a UTM Zone 14 projection with a NAD83 datum.

These data have been generated by the U.S. Bureau of Reclamation. Although all data have been processed successfully on a computer system at the BOR, no warranty, expressed or implied, is made regarding the accuracy or utility of the data on any other system or for general or scientific purposes. Any person using the information presented here should fully understand the data collection and compilation procedures, as described in the metadata, before beginning analysis. The burden for determining fitness for use lies entirely with the user.

U.S. Fish & Wildlife Service

Bureau of Reclamation, Technical Service Center
Remote Sensing & Geographic Information Group
Denver, CO 80225
(303) 445-2266
www.rsgis.do.usbr.gov

N
W E
S

UTM Zone 14, NAD 83

1 0 1 Miles

1 0 1 2 Kilometers

Map Date: 02/14/00

4.5 Field Inventory and Vegetation Classification

Field Inventory

Woodlands and grasslands are nearly equally represented in the study corridor, but much smaller areas of shrublands and sparse vegetation habitats are present. These major physiognomic groups are delineated on the land cover/use maps; their distribution and specific observations related to them are described below in more detail. The descriptions are written from site-specific data collected during the 1999 growing season (Butler 1999). For representative color photographs, refer back to Section 2. A species list prepared from the field data sheets and researcher observation is presented as Appendix L.

Woodlands

Woodlands are one of the common habitats of the Central Platte River Valley, occupying islands, terraces, and tributary drainages along the length of the corridor. Only a few woodlands, with scattered trees, are present on adjacent uplands. Introduced tree plantings for shade and to act as windbreaks are also included in this discussion. Woodlands are classified in this study by their location relative to the floodplain (e.g., Map Unit 15 represents woodland habitat within the Platte River floodplain and Map Unit 16 represents woodland habitat outside the floodplain) (Fig. 2.14).

Naturally occurring upland woodlands (Map Unit 16) are dominated by eastern red cedar, which are present in scattered stands with some dense pockets of trees. These stands occupy low hills, ridges, and the margins of ephemeral drainages or draws, and are typically distributed on north-facing aspects. In addition, a few small stands dominated by green ash trees were observed in larger intermittent drainages of the uplands. Access to upland woodland stands was not available during the summer field data collection program.

Eastern red cedar trees have also become established in the Platte River floodplain (and are identified as Map Unit 15) as understory trees to larger, deciduous species, and as floodplain dominants in a few smaller stands. Two floodplain stands of eastern red cedar were examined; the trees were relatively dense (approximately 60% canopy cover) and between 5-10 meters tall. Common understory grasses in these stands were Kentucky bluegrass and foxtail barley, which attained an estimated cover of 65%.

Trees have been introduced in and around farm fields, farm houses, and elsewhere for shade and to provide windbreaks (these are included in Map Unit 16 if planted outside the floodplain). Many of the species used for these purposes are non-natives, including Russian-olive, Siberian elm, and honey locust. These introduced stands of trees were not sampled during the vegetation sampling program for this land cover/use mapping effort.

Riparian woodlands occupy the Platte River floodplain and floodplains of its major tributary drainages. These woodlands are apparently recent vegetation formations, as historic aerial photography reveals little to no woodland habitat along the Platte River early in the 20th century. In the past century, Platte River woodlands have developed from eastern cottonwood and peachleaf willow softwood stands to stands of green ash and slippery elm/American elm hardwoods, and may be further trending towards stands of eastern red cedar and Russian-olive at some locations.

In recently disturbed sites along the river, (e.g., sites exposed by overbank flooding/scouring, channel movement, deposition of sediments, scars left by gravel mining), colonizing plant species include eastern cottonwood and peachleaf willow trees and sandbar willow shrubs. It is often difficult to interpret this type because it may be considered a woodland outright, part of a woodland fringe (ecotone), or a shrub community (either tall or short, depending on the age and height). In early stages of development along the Platte River, cover values of this vegetation type were estimated to be from 5–25% for woody species colonizing disturbed riparian sites. A large number of colonizing forb and grass species were also observed. Exotics included: cheatgrass (*Bromus tectorum*), Kentucky bluegrass, burdock (*Arctium minus*), and mullein (*Verbascum thapsus*), and among the most common natives were: prairie cordgrass, Canada wildrye (*Elymus canadensis*), evening primrose (*Oenothera biennis*), western ragweed, and annual sunflower (*Helianthus annuus*).

In mature riparian stands, eastern cottonwood trees 20–35 meters tall provide up to 60% of the ground cover. In a few stands, the mature eastern cottonwood trees were estimated to be nearly 50 meters tall. Shorter-statured green ash, eastern red cedar, peachleaf and black willow *(Salix amygdaloides* and *S. nigra*), slippery elm (*Ulmus rubra*), red mulberry (*Morus rubra*), hackberry (*Celtis* sp.), and Russian-olive trees (to 10 meters tall) form a sub-canopy and contribute 30 to 60% additional ground cover. In one stand, eastern red cedar provided 90% ground cover under a 60% canopy cover of mature eastern cottonwood. The hardwood trees are readily reproducing in this environment, particularly green ash, slippery and American elm, red mulberry, and eastern red cedar. Seedlings and saplings of these tree species are regularly reported in the understory flora.

Riparian woodland understory shrubs, ranging from 1–5 meters tall, include rough-leaved dogwood (*Cornus drummondii*), sapling eastern red cedar and green ash trees, chokecherry (*Prunus virginiana*), Arkansas rose (*Rosa arkansana*), false indigo (*Amorpha fruticosa*), prickly ash (*Zanthoxylum americanum*), and coralberry (*Symphoricarpos orbiculatus*) which provide up to 50% additional vegetative cover. At one sample site, rough-leaved dogwood was estimated to cover approximately 80% of the ground surface. The lianas, wild grape (*Vitis riparia*) and Virginia creeper (*Parthenocissus quinquefolia*), also contributed up to 20% ground cover at some locations. At many sites the understory shrubs and sapling trees were described as dense enough to prohibit or greatly limit passage through them by researchers. Figure 4.38 shows an example of the Platte River with considerable riparian vegetation in 1998 along with the corresponding historical aerial photo in 1938 showing little riparian vegetation.

Herbaceous riparian woodland understory species form a dense layer of up to 80% cover and include the grasses switchgrass, Kentucky bluegrass, smooth brome, Canada and Virginia

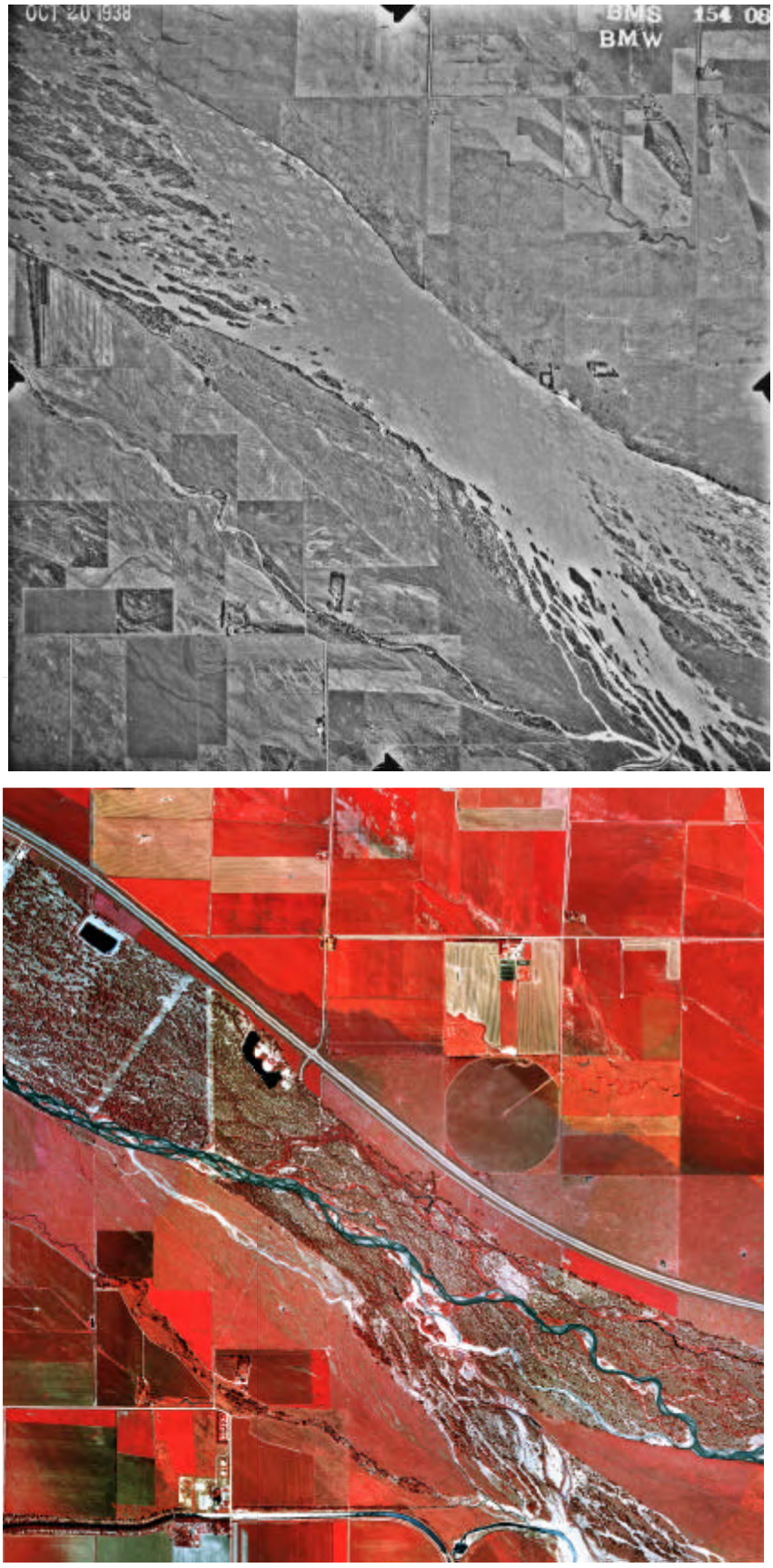


Figure 4.38. Example of land cover/use changes in the Central Platte River Valley east of Lexington, Nebraska, between 1938 (upper photo) and 1998 (lower photo)

wildrye (*Elymus canadensis* and *E. virginiana*), prairie cordgrass, redtop (*Agrostis stolonifera*), rice cutgrass (*Leersia oryzoides*), orchardgrass (*Dactylis glomerata*), reed canarygrass (*Phalaris arundinacea*), and the annual, Japanese brome (*Bromus japonicus*). Common forbs and grass-like plants include sedge (*Carex brevior*), Nuttall sedge (*Carex nuttallii*), common and western ragweeds (*Ambrosia artemisiifolia* and *A. psilostachya*), field mint (*Mentha arvensis*), fog fruit (*Phyla lanceolatum*), smooth horsetail (*Equisetum laevigatum*), dandelion (*Taraxacum officianale*), northern bedstraw (*Galium aparine*), hemp (*Cannabis sativa*), catnip (*Nepeta cataria*), dogbane or Indian-hemp (*Apocynum cannabinum*), mullein, common plantain (*Plantago major*), curly dock (*Rumex crispus*), white avens (*Geum canadense*), stinging nettle (*Urtica dioica*), poison ivy (*Toxicodendron rydbergii*), goldenrod (*Solidago* spp.), white and yellow sweetclover *(Melilotus alba* and *M. officianalis*), black medic (*Medicago lupulina*), marsh-elder (*Iva annua*), musk thistle (*Carduus nutans*), and showy milkweed (*Asclepias speciosa*).

Some less typical riparian woodland sites were also sampled during the course of field data gathering for this study. In particular, relatively pure stands of eastern red cedar (described above) and mixed stands of red mulberry–eastern red cedar and green ash–boxelder (*Acer negundo*). In both mixed stands rough-leaved dogwood was the dominant shrub, providing up to 50% ground cover.

Shrubland

Most shrublands are represented by two map units in this study (i.e., shrublands outside the floodplain (Map Unit 13) and shrublands within the floodplain (Map Unit 10)). Very little habitat within the study corridor falls under Map Unit 13, this possibly consisting of stands of sand sagebrush on sandy ridges and hills and American plum thickets in some draws. Upland shrublands were not sampled for this study because of access limitations. Short shrubs, including rabbitbrush and seedling cottonwood and willow are mapped for this study with tall forbs and grasses under Map Unit 18.

Almost the entire shrubland area mapped for the project occurs on islands in, and shorelines adjacent to, the Platte River. Two species dominate floodplain shrublands; they are sandbar willow and rough-leaved dogwood. A third species, black willow, sometimes forms tall shrub stands, but its height (greater than 4 meters tall) usually results in inclusion with woodland habitats.

Rough-leaved dogwood stands occur adjacent to or intermixed with stands of eastern cottonwood and green ash trees (Fig 4.39). This species is the principal understory shrub of floodplain woodlands and only rarely occurs above the project minimum mapping unit as individual stands. These stands are placed under Map Unit 10 when a sufficient area is interpreted outside tree canopies.

Sandbar willow stands may occupy entire islands or form a fringe along the riverbanks; it is one of the first species to invade newly exposed or newly deposited sandy sites (Fig 4.39). Sandbar willow is usually associated with seedling and sapling eastern cottonwood and peachleaf willow trees, as described under the *Woodland* section of this report; however, more mature stands of sandbar willow often share dominance, in terms of estimated aerial cover, with rough- leaved dogwood.

Figure 4.39. Ground photos of sandbar willow (first two photos) and rough-leaved dogwood

Two sandbar willow stands also had near-equal dominance with false indigo (*Amorpha fruticosa*). Aerial cover estimates from summer 1999 field work range from 30–100% for sandbar willow in sampled stands, and total vegetation cover is usually over 90%. Commonly associated understory species include reed canarygrass, common reed (*Phragmites australis*), Canada wildrye, Kentucky bluegrass, prairie cordgrass, cheatgrass, Japanese brome, common burdock, mullein, annual sunflower, evening primrose, broad-leaved cattail, western ragweed, white sweetclover, and barnyard grass (*Echinochloa crus-gallii*).

Grasslands are nearly equal to woodlands in terms of area covered within the study corridor; they occupy upland hills, ridges, swales, and flats, and floodplain terraces. Grasslands, like woodlands, are classified by location relative to the floodplain. Upland grasslands are located above the floodplain and are classified as Map Unit 11. Upland grasslands were not sampled for this study because of access limitations. Grasslands within the floodplain are classified as lowland grasses, Map Unit 12; when lowland grasses are mown, they are classified as Map Unit 17. These grasslands were sampled extensively, including two study plots that represent drier grassland sites (elevated sites) within the floodplain. The elevated sites were dominated by sand dropseed (*Sporobolus cryptandrus*), little barley (*Hordeum pusillus*), hoary vervain (*Verbena stricta*), western wheatgrass, and windmill grass (*Chloris verticillata*).

Figure 4.40. Ground photo of sand dropseed grass

Included within grassland habitat map units are relatively large acreages that have been converted to introduced grasslands. While most grassland conversion was probably for production of a grass hay crop, some may be revegetating abandoned agricultural fields or exotic grasses invading native grasslands. In addition, the herbaceous understory vegetation of most riparian woodlands is typically dominated by these introduced and exotic grass species. Most introduced grasslands have vegetative cover values ranging between 70–100% with Kentucky bluegrass, smooth brome, orchardgrass, intermediate wheatgrass, foxtail barley, cheatgrass, and Japanese brome present as the dominant or common species.

A variety of forbs, many of them exotic weeds, were also identified in introduced grasslands, including yellow sweetclover, western ragweed, common ragweed, hemp, annual sunflower, black medic, prairie clover (*Petalostemon purpurea*), and wild licorice. Two old field sites that had not been planted to grass species were dominated by horseweed (*Conyza canadensis*), Maximilian sunflower (*Helianthus maximilianii*), and late goldenrod (*Solidago gigantea*).

Native grasslands in the study corridor floodplain are dominated by tall grasses, particularly big bluestem and switchgrass (Fig. 4.43). It is rare to find a stand that has not been invaded by exotic species especially Kentucky bluegrass and smooth brome. Some sample plots were estimated to contain big bluestem at up to 80% aerial cover, while others reported switchgrass at up to 70% aerial cover. Most sites recorded a nearly equal mix of big bluestem and switchgrass in the stand that was sampled. Switchgrass occupies lower, moister soils and the upper margins of emergent wetlands, while big bluestem grows on higher, slightly drier soils that are elevated above the ground water table. Almost all the acreage of lowland grasses within the study corridor is grazed annually, mown annually, or both. A few sites were sampled that had been recently burned and some sites had been recently re-seeded to native tall and mixed grasses, resulting in vegetative cover by little bluestem in addition to the dominants mentioned in the above discussion.

Figure 4.41.Ground photos of big bluestem, big bluestem with smooth brome, and grazed big bluestem

Ground cover estimates for lowland grasses typically are at or exceed 100%. The common species found in lowland grasses within the floodplain include big bluestem, switchgrass, Kentucky bluegrass, smooth brome, little bluestem, western wheatgrass, saltgrass (*Distichlis spicata*), intermediate wheatgrass, orchardgrass, redtop, foxtail barley (*Hordeum jubatum*), Indiangrass (*Sorgahastrum nutans*), cheatgrass, and Japanese brome. Associated forbs and grass-like plant species include sedges, field horsetail (*Equisetum arvensis*), wild licorice, showy milkweed, Maximillian and annual sunflowers, giant ragweed (*Ambrosia trifida*), snow-on-the-mountain (*Euphorbia marginata*), curly dock, goldenrods, buffalo-bur (*Solanum rostratum*), white and yellow sweetclovers, hemp, horsetail, western ragweed, dandelion, black medic, mullein, and white clover (*Trifolium repens*).

Emergent Wetland

Emergent wetlands occur throughout the study corridor in topographic lows, adjacent to rivers and creeks, or on seeps and springs. They are identified as a unique Map Unit (1) when they meet or exceed the minimum mapping unit (0.5 acres), but small emergent wetlands are included in the larger map units with which they are associated. Many small emergent wetlands can be found in lowland grasses or mown lowland grasses (Map Units 12/17) and in floodplain riparian woodlands (Map Unit 15). Emergent wetlands range from saturated soils that support prairie cordgrass and three-square bulrush to inundated sites dominated by cattail.

Figure 4.42. Ground photos of reed canarygrass, prairie cordgrass, cattails, and bulrush

Two sampled, inundated sites contained broad-leaved cattail with an estimated aerial cover value of 80% and another near 50%. Associated species included three-square bulrush, reed canarygrass, prairie cordgrass, foxtail barley, curly dock, giant ragweed, and smooth brome.

Most emergent wetland samples were taken on saturated soils dominated by three-square bulrush (between 5–90% aerial cover) or prairie cordgrass (at nearly 80% aerial cover). However, one sampled site with saturated soil also was dominated by reed canarygrass (80% aerial cover). Plant species associated with emergent wetlands of saturated soils include foxtail barley, redtop, Kentucky bluegrass, reed canarygrass, intermediate wheatgrass, Arctic rush (*Juncus balticus*), spikerush (*Eleocharis* sp.), showy milkweed, western ragweed, field horsetail, sedges, and goldenrods.

5. Discussion

The Central Platte River Valley lies within the Central Great Plains grasslands and includes eolian sand and loess features in addition to the river floodplain. The entire corridor is relatively level, and many acres have been converted to agricultural and urban land uses. The geology and topography of this region create a somewhat uniform mosaic of plant associations, made more interesting because of the relatively recent dominance of deciduous woodlands within the floodplain and introduction or invasion of exotic plant species, particularly perennial grasses.

These factors and the decision to use habitat/physiognomic map units combine to produce reasonably straightforward vegetation classification, photographic interpretation, and digital transfer needs that were met and addressed during this study. An accurate electronic database has been created, using August 1998 color-infrared aerial photography and digital orthophotos. The total accuracy (approximately 89%) for the land cover/use map reflects the time and effort given by researchers to understand and appreciate the study area and project needs.

The importance of developing this database, along with basinwide database development, should not be underestimated; during the 2-year course of this study, the following data requests were completed by RSGIS:

- Converted color-infrared digital orthophotos into MrSID images and made these smaller files available to project partners and the public through a USGS website http://mcmcweb.er.usgs.gov/platte/cir_doq/cir.html
- Created a land ownership coverage to provide contact information for managed lands
- Prepared numerous maps and shared digital data for formal presentations in support of the Platte River EIS (e.g., Central, North, and South Platte River basin maps; 1998 land cover/use maps for 13 bridge segments; locations of sediment transects; basin maps with power plants from CNPP and Federal planning agency)
- Created a river mile coverage to assist with locating riverine features, transects, and other areas of interest
- Generated trend analysis tables comparing 1982 and 1998 land cover/use databases
- Used project imagery as a backdrop to show selenium concentrations in Groundwater Mound wells for report figures
- Mapped monitored well locations in the Central Platte River basin
- Calculated linear footage of proposed block, scatter, segment, and sediment managed areas turning to lowland grasses; created maps with proposed hunting and viewing blinds along the Central Platte River based on proposed vegetation changes
- Used 1998 land cover/use database for GIS channel width analysis
- Developed digital database from least tern and piping plover sighting coordinates; overlayed land cover/use database to show habitat preferences; a similar effort was performed for whooping cranes in the Fish and Wildlife Service Office in Grand Island, Nebraska
- Created series of land cover/use maps for 1938, 1969, 1982, and 1998 data to show historic trends along four areas in the Central Platte River
- Developed shaded relief map for the Central Platte River to depict topography of basin area
- Prepared maps for biota and sediment contaminant sampling transects

- Provided acreages of irrigated lands for Nebraska, Colorado, and Wyoming for economic analyses
- Provided land cover/use data for creating block, segment, scatter, and sediment management plans for the Platte River EIS
- Created maps and shared data with CNPPID to provide information on vegetation sampling sites for the Cottonwood Ranch and Jeffrey's Island properties
- Prepared CD with project data for West, Incorporated, to assist with selecting random transects
- Plotted least tern and piping plover sites to assist with locating cell towers away from critical bird habitat in the Central Platte River corridor

5.1 1998 Central Platte River Database

Before deciding to create a new CPRV digital database, two prior databases were reviewed. The first database was created by WELUT in 1983, but was not assessed for accuracy and contained fewer land cover/use map units than selected for the current study. The CALMIT update of the WELUT study completed in 1998 provided nearly matching land cover/use map units, but contained many sliver polygons and unlabeled polygons. Additionally, the CALMIT database did not include the six-mile Overton to Lexington, Nebraska, river reach. For the above reasons, it was decided to produce a new database from 1998 CIR photography and use prior databases for limited comparative analyses.

5.2 Field Inventory and Vegetation Classification

Most of the vegetation present in the CPRV study area was classified using existing community types for the Central Great Plains. In a few cases, particularly in riparian woodland habitat, new types were sampled that were not described prior to this project. A majority of the natural and semi-natural vegetation observed in the study corridor grows on soils comprising the subirrigated range site, where the ground water table and risk of overbank flooding is too high for growing traditional agricultural crops (e.g., corn, alfalfa, soy beans). Lesser amounts of natural and semi-natural vegetation occupy sandy range site soils, which are also areas that are uneconomical to farm. The use of current CIR aerial photographs for interpretation and transfer of data into an electronic database made from digital orthophotos greatly improved land-cover map accuracy.

Field inventories to collect baseline vegetation and environmental data and accuracy assessment points were conducted in the summer of 1999. Conditions during that time period were hot and humid, and heavy afternoon thunderstorms were common, making sampling efforts challenging for researchers. In addition, access was restricted to approved sites because a majority of the land in the corridor is privately owned. Because the field data were collected near the time of aerial photography acquisition (August), seasonal changes in plant phenology were not a significant issue.

The most common woodland types observed by researchers are riparian stands dominated by plains cottonwood and green ash–(American, slippery) elm. Stands of mature plains cottonwood trees appear to be under succession to green ash–elm in more mesic riparian sites and eastern red

cedar on drier riparian sites. Riparian woodland map accuracy for this project is greatly increased by combining the six described woodland types into one map unit.

Riparian shrubs are also placed under one map unit because sandbar willow is the common shrub within the corridor. Riparian shrublands, however, can be a confusing mix of mature shrubs, including sandbar willow, false indigo, and rough- leaved dogwood interspersed with sapling tree species. Some additional work to adequately describe and delineate upland shrublands should be undertaken in future studies.

Common grasslands within the CPRV are dominated by big bluestem and switchgrass, but nearly every stand has become invaded by exotic grasses, particularly Kentucky bluegrass and smooth brome. In many instances, exotic grasses are the stand dominants, because they out-competed native species or were planted for hay crops and to reseed abandoned agricultural fields. Grasslands growing on subirrigated soils typically have associated drainages, depressions, and swales present, which support more mesic grasses such as prairie cordgrass and switchgrass, and also emergent wetlands with three-square bulrush and spikerush. Emergent wetlands dominated by cattail and bulrush species and larger than the minimum mapping unit are placed in their own classification.

The vegetation study was designed to provide a vegetation classification describing the set of natural and semi-natural map units or habitats. Typically with habitat classification maps, several plant associations or alliances occur within individual physiognomic classes. Effective fieldwork and map verification work aided enormously to interpret the land-cover map units and describe the units in detail.

The number and variability of vegetation signatures sometimes made them a challenge to distinguish and consistently interpret. Environmental factors such as annual grazing, mowing, burning, moisture gradients, presence and density of exotic grasses and forbs, and soil diversity result in several photographic signatures for most of the map units.

5.3 GIS Database Production

Digital transfer and registration of information from aerial photographs to a spatial database proved to be a time-consuming task, but was greatly aided by digital orthophotos produced from the same overflight. Instead of using the unregistered aerial photos (which involves locating common 'control' between the photo and basemap), Mylar overlays were placed on the hardcopy orthophoto portions and simply marked with the orthophoto tics and then scanned. Scanning was used to insure that all the line work was transferred from each orthophoto overlay. Further editing and quality checking of the digital polygons created borders that tightly bounded corresponding features on the digital orthophoto base map. Use of orthophotos also allowed plotting of a QA/QC map that was placed on top of the interpreted orthophoto portion and the map checked not only for attribute accuracy but also line accuracy. Automation of the scanning and transfer process via a 'shell' of in-house produced Arc/Info AMLs greatly aided this time-consuming process.

5.4 Accuracy Assessment

A total of 250 accuracy assessment (AA) points were evaluated for land-cover map units; 175 AA points were in natural or semi-natural vegetation types and 74 AA points were in agricultural crop map units. Table 5.1 provides a contingency table for the vegetation mapping accuracy assessment. The calculations used for the confidence intervals in this assessment can be found in Appendix K.

One AA point was assessed on an unvegetated site, Map Unit 6–Barren Beach/Bar. Vegetated map units 11, 12, 15, and 21 all assessed at greater than 90% accuracy in both errors of omission (user's errors) and commission (producer's errors), and these map units represent 70% of the total land cover in the study corridor. Add to these map units 10, 20, and 24, which assessed at near 80% or greater, bringing the total land area to 81% of the study corridor that is considered very accurately mapped.

Errors in interpretation, or confusion, occurred in several predictable map units/situations. For example, in Map Unit 1–Emergents, no errors of commission occurred, but three errors of omission were tallied. Two of these occurred within Map Unit 12–Lowland Grasses, and may be related to wetland size relative to the minimum mapping unit (0.5 acres). Three AA points were considered in error between Map Units 10–Shrub and 15–Trees. This type of confusion is normal, and the field data verify that some shrubs are quite tall and intermix with sapling trees. In addition, shrubs often grow in a band adjacent to woodlands, and the two are difficult to separate. In agricultural Map Unit 20–Alfalfa, two AA points were considered errors of omission and fell under Map Unit 25–Mown Agriculture. This type of confusion is normal for a crop like alfalfa, which presents several different color and texture signatures through the course of a growing season as the crop matures, is cut, cured, baled, and then regrows.

Errors between major physiognomic map units (i.e., grassland and trees) are problematic because very distinct photo signatures are available. Only two such AA errors were recorded for this analysis, which can usually be related to one of two causes: 1) a tree stand or scattered individual trees below the minimum mapping unit are interpreted within the larger grassland unit, or 2) a recording or receiving error related to the global positioning system unit resulted in an inaccurate location of the AA point.

Map Unit 18–Riparian Herbaceous, proved very difficult to reliably interpret, with nearly equal amounts of confusion or error in omission (4) and commission (5) occurring with Map Unit 12–Lowland Grasses. Several factors may be involved, one being the presence of tall forbs in excess of 30% aerial cover during the year of photography (1998) that did not occur during the year of the AA (1999) (or vice-versa), as is the case with some biennial species such as yellow and white sweet clovers. A second factor is the presence of exotic grasses that affects both color and texture signatures to the point that the interpretation/classification becomes confusing. It is possible that these two map units are too similar and/or intermixed to separate either on aerial photographs or on the ground by field researchers. In this situation, consideration could be given to combining Map Units 12 and 18, resulting in 9 additional correct AA points. If this map unit (18) is valuable to the study protocol, then more time needs to be given to study it in the field and relate those studies to aerial photograph signature and/or landscape position detection.

Table 5.1 - Contingency table (error matrix) for CPR vegetation mapping accuracy assessment

	Interpreted land cover/use:												Total N	Omission Error	90 % Confidence Interval	
Actual land class:	1	6	10	11	12	15	18	20	21	22	24	25		% Correct	-	+
1. Emergent	2		1		2								5	40.0	11.2	75.3
6. Barren beach/bar		1											1	100.0	10.0	100.0
10. Shrub			10			1	1						12	83.3	60.2	95.5
11. Upland grasses				5									5	100.0	62.1	100.0
12. Lowland grasses					85	2	4				1		92	92.4	86.2	96.4
15. Trees			2			52							54	96.3	88.8	99.3
18. Riparian herbaceous					5		2						7	28.6	7.9	68.4
20. Alfalfa								8		1		2	11	72.7	42.3	89.5
21. Corn					1				51	1			53	96.2	88.9	99.3
22. Agriculture other crop					1			1	1				3	0.0	0.0	0.0
24. Soybeans									1		6		7	85.7	50.0	98.5
25. Mown agriculture													0	0.0	0.0	0.0
Total N:	2	1	13	5	94	55	7	9	53	2	7	2	**250 Total AA Points**			
Commission Error (% Correct)	100.0	100.0	76.9	100.0	90.4	94.5	28.6	88.9	96.2	0.0	85.7	0.0		**222 Total Correct**		
90% Confidence Interval -	31.6	10.0	53.0	62.1	83.9	86.5	7.9	60.9	88.6	0.0	50.0	0.0				
90% Confidence Interval +	100.0	100.0	91.2	100.0	94.9	98.5	68.4	98.8	99.3	0.0	98.5	0.0				

OVERALL TOTAL ACCURACY = 88.8% (Total number of correctly classified polygons/total number polygons)

OVERALL KAPPA INDEX = 85.3% (Pchance = .2367)

OVERALL TOTAL ACCURACY 90% Lower and Upper CONFIDENCE INTERVAL = 85.0 % to 91.9 %

Notes:

1. Map unit combinations of 12 and 17 were combined for the A.A.
2. See Appendix 11 for Confidence Interval Calculations.
3. Omission and Commission errors were calculated using total accuracy.

5.5 Recommendations for Future Land Cover/Use Mapping

Several recommendations for future land cover/use database development have resulted from the experience gained through this corridor study. The most important is having aerial photography and ortho-rectified photo basemaps at the same scale (1:12,000) and acquired of the same over-flight mission. This allowed photo-interpretation and subsequent digital transfer to be performed more easily and accurately. Most map units can be recognized and digitized directly on the computer screen, eliminating the need for manual photo-interpretation for future habitat and land use mapping in this corridor. Using this approach would result in a map product with an error not much larger than that of the digital orthophoto base, which is typically + or – 10 meters. Theoretically, this method could be an improvement over manual photo-interpretation, but it proved slower to implement for this project. This slowness was primarily due to the tendency to zoom in well beyond a 1:12,000-scale, simply because a digital image makes this possible. It would be interesting to test these methods further to see whether both a saving of time and increased accuracy could be obtained with on-screen digitizing, particularly if the aid of technicians could be employed.

It is strongly recommended that each future mapping study of this corridor begin with a reconnaissance step involving observation point information collection from a large number of sites to confirm land-cover map units. This type of information gathering is conducted relatively rapidly and allows investigators to become familiar with land-cover types and their variability in the study area. The information thus gathered serves to guide the interpretive effort, but could also act as an interim assessment of accuracy.

Developing a classification system compatible with prior corridor studies was very successful. It is important to users that these systems be as similar as possible to maximize data analyses over time. However, if additional map classes are deemed important for future projects, a system to combine classes should be determined in advance to facilitate trend analyses. During draft map development, products should be assessed using interim field verification techniques to address any compatibility problems between classification units and the interpretation. It is unfortunate that previous mapping efforts did not provide an accuracy assessment analysis—an extremely important step when database reliability is considered. As GIS technology improves, more detail can be expected to further fine-tune land cover/use analyses and the assessment of accuracy.

A recommendation was received regarding center pivot locations on the land cover/use maps. Although most center pivot locations can currently be seen on the maps, where the corner crops are the same as the center pivot crop, the actual lines between them are dissolved. Retaining these lines would be beneficial for agricultural-related studies.

The accuracy assessment approach must be thoroughly planned to take advantage of public and other approved access within the corridor. Accuracy assessment data can be augmented by referring to local government records for assistance in historic agricultural crop identification. In the future, a database of private landowners willing to provide access for research could be considered to assist with accurate land cover/use map preparation. To the extent possible, a random selection of polygons to assess will alleviate any potential for minor mapping units to unduly influence the total accuracy assessment outcome. Selecting polygons rather than points

will allow researchers in the field to choose appropriate access and representative sites, thus avoiding ecotones, polygon boundary lines, and land uses inappropriate for vegetation or crop analyses.

5.6 Future Applications of the 1998 Photography and Land Cover/Use Database

The Platte River EIS Office is exploring several alternatives to improve the habitat for four threatened and endangered species in the Central Platte River Valley. The 1998 land cover/use database is a critical element to assist with analyzing components of the Platte River Program. As an example, islands in the wetted channel of the river may be cleared and leveled to provide habitat for least terns, piping plovers, and whooping cranes. Current efforts utilize the existing island areas in the 1998 baseline database to provide an indication of the effects of channel widening along pre-selected bridge segments. As the Program continues, the database will be used for individual analyses that require specific land cover/use information (e.g., monitoring changes in the acreage of lowland grass areas within the floodplain, looking at sand/gravel pit habitat for piping plover and least tern nesting) for developing management alternatives or evaluating adaptive management efforts.

Additional uses of the database would include land use zoning and planning or real estate valuation of agricultural or urban areas. The relative distribution of crop types could be used in a change-use analysis or the total surface area of all water bodies could be computed to determine evapo-transpiration losses. Relative stress indicators on the river system could be ascertained through looking at spatial relationships that may not be intuitively obvious from the data alone, such as the proximity of the river to agricultural run-off areas. Potential uses of the database should not be confined to the current study and will be made readily available online or in a CD format.

The database could also be used in conjunction with the digital color-infrared orthophotos that were created to assist with the 1998 land cover/use classification. Digital orthophoto quadrangles were produced from the original 1998 color-infrared photography. These images were compressed from approximately 48 megabytes each to about 2.2 megabytes each, which made file sizes more manageable for downloading and use on a personal computer. These 146 image files, covering a square area of approximately 2.5- × 2.5-miles, can be accessed online or through the USGS website in Rolla, Missouri (http://mcmcweb.er.usgs.gov/platte/cir_doq/cir.html); they are available for use by farmers, private and public agencies (e.g., agronomists, agrichemical field service, crop consultants, natural resource districts) as well as government offices. A potential use of these digital images would be to look at overall health of specific fields to make field predictions from year to year. A histogram of health of the particular crop could be computed and correlated to soil fertility. These images could also assist with fire and emergency unit response or hazardous spill response for any chemical spills along Interstate 80 or railroads adjacent to water features.

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Manager, Remote Sensing and Geographic Information System Group. Denver Federal Center. Denver, Colorado.

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7. List of Contributors and Contacts

Contributors

Bureau of Reclamation

Mike Armbruster, Alan Bell, Darrell Berk, Curt Brown, Jack Butler, Deb Callahan, Doug Crawford, Beverly Friesen, Trudy Meyer, Joy Nelson, Jan Oliver, Mike Pucherelli, Vince Riedman, Joyce Schrott, Jim Von Loh, Stefanie Wacker, Bruce Whitesell, and Patrick Wright

U.S. Fish and Wildlife Service

Dave Carlson, Dave Felley, Jan Mckee, Jeff Runge, Kirk Schroeder, Martha Tacha, Erika Wilson, Sharon Whitmore

U.S Geological Survey

Tammy Fancher, Randy Parker, Sharon Shin, Michael Starbuck

Contacts

Remote Sensing and Geographic
Information Group (RSGIG)
P.O. Box 25007 Mail Code D-8260
Denver, CO 80225
Fax: (303) 445-6337

Mike Pucherelli Title: RSGIG Group Manager
Phone: (303) 445-2267
E-mail: mpucherelli@do.usbr.gov

Beverly Friesen CPRV Mapping Project Leader
Phone: (303) 445-2286
E-mail: bfriesen@do.usbr.gov

Platte River EIS Office
P.O. Box 25007, PL-100
Denver, CO 80225-0007
Fax: (303) 445-6331

Jan Mckee Title: State Botanist
Phone: (303) 445-2105
E-mail: jan_mckee@fws.gov

U.S. Geological Survey
Bldg. 53, Denver Federal Center
Mail Stop 415, Box 25046
Lakewood, CO 80225
Fax: (303) 236-4912

Randy Parker Title: Resident Hydrologist
Phone: (303) 236-4882
E-mail: rsparker@usgs.gov

Platte River Whooping Crane Maintenance Trust

Paul Currier

Platte River Whooping Crane
Maintenance Trust
6611 West Whooping crane Drive
Wood River, NE 68883
Fax: (308) 384-7209

Paul Currier Title: Executive Director
Phone: (308) 384 –4633
E-mail: currier@hamilton.net

The National Audubon Society

Paul Tebbel

National Audubon Society
RT. 2, Box 146
Gibbon, NE 68840
Fax: (308) 468-5627

Paul Tebbel Title: Manager
Phone: (308) 468 - 5282
E-mail: rowe@nctc.net

Mid-America Mapping

Larry Wells

Mid-America Mapping
6970 Turkey Creek Road
Elm Creek, NE 68836
Fax: (308) 856-4355

Larry Wells Title: President & CEO
Phone: (308) 856-4721
E-mail: lwells@nebi.com

The Nature Conservancy

Brent Lathrop

The Nature Conservancy
Suite 1, 1228 L Street
P.O. Box 438
Aurora, NE 68818
Fax: (402) 694-2231

Brent Lathrop Title: Project Director
Phone: (402) 694-4191
E-mail: blathrop@tnc.org

Tri-Basin Natural Resources District

Richard Holloway

Tri-Basin Natural Resources District
1308 Second Street
Holdrege, NE 68949
Fax: tribasin@atcjet.net

Richard Holloway Natural Resources Coordinator
Phone: (308) 995-6688
E-mail: tribasin@atcjet.net

The Central Nebraska Public Power and Irrigation District

Mark Peyton, Trent Ringenberg

Central Nebraska Public Power and
Irrigation District
415 Lincoln Street
Holdrege, NE 68949
Fax: (308) 995-8601

Mark Peyton
Title: Senior District Biologist
Phone: (308) 995-8601
E-mail: mpeyton@nrcdec.nrc.state.ne.us

Central Platte Natural Resources District

Mark Czaplewski, Duane Woodward

Central Platte Natural Resources District
215 North Kaufman Avenue
Grand Island, Nebraska 68803
Fax: (308) 385-6285

Mark Czaplewski Title: Biologist
Phone: (308) 385-6282
E-mail: www.cpnrd.org

Nebraska Public Power District

Tim Cielocha, Jim Jenniges, Steven Schlautman, John Shadle, Paul Srock

Nebraska Public Power District
900 4th Ave., PO Box 2170
Kearney, NE 68848-2170
Fax: (308)

Jim Jenniges Title: Senior Environmental Specialist
Phone: (308) 236-2293
E-mail: jjjenni@nppd.com

Wyoming Water Development Commission

Mike Besson, Jon Wade

Wyoming Water Development Commission
4th Floor, West Wing, Herschler Building
Cheyenne, WY 82002
Fax: (307) 777-6819

Mike Besson Title: Director
Phone: (307) 777-7626
E-mail: lbesso@missc.state.wy.us

LYNX SPATIAL TECHNOLOGIES Inc.

Jeff Lucas

Lynx Spatial Technologies, Inc.
PO Box 911
Holdrege, NE 68949
Fax: (308) 995-6260

Jeff Lucas Title: President, CEO
Phone: (308) 995-6260
E-mail: lynxtech@nebi.com

NE Game & Parks Commission

Frank Albrecht, Mele Koneya

NE Game & Parks Commission
2200 North 33rd St.,
P.O. Box 30370
Lincoln, NE 68503-0370
Fax: (402) 471-5528

Frank Albrecht
Title: Environmental Analyst Supervisor
Phone: (402) 471-5422
E-mail: albrecht@ngpc.state.ne.us

NE Board of Educational Lands and Funds

Richard LeBlanc

NE Board of Educational Lands and Funds
555 North Cotner Blvd
Lincoln, NE 68505
Fax: (402) 471-3599

Richard LeBlanc
Title: Executive Secretary
Phone: (402) 471-2014

University of Nebraska–Lincoln

Steven Waller, Sunil Narumalani, Marcus Tooze, Gary Lingle, Nicole Albright

University of Nebraska
Lincoln, NE 88588-0517

Sunil Narumalani
Title: Associate Professor,
School of Natural Resource Science
E-mail: snarumalani1@unl.edu

Steven Waller
Title: Dean, College of Agricultural Sciences & Nat Resources
E-mail: swaller1@unl.edu

Marcus Tooze
CALMIT Research Analyst
E-mail: mtooze@tan.unl.edu

Gary Lingle
Title: Platte River Watershed Program Coordinator
E-mail: glingle@unlvm.unl.edu

Nicole Albright
E-mail: albright@unlgrad1.unl.edu

Appendix A.

Cooperative Agreement for Platte River Research and Other Efforts Relating to Endangered Species Habitat along the Central Platte River, Nebraska

(from www.platteriver.org)

(referenced on page 1-1)

COOPERATIVE AGREEMENT FOR PLATTE RIVER RESEARCH AND OTHER EFFORTS RELATING TO ENDANGERED SPECIES HABITATS ALONG THE CENTRAL PLATTE RIVER, NEBRASKA

Pursuant to the authorities set forth in Paragraph X.D of this Cooperative Agreement for Platte River Research and Other Efforts Relating to Endangered Species Habitats Along the Central Platte River, Nebraska ("Cooperative Agreement"), the signatories agree to participate in and implement certain activities relating to four target species (interior least tern, whooping crane, piping plover and pallid sturgeon) listed as threatened or endangered pursuant to the Endangered Species Act ("ESA"), 16 U.S.C. 1531 et seq., and their associated habitats.(1)

I. PURPOSES

The purpose of this Cooperative Agreement is to implement certain aspects of the U.S. Fish and Wildlife Service's ("FWS") recovery plans for the target species that relate to their associated habitats by providing for the following during the term of this Cooperative Agreement:

A. implementation of research, analysis and other measures that will benefit the target species and their associated habitats, as set forth in Attachment I, "Milestones for the Cooperative Agreement";

B. implementation of efforts to acquire, restore, and manage land or interests in land so as to provide and improve associated habitats for the target species, as set forth in Attachment I, "Milestones for the Cooperative Agreement";

C. development and implementation of certain water management, conservation and supply measures, as set forth in Attachment I, "Milestones for the Cooperative Agreement," and in Attachment II, "Water Conservation/Supply Component";

D. development of a basin-wide program ("Program") to be implemented following evaluation of the Proposed Alternative, as defined in Paragraph III and as set forth in Attachment III, and a range of reasonable alternatives in compliance with the National Environmental Policy Act ("NEPA"), 42 U.S.C. 4331 et seq., and the ESA, the intent of which is to: (1) secure defined benefits for the target species and their associated habitats to assist in their conservation and recovery through a basin-wide cooperative approach that can be agreed to by the three states and DOI; (2)serve as the reasonable and prudent alternative to offset the effects of existing and new water related activities(2) in the Platte River Basin that, in the absence of such a Program, would be found by FWS to be likely to jeopardize the continued existence of the target species or adversely modify designated critical habitat; (3) help prevent the need to list more basin associated species pursuant to the ESA; and (4) mitigate new water-related activities in a state in a manner that will not increase the mitigation responsibilities of other signatory states, with the intent that mitigation will be implemented in the state where the activity occurs to the extent described in Atttachment III, Appendix A; and

E. establishment of a governance structure that will ensure appropriate state government and stakeholder involvement in the completion of NEPA compliance tasks, in the implementation of research and other projects beneficial to the target species and their associated habitats, and in the development of a Program.

II. RELATIONSHIP OF THE COOPERATIVE AGREEMENT AND ANY PROGRAM TO NEBRASKA V. WYOMING, AND OTHER MATTERS

A. The signatories to this Cooperative Agreement are also signatories to Nebraska v. Wyoming, No. 108 Original, expected to go to trial during the term of the Cooperative Agreement. Because certain matters in that proceeding may overlap with issues addressed by the Cooperative Agreement and to be addressed by any Program, each signatory reserves the right to reconsider its participation in the Cooperative Agreement and in any proposed Program based upon the outcome of Nebraska v. Wyoming, whether by settlement or decision. Such reconsideration shall, without restriction, include the right to require modification of the respective obligations and undertakings proposed to be assumed by each of the signatories in the Program to equitably account for the outcome of Nebraska v. Wyoming, and in the absence of an acceptable modification, the right to withdraw from the Cooperative Agreement or from any proposed Program.

B. In the event of such withdrawal, or if any signatory withdraws from this Cooperative Agreement for another reason, or if the Cooperative Agreement terminates and a Program is not adopted, FWS believes such situation warrants reinitiation of consultation and will reinitiate all ESA section 7(a)(2) consultations, referenced in Paragraph VIII below, which relied upon the Cooperative Agreement and the proposed Program as a component of their reasonable and prudent alternatives, and which are subject to reinitiation pursuant to 50 C.F.R. §402.16.

C. Because it is the intent and the commitment of the signatories to this Cooperative Agreement to work cooperatively and in good faith to resolve resource issues relating to threatened and endangered species habitats along the Central Platte River in Nebraska, the signatories make the following additional commitments for so long as all signatories remain signatories of this Cooperative Agreement:

1. The signatories agree that the pending trial in Nebraska v. Wyoming does not present the appropriate forum for establishing the specific

water flow requirements for threatened and endangered species or their habitat in Nebraska. Those requirements are more appropriately defined and addressed in this Cooperative Agreement and a Program, both of which the signatories enter into or may enter into voluntarily.

2. With the exception of Nebraska v. Wyoming, each state agrees that during the term of this Cooperative Agreement, it shall not, in any judicial or administrative proceeding: (1) assert a position adverse to either of the other states on any issue relating to the target species or the associated habitats, or (2) assert a position adverse to a water related activity in either of the other states on any issue relating to the target species or the associated habitats if that water related activity is covered by this Cooperative Agreement, unless the other state consents to that assertion.

III. RELATIONSHIP OF ACTIVITIES UNDER THE COOPERATIVE AGREEMENT TO ANY SUBSEQUENT PROGRAM OR SECTION 7(a)(2) CONSULTATION

Attachment III to this Cooperative Agreement is a Proposed Alternative for evaluation under NEPA and ESA entitled Proposed Platte River Recovery Implementation Program.

The signatories anticipate that the process to comply with NEPA and the programmatic section 7 consultation process will take approximately three years and have planned specific activities defined in Attachment I, "Milestones for the Cooperative Agreement," which are to take place during that period and which are exempt from or do not require further NEPA review. The Proposed Alternative is designed and other Program alternatives should be designed to build upon these activities. If the term of the Cooperative Agreement is less than three years because a Program is reviewed and agreed to in a shorter period of time, any uncompleted activities planned for the three year period will be implemented if appropriate within the context of the agreed-to Program. For purposes of the NEPA baseline evaluation, the activities planned to be undertaken during the term of the Cooperative Agreement will be considered part of the Program alternatives evaluated.

If the Proposed Alternative or an alternative Program is agreed to following NEPA and ESA evaluation, the activities undertaken during the term of the Cooperative Agreement will be credited to the appropriate state or the federal government as contributions to the Program. Similarly, if no Program is adopted, consistent with Paragraph VIII below, activities undertaken during the term of the Cooperative Agreement will be credited to the appropriate entity for purposes of ESA evaluations.

IV. RESEARCH AND RELATED ACTIVITIES

Research and analysis undertaken pursuant to this Cooperative Agreement will be designed to resolve issues or fill knowledge gaps concerning actions required to induce measurable improvements to the recovery of the target species and their associated habitats. The signatories agree to undertake during the term of this Cooperative Agreement specific research, analysis, peer review and related activities as set forth in Attachment I, "Milestones for the Cooperative Agreement."

V. HABITAT ACTIVITIES

The signatories agree to undertake activities during the term of the Cooperative Agreement to acquire, restore, and manage land and interests in land to provide habitat as set forth in Attachment I, "Milestones for the Cooperative Agreement." Land and interests in land will be acquired from willing landowners only. The intent of the signatories is to focus activities to create the greatest biological benefit to the target species.

VI. WATER CONSERVATION AND SUPPLY ACTIVITIES

The signatories agree during the term of the Cooperative Agreement to undertake the water conservation and supply activities as set forth in Attachment I, "Milestones for the Cooperative Agreement," and in Attachment II, "Water Conservation/Water Supply Component."

VII. NEPA COMPLIANCE

A. The Department of the Interior agrees immediately to initiate steps as required by NEPA to undertake evaluation, with assistance from the other signatories, of the Proposed Alternative and of a range of reasonable alternatives which might serve the purposes of the basin-wide Program stated above in Paragraph I.D. The signatories agree that the Proposed Alternative described in Attachment III to this Cooperative Agreement will form the "proposed federal action" to be evaluated in the NEPA process. A range of reasonable alternatives will be rigorously explored and evaluated. The draft environmental impact statement should identify a preferred alternative.

B. Any activities to be implemented under the Cooperative Agreement requiring NEPA evaluation will receive such review separately.

VIII.ESA COMPLIANCE

A. Consistent with Paragraph X.E, implementation of the following measures is to serve as the reasonable and prudent alternative for impacts to the target species and their habitats within the Platte River Basin downstream from the confluence of the North and South Platte Rivers, for water related activities in the Platte River Basin during the term of this Cooperative Agreement.

1. For any water related activity for which consultation on a federal action pursuant to section 7(a)(2) of the ESA has been completed prior to the effective date of this Cooperative Agreement, and for which a federal action agency has required a non-federal signatory to implement reasonable and prudent alternatives by engaging in certain measures designed to produce defined benefits to the target species and/or their associated habitats pending development of and participation in a basin-wide recovery implementation program, FWS agrees to seek to extend such measures, as such measures currently exist, for the term of this Cooperative Agreement. To the extent they contribute to the land acquisition and restoration purposes of a Program, payments made or measures undertaken by or on behalf of such signatories shall be credited at the inception of a Program. FWS agrees to request the federal action agency to make provision for the changed circumstances that will exist if a

Program is implemented and to include the provisions of Paragraph II.B in the event a Program is not implemented or terminates and provisions of Paragraph VIII.C in the event this Cooperative Agreement terminates prematurely.

2. For water related activities in existence as of the effective date of this Cooperative Agreement, for which consultations on federal actions pursuant to section 7(a)(2) of the ESA will be completed during the term of this Cooperative Agreement, FWS agrees that it will recommend that the federal action agency engage in or require a non-federal signatory to engage in certain measures or make certain payments designed to produce defined benefits to the target species and/or their associated habitats during the term of this Cooperative Agreement, based on the same formula for the applicant's share of the annual streamflow shortfall and annual cost of riverine habitat required for those signatories identified in Paragraph VIII.A.1. To the extent they contribute to the land acquisition and restoration purposes of a Program, payments made or measures undertaken by or on behalf of such non-federal signatories shall be credited to the state in which the water related activity is occurring at the inception of a Program. FWS agrees to request the federal action agency to make provision for the changed circumstances that will exist if a Program is implemented and to include the provisions of Paragraph II.B in the event a Program is not implemented or terminates and provisions of Paragraph VIII.C in the event this Cooperative Agreement terminates prematurely.

3. For any new water related activity for which consultation on a federal action pursuant to section 7(a)(2) of the ESA will be completed during the term of this Cooperative Agreement, FWS agrees that it will recommend that the federal action agency engage in or require a non-federal signatory to engage in certain measures or make certain payments designed to produce defined benefits to the target species and/or their associated habitats during the term of this Cooperative Agreement. FWS agrees to request the federal action agency to make provision for the changed circumstances that will exist if a Program is implemented and to include the provisions of Paragraph II.B in the event a Program is not implemented or terminates and provisions of Paragraph VIII.C in the event this Cooperative Agreement terminates prematurely.

a. For new water related activities with depletions greater than 25 acre feet per year, FWS agrees to recommend replacing the consumptive use below the diversion point within the state in which the depletion occurs. Timing of replacement water will be outside of the irrigation season and at a time of shortage for the species. Because the consumptive use will be replaced during the term of this Cooperative Agreement, there will be no land component in reasonable and prudent alternatives for new depletions greater than 25 acre feet.

b. For new water related activities with depletions of 25 acre feet or less annually, FWS agrees to recommend reasonable and prudent alternatives pursuant to the June 13, 1996 biological opinion on minor water depletions. To the extent they contribute to the land acquisition and restoration purposes of a Program, payments made or measures undertaken by or on behalf of such signatories shall be credited to the state in which the water related activity is occurring at the inception of a Program.

4. Notwithstanding Paragraph VIII.A.2, the ESA responsibilities for the Federal Energy Regulatory Commission ("FERC") Projects Nos. 1417 and 1835 will be those adopted by FERC in new licenses issued for such projects. The signatories agree to recommend to FERC that license conditions should be consistent with this Cooperative Agreement and a Program. Payments made or measures undertaken by such projects shall be credited to Nebraska at the inception of a Program.

5. During the term of this Cooperative Agreement, FWS agrees that for all water related activities described in Paragraphs VIII.A.1, 2, 3 and 4 the reasonable and prudent alternatives shall define the actions to be undertaken by the activity's proponent. FWS agrees to request the National Fish and Wildlife Foundation, which will administer funds paid pursuant to Paragraphs VIII.1, 2 and 3, to expend the funds for water mitigation for water related activities in the state in which such activity occurs. Reasonable and prudent alternatives also will include a recommendation to the federal action agency for the non-federal signatory to cooperate with and participate in activities undertaken under the Cooperative Agreement and any Program subsequently implemented. During the term of this Cooperative Agreement, FWS agrees to encourage agencies to rely on measures taken pursuant to this Cooperative Agreement without waiting for completion of the Program's NEPA and ESA evaluation when considering agency actions affecting the target species.

6. Nothing in this Cooperative Agreement shall be construed to require any person or entity undertaking or proposing to undertake any water related activity to rely on the provisions of this Cooperative Agreement or to rely on any Program subsequently implemented. Reliance on this Cooperative Agreement or any subsequent Program shall be voluntary. In the event such person or entity chooses not to so rely, FWS will not consider this Cooperative Agreement or any Program subsequently implemented as providing a reasonable and prudent alternative for such water related activity. In the event such person or entity chooses to revoke its reliance on this Cooperative Agreement, FWS will reinitiate any ESA Section 7(a)(2) consultation which relied upon one of the reasonable and prudent alternatives described in Paragraph VIII.A and issue a new biological opinion.

B. In coordination with NEPA compliance as provided for by this Cooperative Agreement, FWS will evaluate whether the activities under the Proposed Alternative and, if different, under the preferred alternative, can serve as a reasonable and prudent alternative under section 7(b)(3) of the ESA for water related activities in the Platte River Basin. In the event FWS determines that the Proposed Alternative cannot serve as the reasonable and prudent alternative and the signatories cannot reach an agreement on modifying the Proposed Alternative so it can so serve, the signatories are not bound to enter into an agreement to implement a Program.

C. In the event that activities under the Cooperative Agreement are not adequately completed, FWS may reinitiate all ESA section 7(a)(2) consultations which relied upon the reasonable and prudent alternatives described in Paragraph VIII.A. Before taking such action or reinitiating consultations as described in Paragraph II, FWS will notify the Governance Committee and request its assistance in resolving the situation. If the Governance Committee is unable to resolve the situation, the Committee shall notify the Secretary of the Interior and the Governors and request their assistance. If such attempts at resolution are unsuccessful, FWS believes such situation warrants reinitiation and will reinitiate all such ESA section7(a)(2) consultations and issue new biological opinions.

D. Any time that FWS reinitiates section 7(a)(2) consultation, it will issue a new biological opinion based on then-current conditions. FWS believes that the new biological opinion and any subsequent amendment, restatement, or modification of a federal action based on the new biological opinion would constitute a new federal action for purposes of administrative or judicial appeals. FWS further believes that no person or entity should be deemed to have waived or relinquished any right to challenge the legal, scientific, or technical validity of any aspect of the new biological opinion or agency action by virtue of its acceptance of or its reliance on this Cooperative Agreement, or by virtue of its support for this Cooperative Agreement in other judicial or administrative proceedings. In developing any new reasonable and prudent alternative, FWS agrees to give credit for any contributions by the owner or operator of the water related activity made pursuant to this Cooperative Agreement.

E. Any person or entity undertaking a water related activity described in Paragraph VIII.A.1, 2, 3 or 4 must agree to inclusion of reopening authority by the federal action agency in its funding or authorization documents and must agree to request amendments by the federal action agency as needed to conform its federal authorization to any agreed upon Program. Notwithstanding Paragraph II.C.2, the states shall not be restrained from taking a position adverse to one another in administrative or judicial proceedings to compel the action agency to include reopening authority in any such federal funding or authorization.

IX. GOVERNANCE STRUCTURE

Following the execution of this Cooperative Agreement, a Governance Committee is to be established to review, direct, and provide oversight for the activities undertaken under this Cooperative Agreement except as provided by Paragraphs VII and VIII of this Cooperative Agreement.

A. The Governance Committee will consist of the following members:

1. one member per signatory state, to be selected by the Governor of that state;

2. two federal members, to be selected by the Secretary of the Interior, one representing FWS and one representing the Bureau of Reclamation;

3. owo environmental members representing the environmental entities in the three states, to be selected by those entities;

4. one member representing water users on the North Platte River in Wyoming and also water users in Nebraska above Lake McConaughy who have storage contracts for water in the federal reservoirs in Wyoming, to be selected by those users;

5. one member representing water users on the South Platte River above the Western Canal diversion, to be selected by those users; and

6. one member representing water users downstream of Lake McConaughy or the Western Canal and Nebraska users upstream of Lake McConaughy who do not have federal storage contracts, to be selected by those users.

Within 15 days of execution of this Cooperative Agreement, FWS will provide notice to the appropriate constituencies or entities and request that they select their members and notify FWS of the selection within 30 days. Each entity or constituency represented may select its own methods of choosing its member(s). Each member of the Governance Committee will also have an alternate selected in the same manner as that member. Until the initial selections are made, or in the event of a vacancy, the member's seat(s) shall be considered vacant, and the voting requirements in Paragraph IX.B shall be reduced accordingly. Members of the Governance Committee serve at the sufferance of their constituents.

B. For the purpose of voting on any issue, a quorum consists of the member or alternate appointed by each Governor, the FWS member or alternate, and three other members or alternates. The chair shall provide reasonable notice of all Governance Committee meetings and a proposed agenda to all members and alternates. Nine of the ten members of the Governance Committee, including the member or alternate appointed by each Governor and the FWS member or alternate, must vote in the affirmative for the Governance Committee to establish a position on policy issues. Seven of ten votes are needed for the Governance Committee to take action on non-policy issues. For purposes of this Cooperative Agreement, the term "policy issue" shall mean an issue affecting the term, scope, allocation of funding, or continued viability of this Cooperative Agreement. If a member and alternate are absent from a meeting or abstain from voting, the voting requirements may be reduced accordingly.

C. The Governance Committee will:

1. meet on a quarterly basis for the first year of the Cooperative Agreement and semiannually thereafter except when more frequent meetings are agreed upon;

2. elect a chair and develop such other rules of governance, procedure and conflict resolution as it deems appropriate;

3. establish technical committees composed of persons with appropriate expertise, as

appropriate, to carry out activities under the Cooperative Agreement;

4. serve as arbiter of disputed external peer reviews upon request of any technical committee;

5. agree on allocations of funds and other available resources to any technical

committees for utilization consistent with the committees' responsibilities, subject to any applicable limitations on the use of federal or state funds;

6. enter into an agreement with an appropriate entity for the administration of certain funds expended pursuant to this Cooperative Agreement;

7. assess accomplishments, implement measures to correct any shortfalls, and revise milestones accordingly; and

8. develop specific milestones for implementing a Program.

Although the signatories agree to cooperatively participate in the Governance Committee, nothing in this Paragraph is intended to modify the provisions of Paragraph X.E.

D. Contributions of the Signatories The Department of the Interior and the States of Nebraska, Colorado, and Wyoming will provide representatives to the Governance Committee and to any technical committees established by the Governance Committee without compensation from any other signatory.

E. Governance Structure For Any Program The governance structure, responsibilities and authorities described in Attachment III, Appendix C shall be applicable to any Program developed pursuant to this Cooperative Agreement unless, after the NEPA evaluation, the signatories agree otherwise.

X. OTHER PROVISIONS

A. Geographic Scope This Cooperative Agreement applies only to water related activities occurring in the Platte River Basin upstream of the confluence of the Loup River with the Platte River.

B. Term This Cooperative Agreement shall remain in effect for three years or until the signatories enter into an agreement implementing a Program following the NEPA and ESA processes, whichever comes earlier, or until terminated by the Governance Committee after notification of the Secretary of the Interior and the Governors as described in Paragraph IX.C.6. If NEPA or ESA review is prolonged, the Cooperative Agreement may be extended for six months and the Governance Committee may include further activities exempt from or not requiring further NEPA or ESA review. FWS will take appropriate action regarding ESA compliance for the activities described in Paragraph VIII in the event of such extension.

C. Contributions of the Signatories The Department of the Interior and the States of Nebraska, Colorado, and Wyoming will make certain cash and cash-equivalent contributions during the term of the Cooperative Agreement for purposes of undertaking the activities provided for by this Cooperative Agreement, as set forth in Attachment I, "Milestones for the Cooperative Agreement," and subject to the authorities and limitations described in Paragraphs X.D, E, F, G and H.

D. Authorities and Responsibilities

1. Federal Cooperation with States Section 2(c)(2) of the ESA, 16 U.S.C. § 1531(c)(2), states that "the policy of Congress is that federal agencies shall cooperate with state and local agencies to resolve water resource issues in concert with conservation of endangered species." Under Section 6 of the ESA, the Secretary of the Interior is directed to cooperate to the maximum extent practicable with the states in carrying out the program authorized by the ESA and to consult with the affected states before acquiring any land and water, or interest therein, for the purpose conserving listed species. Under Section 6 of 41 U.S.C. 505, an executive agency should enter a cooperative agreement when anything of value will be transferred to a state or local government to carry out a public purpose authorized by federal statute.

2. Recovery Plans and Teams Under Section 4(f) of the ESA, 16 U.S.C. § 1533(f), the Secretary of the Interior is directed to develop and implement plans for the conservation of endangered species. The Secretary of the Interior may procure the services of public and private agencies and institutions in developing and implementing such recovery plans. Advice from such agencies and institutions is not subject to the Federal Advisory Committee Act, 5 U.S.C. app.2.

3. Consultation and Regulatory Certainty Under Section 7 of the ESA, 16 U.S.C. § 1536, federal agencies shall utilize their programs and authorities in furtherance of the purposes of the ESA and ensure that their actions are not likely to jeopardize listed species or adversely modify designated critical habitat of such species. Under the Fish and Wildlife Coordination Act, 16 U.S.C. § 662, federal agencies must consult with the Service and with state wildlife agencies on the impacts to fish and wildlife resources of federal or federally licensed or permitted water projects.

4. Operation of Federal Water Projects The Bureau of Reclamation is charged with the operation of certain federal projects in the North Platte and South Platte River Basins under applicable federal laws.

5. Applicable State Law Subject to applicable compacts and decrees, the States of Wyoming, Nebraska, and Colorado administer water rights, including water rights for instream flows. Each of these states also has certain statutory authorities and responsibilities to protect and manage its fish and wildlife resources. All water rights necessary to carry out activities under the Cooperative Agreement and the Program developed under its terms will be applied for by a state agency or a project operator, and granted as appropriate under the state's water law and in keeping with state authorities and

responsibilities for fish and wildlife. Nothing in this Cooperative Agreement shall be construed as creating federal water rights or requiring the granting of water rights to federal entities.

E. No Delegation or Abrogation Although this Cooperative Agreement sets forth a cooperative process, all signatories to this Cooperative Agreement recognize that they each have statutory responsibilities that cannot be delegated, and that this Cooperative Agreement does not and is not intended to abrogate any of their statutory responsibilities.

F. Consistency with Applicable Law This Cooperative Agreement is subject to and is intended to be consistent with all applicable federal and state laws and interstate compacts and decrees.

G. Legislative Approval Funding commitments made under this Cooperative Agreement are subject to approval and appropriations by the appropriate state and federal legislative bodies.

H. Officials not to Benefit No member of, or delegate to Congress, or resident Commissioner, shall receive any benefit that may arise from this Cooperative Agreement.

I. No Admissions by States The states are entering into this Cooperative Agreement on a voluntary and cooperative basis in an effort to resolve ESA species conflicts through a negotiated and mutually agreed upon basin-wide Cooperative Agreement and Program. Nothing herein shall constitute an admission that any water related activities or new water related activities have caused or will cause adverse effects to the target species or their habitats.

Bruce Babbitt, Secretary

Department of the Interior

State of Wyoming

Governor Roy Romer

Governor Ben Nelson

State of Nebraska

State of Colorado

Governor Jim Geringer

1. 1For purposes of this Cooperative Agreement and its attachments, the term "associated habitats" means, with respect to the interior least tern, whooping crane and piping plover, the Platte River Valley beginning at the junction of U.S. Highway 283 and Interstate 80 near Lexington, Nebraska, and extending eastward to Chapman, Nebraska, including designated critical habitat for the whooping crane. With respect to the pallid sturgeon, the term "associated habitat" means the Lower Platte River between its confluence with the Elkhorn River and its confluence with the Missouri River. "Associated habitats" shall include critical habitat in the Platte River Basin which may be subsequently designated by FWS for the target species. The Governance Committee may, through the adaptive management process, agree to undertake, fund or give credit for activities outside the associated habitats with the intent to focus activities to create the greatest biological benefit to the target species.
2. 2 For purposes of this Cooperative Agreement and its attachments, the term "water related activities" means activities and aspects of activities which: (1) are subject to Section 7(a)(2) of the ESA; (2) occur in the Platte River Basin upstream of the confluence of the Loup River with the Platte River; and (3) may affect Platte River flow quantity or timing, including, but not limited to, water diversion, storage and use activities. Those changes resulting from land use activities which affect flow quantity and timing will be considered impacts of a "water related activity." Changes in temperature and sediment transport will be considered impacts of a "water related activity" to the extent that such changes are caused by activities affecting flow quantity or timing. "Water related activities" do not include those components of land use activities or discharges of pollutants that do not affect flow quantity or timing. "New water related activities" are new surface water or hydrologically connected ground water activities, including both new projects and expansion of existing projects, both those subject to and not subject to section 7(a)(2) of the ESA, which may affect the

quantity or timing of water reaching the "associated habitats" and which are implemented after the effective date of this Agreement.

Appendix B.

Crosswalk Table of Mapping Units for Three GIS Databases of the Central Platte River, Nebraska

(Created by J. Von Loh)

(referenced on pages 1-2, 3-8 and 4-2)

Table B. Comparison or crosswalk of mapping units for three GIS databases of the Central Platte River, Nebraska

2000 - BOR-RSGIG	1998 - CALMIT*	1983 - WELUT
1 (EM) Emergents: out of channel wetland communities consisting of *Typha*, bulrush, burreed, etc.	(EM) Emergent: *Typha*, bulrush, bur-reed, etc.	(EM) Emergents: any emergent "wet grassland"
2 (CH) Channel: active, inundated channels, bank to bank (indicates open water)	(CH) Channel	(CH) Channel
3 (OWC) Open Water Canal or man-made drainage ditch	(OW) Open Water: any open water outside the river channels (OWC) Open Water Canal*	(OW) Open Water
4 (OWS) Open Water Slough	(OW) Open Water: any open water outside the river channels (OWE) Open Water Slough* (OWR) Open Water Remnant Channel*	(OW) Open Water
5 (OWP) Open Water Pit, Pond, or Lake	(OW) Open Water: any open water outside the river channels (OWP) Open Water Pit* (OWL) Open Water Lake or Pond* (OWS) Open Water Stock Pond*	(OW) Open Water
6 (BBB) Barren Beach/Bar: unvegetated sand bar or gravel/cobble/sand (annual vegetation <30% total cover) within the active channel area	(BB) Beach/Bar: unvegetated sandbar or gravel/cobble/sand (less than 30% total cover)	(BB) Beach/Bar

7 (OW) Open Water: any open water outside the river channels—in general this will include deeper water and not transitory sloughs	(OW) Open Water: any open water outside the river channels	(OW) Open Water
**8 (HI) Herbaceous on Island: dominated by herbs/woody seedlings under 3' tall on an island	(HI) Herbaceous on Island: includes herbs/woody seedlings under 3' tall	(HI) Herbaceous on Island
**9 (SI) Shrubs on Island: dominated by any woody vegetation 3'–12' tall on an island	(SI) Shrubs on Island: any woody vegetation 3'–12' tall on an island	(SI) Shrubs on Island
10 (SHI) Shrubs: dominated by any woody vegetation 3'–12' tall inside floodplain	(SH) Shrubs: any woody vegetation 3'–12' tall inside floodplain	(SH) Shrubs inside floodplain
11 (UG) Upland Grasses	(GL) Any grassland habitat (GH) Grassland hayed* (GG) Grassland grazed* (GI) Grassland idle*	(GR) Grassland
12 (LG) Lowland Grasses	(GL) Any grassland habitat (GG) Grassland grazed* (GI) Grassland idle*	(HE) Herbaceous, also known as "wet meadows" or lowland grasses
13 (SHO) Shrubs: dominated by any woody vegetation 3'–12' tall outside floodplain	(WS) Woods/Shrubs: any tree or shrub stand or row outside floodplain	(WS) Woods/Shrubs
**14 (WI) Wooded: dominated by any woody vegetation over 12' tall on an "island"	(WI) Woody on Island: any woody vegetation over 12' tall on an island	(WI) Woody on island 15 (WO) Woody
**15(WR) Wooded: dominated by any woody vegetation over 12' tall within the floodplain	(WO) Woody: any woody vegetation over 12' in floodplain (WR) Wood River: woody vegetation with water*	

16 (WO) Wooded: dominated by any woody vegetation over 12' outside the floodplain	(WS) Woods/Shrubs: any tree or shrub stand or row outside floodplain	(WS) Woods/Shrubs
17 (MLG) Mown Lowland Grasses	(GL) Any grassland habitat (GH) Grassland hayed*	(HE) Herbaceous, also known " wet meadows" or lowland grasses
18 (HR) Herbaceous Riparian: includes herbs/woody seedlings under 3' tall inside floodplain	No corresponding map unit	No corresponding map unit
20 (AAL) Agriculture Alfalfa: may include both alfalfa and clover, plus ditches or travel lanes between fields	(AAL) Agriculture Alfalfa: clover or alfalfa	(AL) Alfalfa
21 (ACO) Agriculture Corn: corn and seed sorghum crops, plus ditches or travel lanes between fields	(ACO) Agriculture Corn: corn and seed sorghum	(CO) Corn
22 (AOC) Agriculture Other Crops: any crops not included in AAL or ACO, including small grain crops and corn silage	(AOC) Other Crops: any crops not corn or alfalfa	(OC) Other Crops
23 (ABG) Agriculture Bare Ground/Fallow	(AOC) Other Crops: any crops not corn or alfalfa (ABG) Agricultural Bare Ground*	(OC) Other Crops
24 (ASB) Agriculture Soy Bean	(AOC) Other Crops: any crops not corn or alfalfa (ASB) Agricultural Soy Bean	(OC) Other Crops

25 (AMF) Agriculture Mown Field	(AOC) Other Crops: any crops not corn or alfalfa	(OC) Other Crops
26 (AWW) Agriculture Winter Wheat	(AOC) Other Crops: any crops not corn or alfalfa (AWW) Agriculture Winter Wheat*	(OC) Other Crops
30 (BR) Bridge: any bridge within the floodplain	(BR) Bridge: any bridge within the floodplain	(BR) Bridge
31 (DC) Development Commercial: any commercial or industrial development	(DC) Development Commercial	(CD) Commercial Development
32 (DR) Development Residential: any housing tract—more than one dwelling	(DR) Development Residential: parks or housing tracts	(UD) Urban Development
33 (DRS) Development Residential: any single dwelling	(DRS) Development Residential: any single dwelling	(SD) Single Dwelling
34 (PL) Powerline: any major transmission line and electrical substations	(PL) Powerline	(PL) Powerline
35 (RG) Road, gravel: any publicly maintained gravel road	(RG) Road, gravel	(GA) Gravel Road
36 (RI) Road, interstate	(RP) Road, paved (RI) Road, interstate*	(PA) Paved Road
37 (RP) Road, paved: any publicly maintained paved road	(RP) Road paved (RPH) Road paved highway*	(PA) Paved Road
38 (RR) Railroad: any railroad line	(RR) Railroad	(RR) Railroad

39 (RS) Other Road: any private road, does not include travel lanes within floodplain	(RS) Road to single dwelling	(PR) Private Road
40 (SG) Sand/Gravel Areas within Sand/Gravel Operations	(SG) Sand/Gravel Operation	(SG) Sand/Gravel Operation
41 (SGO) Sand/Gravel Operation: all operations	(SG) Sand/Gravel Operation	(SG) Sand/Gravel Operation
42 Barren Surface: berms, disturbed sites, rest stops, way stations, pull-outs	No corresponding map unit	No corresponding map unit
**43 (UVI) Unvegetated Island not otherwise included in the BBB map unit: substrate of developed soil or duff ground cover	(BB) Beach/Bar: unvegetated sandbar or Gravel/cobble/sand <30% total cover	(BB) Beach/Bar
50 (FP) Floodplain: delineates the outer boundary remnant of the contiguous, natural historic floodplain	(FP) Floodplain: outer boundary remnant of floodplain	(FP) Floodplain

***T**he CALMIT database contains two sets of mapping units: 1) Bridge Segments 1, 2, 9, 10, and 11 mapping units are designated without an asterisk (*) and can be used for all Bridge Segments, and 2) Bridge Segments 3, 4, 5, 6, 7, and 8 mapping units are more detailed and are marked with an asterisk (*) where they vary from the broader classification of Bridge Segments 1, 2, 9, 10, and 11.*

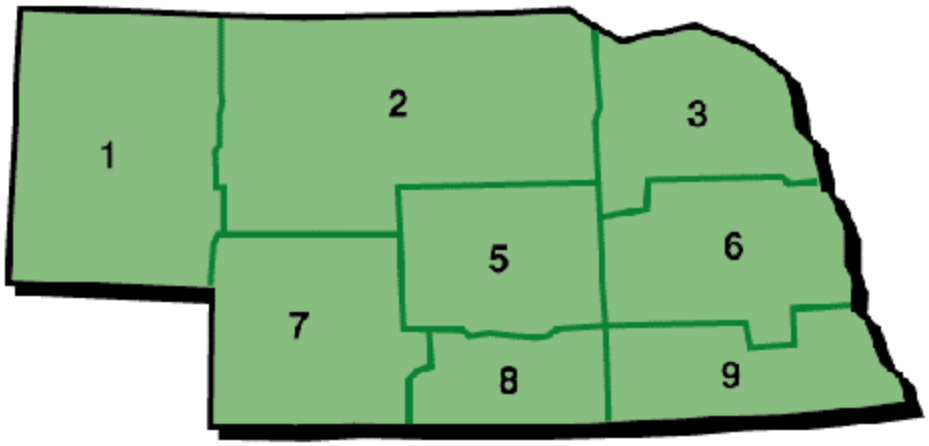
*** The island classes for Map Units 8, 9, and 14 were merged into Map Units 12, 10, and 15, respectively, since determining what constituted an "island"with any consistency could not be achieved. This was especially apparent when comparing databases from previous years. The UVI class was never used since a GIS layer for cleared islands existed as a separate database.*

Appendix C.

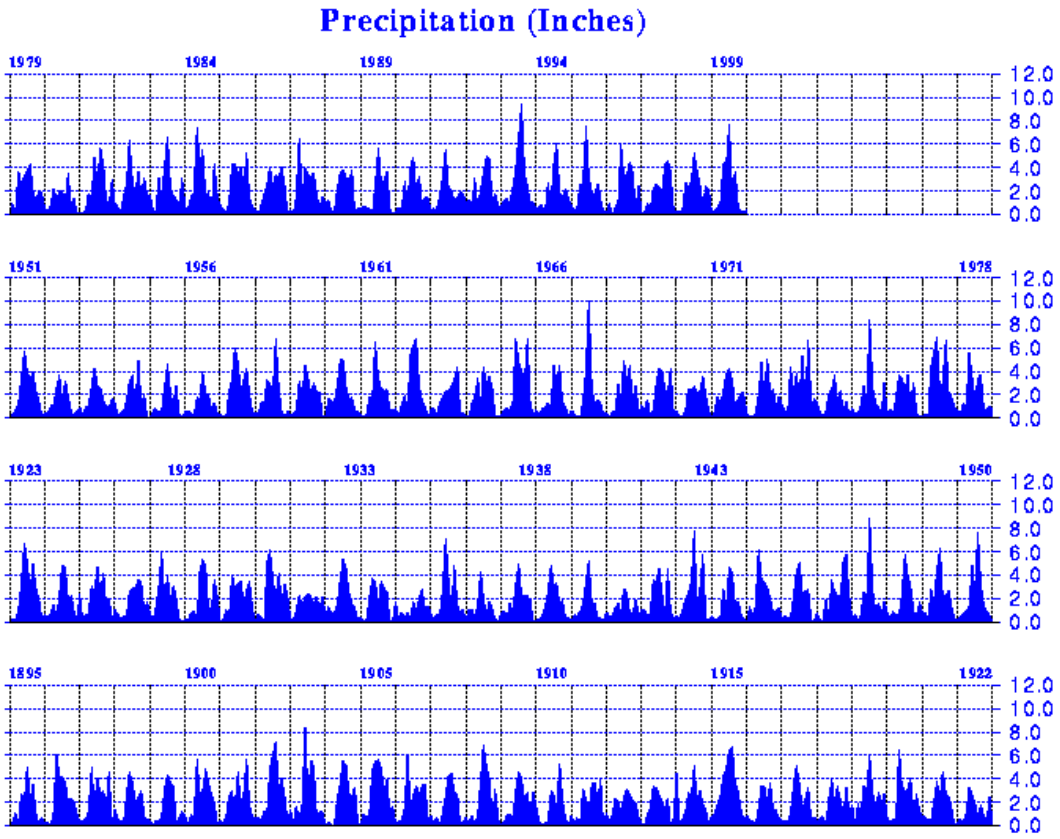
Climate Data for Central Platte River Area

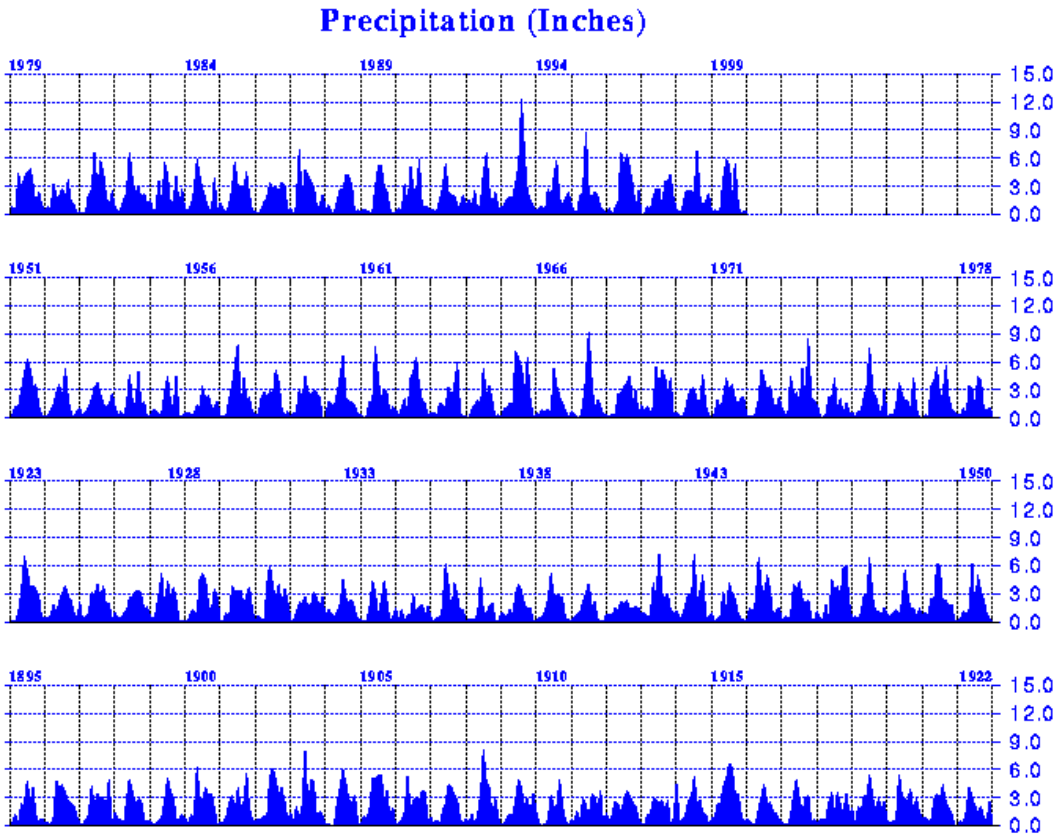
(Data from: http://www.ncdc.noaa.gov/onlineprod/drought/xmgr.html)

(referenced on page 2-4)

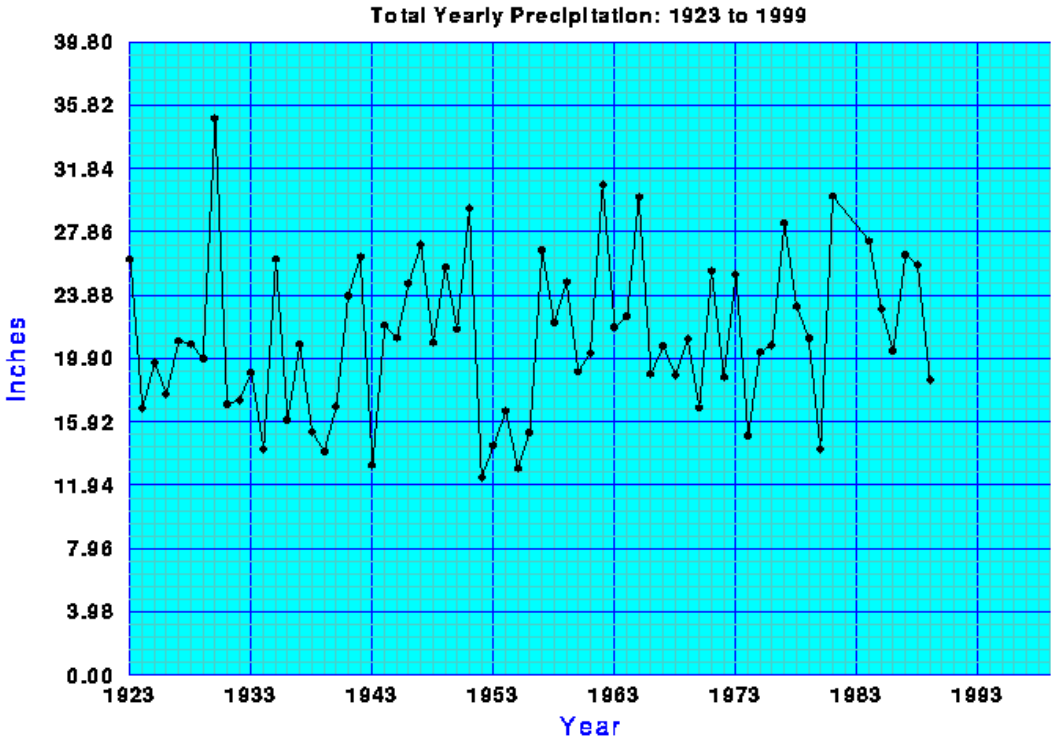


(Area is in NOAA Weather Divisions 5 and 8)


Precipitation (Inches)
1979
1984
1989
1994
1999
1951
1956
1961
1966
1971
1978
1923
1928
1933
1938
1943
1950
1895
1900
1905
1910
1915
1922
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Nebraska - Division 05: 1895-1999 (Monthly Averages)


Precipitation (Inches)
1979
1984
1989
1994
1999
1951
1956
1961
1966
1971
1978
1923
1928
1933
1938
1943
1950
1895
1900
1905
1910
1915
1922
15.0
12.0
9.0
6.0
3.0
0.0
Nebraska - Division 08: 1895-1999 (Monthly Averages)

GOTHENBERG, NEBRASKA

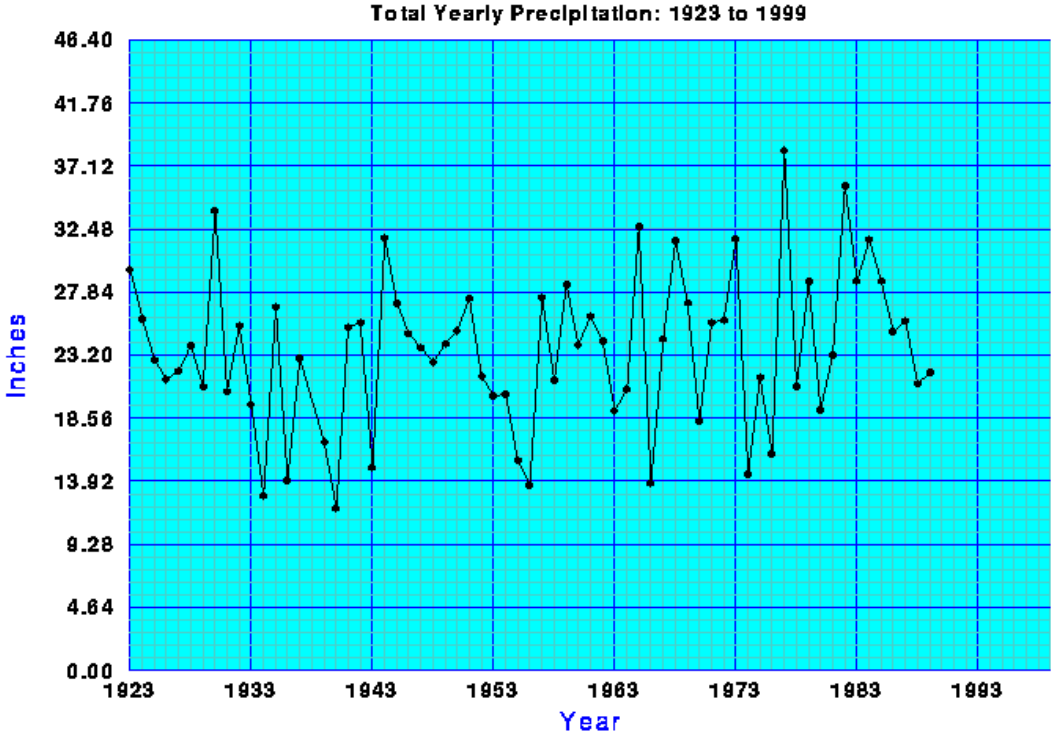


2 years with missing data

Location: 40.90N 100.20W

Created: Thu Mar 30 18:18:38 2000

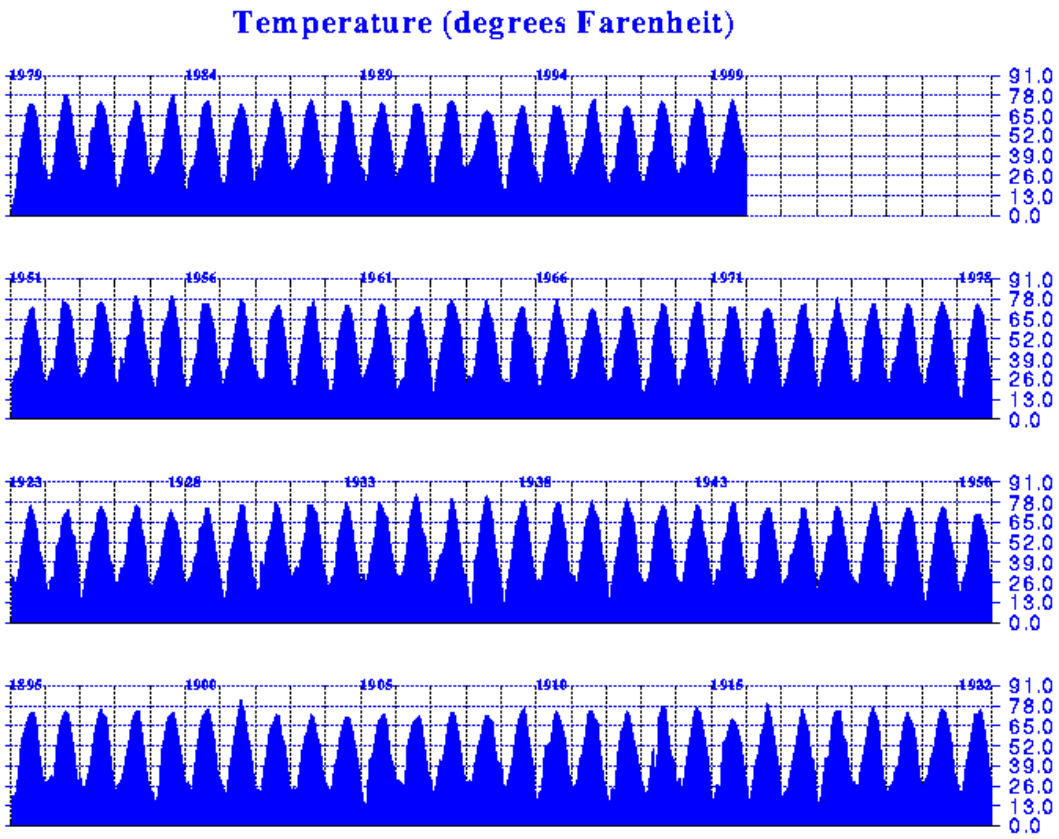
GRAND ISLAND, NEBRASKA

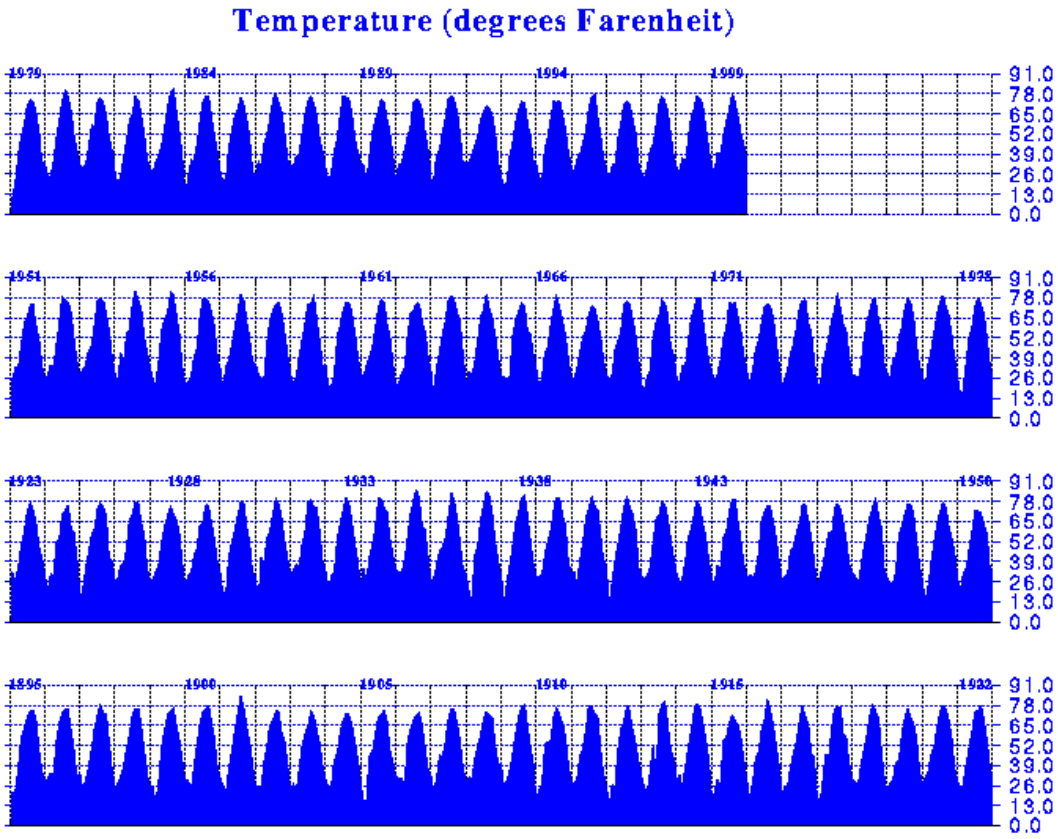


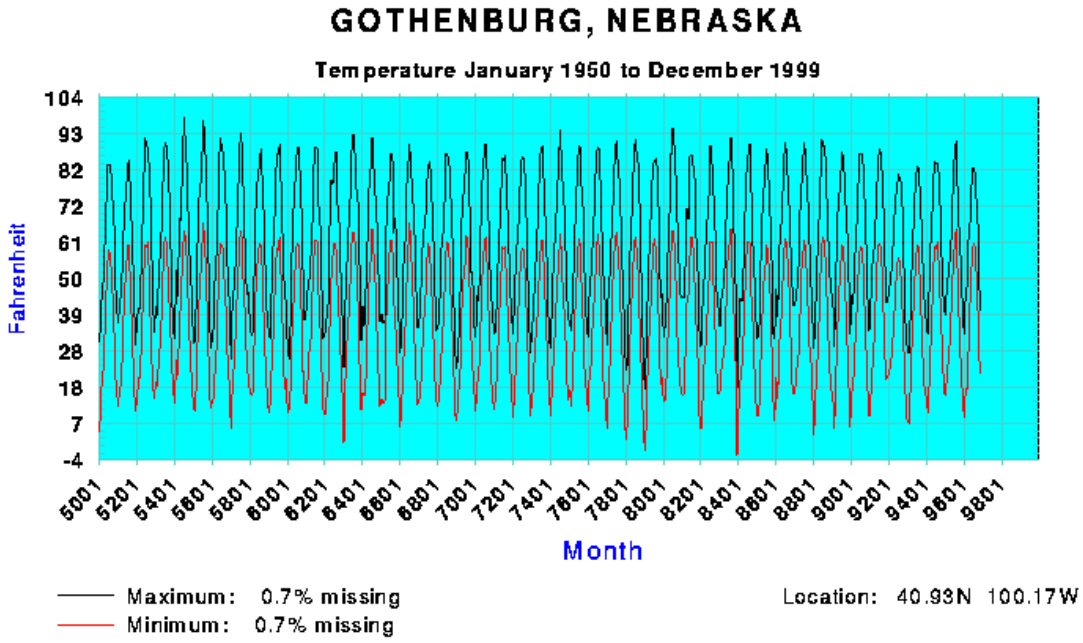
1 year with missing data

Location: 41.00N 98.30W

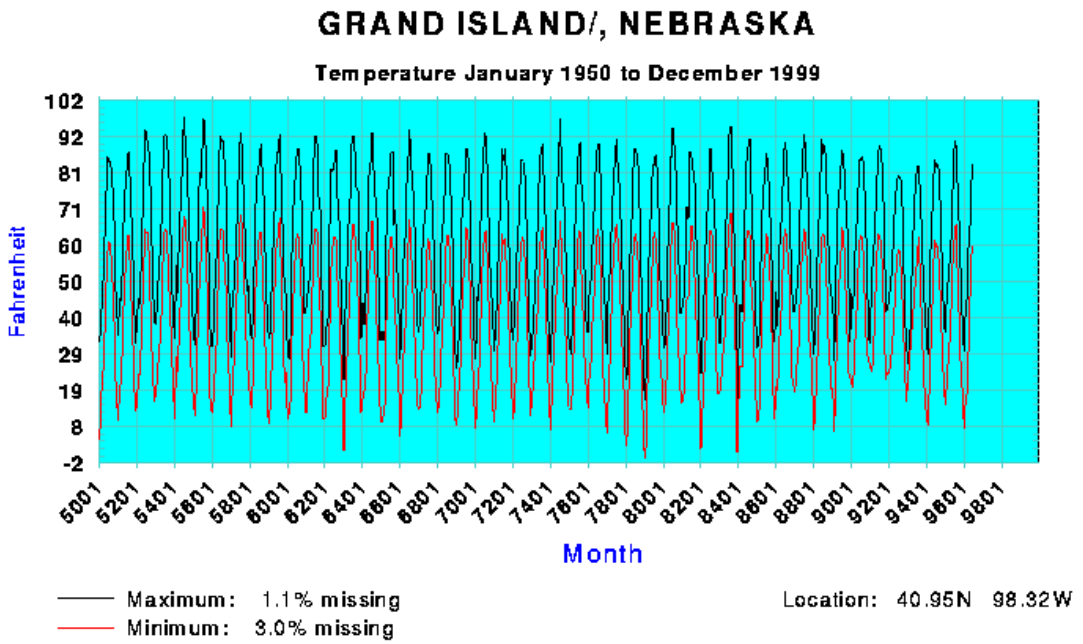
Created: Thu Mar 30 18:19:13 2000


Temperature (degrees Farenheit)
1979
1984
1989
1994
1999
1951
1956
1961
1966
1971
1923
1928
1933
1938
1943
1895
1900
1905
1910
1915
91.0
78.0
65.0
52.0
39.0
26.0
13.0
0.0
Nebraska - Division 05: 1895-1999 (Monthly Averages)


Temperature (degrees Farenheit)
1979
1984
1989
1994
1999
1951
1956
1961
1966
1971
1923
1928
1933
1938
1943
1895
1900
1905
1910
1915
91.0
78.0
65.0
52.0
39.0
26.0
13.0
0.0
Nebraska - Division 08: 1895-1999 (Monthly Averages)



Created: Thu Mar 30 16:21:42 2000



Created: Thu Mar 30 16:23:17 2000

Appendix D.

Table of Range Sites, Soil Associations, and Principal Habitat Classification in the Central Platte River Study Area

(Table Created by J. Von Loh)

(referenced on page 2-5)

Table D. Range sites, soil associations, and principal habitat classification in the Central Platte River study area

Range Site: Definition	**Soil Association(s)**	**Principal Habitat Classification(s)**
Wet Land: deep, poorly drained depressions in the Platte River Valley	Barney loam, Lawet loam-ponded, Loup loam, Marsh, Marlake loamy sand, Massie silty clay loam, Scott silt loam, Wet Alluvial Land	1 Emergent wetlands 12 Lowland grasses
Subirrigated: very shallow to deep bottom land and stream terraces in the Platte River Valley	Alda fine sandy loam, Alda loam, Alda sandy loam, Boel fine sandy loam, Boel loam, Caruso-Gayville complex, Cozad silt loam-wet substratum, Ebs-Els loamy fine sand, Elsmere fine sandy loam, Elsmere loamy fine sand, Fonner loam, Fonner sandy loam, Gibbon loam, Gibbon silt loam, Gothenburg fine sandy loam, Gothenburg soils, Hall silt loam-wet substratum, Hord silt loam-wet substratum, Hord silty clay loam-wet substratum, Lamo clay loam-sandy substratum, Lamo silt loam-wet, Lamoure silt loam, Lawet silt loam-drained, Leshara fine sandy loam, Leshara silt loam, Lex loam, Lex clay loam, Lex silt loam, Libory loamy fine sand, Loamy Alluvial Land, Lockton loam, Loup loam, Merrick loam, Novina sandy loam, Ovina fine sandy loam, Ovina loam, Ovina loamy fine sand, Platte loam, Platte loam-wet, Platte soils, Platte-Alda loams-channeled, Platte-Gothenburg complex-channeled, Platte-Wann complex, Platte-Wann Complex-channeled, Sandy Alluvial Land, Silver Creek silt loam, Silver Creek silty clay loam, Tryon loamy fine sand, Wann fine sandy loam, Wann fine sandy loam-deep, Wann loam, Wann loam-deep, Wann sandy loam	8 Herbaceous riparian (island) 18 Herbaceous riparian 12 Lowland grasses 17 Mown lowland grasses 9 Shrubby riparian (island) 10 Shrubby riparian 14 Wooded (island) 15 Wooded (floodplain) *(Note: agricultural crops are grown on some deeper, subirrigated soils.)*

Saline Subirrigated: deep, moderately alkaline soils on bottom land and terraces of the Platte River Valley	Caruso-Gayville complex, Elsmere loamy fine sand-saline/alkali, Gibbon loam-saline, Gibbon silt loam-saline, Lamo-Saltine complex, Lamoure silt loam-saline, Lawet silt loam-saline/alkali, Lawet Variant fine sandy loam, Leshara silt loam-saline, Lex loam-saline/alkali, Lex Variant loam, Silver Creek complex, Wann fine sandy loam-saline/alkali, Wann loam-saline	12 Lowland grasses 17 Mown lowland grasses 18 Herbaceous riparian
Shallow to Gravel: shallow soils, overlying gravel on stream terraces	Meadin loamy sand-terrace, Meadin sandy loam, Meadin silt loam-terrace, Simeon sandy loam, Simeon loamy sand	10 Shrubby riparian 15 Wooded (floodplain) 18 Herbaceous riparian
Silty Overflow: deep, on bottom lands that flood occasionally	Breaks-Alluvial Land Complex, Cozad-Hobbs silt loam, Hobbs silt loam, Hobbs silt loam-overwash/occasionally flooded/ channeled, Rusco silt loam, Scott silt loam, Silty Alluvial Land	10 Shrubby riparian 15 Wooded (floodplain) *(Note: agricultural crops are grown on some silty overflow soils.)*
Clayey Overflow: deep, in depressions on uplands and river terraces that flood occasionally	Butler silt loam- depressional, Fillmore silt loam-drained, Fillmore silt loam, Scott silt loam-drained, Scott silty clay loam-drained	18 Herbaceous riparian 10 Shrubby riparian 15 Wooded (floodplain) *(Note: agricultural crops are grown on drained clayey overflow soils.)*
Sandy Lowland: deep, terraces of the Platte River .	Cass loam, Cass loam-occasionally flooded, Cass fine sandy loam, Fonner Variant loamy sand, Gosper fine sandy loam, Inavale fine sandy loam, Inavale loamy fine sand, Inavale loamy sand, Ipage-Els loamy fine sands, Janude sandy loam, Libory loamy fine sand	18 Herbaceous riparian 10 Shrubby riparian 15 Wooded (floodplain) *(Note: agricultural crops are grown on lowland sands.)*

Silty Lowland: deep, on stream terraces and uplands	Cozad fine sandy loam, Cozad loam-wet substratum, Cozad silt loam, Cozad silt loam-wet substratum, Cozad silty clay loam, Detroit silt loam, Detroit silt loam-terrace, Gosper loam, Grigston silt loam, Hall silt loam-sandy substratum, Hall silt loam-terrace, Hobbs silt loam, Hobbs silt loam-occasionally flooded, Hord silt loam, Hord silt loam-sandy substratum, Hord silt loam-terrace, Hord silty clay loam, Kenesaw fine sandy loam-calcareous variant, Kenesaw silt loam, Kenesaw silt loam-terrace, Rusco silt loam	18 Herbaceous riparian 10 Shrubby riparian 15 Wooded (floodplain) 11 Upland grasses 13 Shrubby upland 16 Wooded upland 20 Agriculture, alfalfa 21 Agriculture, corn 22 Agriculture, other crops 24 Agriculture, soy bean 25 Agriculture, mown field 26 Agriculture, winter wheat
Saline Lowland: deep, on terraces of the Platte River Valley, moderately alkaline	Cozad silt loam- saline/alkali, Exline-Wood River fine sandy loams, Exline-Wood River silt loams, Gayville Variant silt loam, Gosper loam- saline/alkali, Slickspots, Wann loam-deep/saline, Wood River complex, Wood River-Exline fine sandy loams, Wood River-Exline silt loams	12 Lowland grasses 17 Mown lowland grasses 20 Agriculture, alfalfa
Sands: deep, upland sand	Inavale loamy sand, Loretto-Valentine complex, Platte-Sarpy complex, Platte-Sarpy-channeled, Sarpy fine sand, Sarpy loamy fine sand, Thurman loamy fine sand, Thurman loamy fine sand-loamy substratum, Thurman loamy fine sand-wind eroded, Valentine fine sand, Valentine loamy sand, Valentine loamy fine sand-rolling	11 Upland grasses 13 Shrubby uplands
Clayey: deep, on claypan, on terraces of the Platte River Valley	Butler silt loam, Crete silt loam, Wood River silt loam	12 Lowland grasses 17 Mown lowland grasses

Sandy: deep, on stream terraces or uplands, loamy or sandy	Anselmo fine sandy loam, Anselmo fine sandy loam- hummocky, Anselmo fine sandy loam- hummocky/eroded, Anselmo fine sandy loam-terrace, Anselmo very fine sandy loam, Anselmo very fine sandy loam-terrace, Anselmo loam, Anselmo loam-terrace, Blendon fine sandy loam, Blendon loam, Blendon Variant fine sandy loam, Cass fine sandy loam, Hersh fine sandy loam, Hersh-Kenesaw complex-undulating, Hord fine sandy loam, Hord-O'Neill complex, Loretto fine sandy loam, O'Neill fine sandy loam, O'Neill loam, O'Neill sandy loam, Ortello fine sandy loam, Ortello fine sandy loam-loamy substratum, Sarpy loamy fine sand, Thurman fine sandy loam, Thurman fine sandy loam-terrace, Thurman loamy fine sand, Thurman loamy fine sand-loamy substratum, Thurman loamy fine sand-terrace, Thurman-Valentine loamy fine sands, Thurman-Valentine loamy fine sands-loamy substratum, Thurman-Valentine loamy fine sands-undulating, Valentine fine sand, Valentine loamy fine sand, Valentine-Boelus loamy fine sands	11 Upland grasses 13 Shrubby uplands 16 Wooded uplands
Limy Upland: deep, steep, calcareous silty uplands	Coly silt loam, Crofton silt loam	11 Upland grasses
Thin Loess: thin, silty, calcareous uplands	Coly silt loam, Rough Broken Land-Loess	11 Upland grasses

Silty: deep, silty on surface and in subsoil	Breaks-Alluvial Land Complex, Brocksburg loam, Broken Land, Butler silt loam, Cass loam, Colby silt loam, Cozad silt loam, Cozad silt loam-eroded, Detroit silt loam, Geary silt loam, Geary silty clay loam, Hall silt loam, Hall-O'Neill Complex, Hastings silt loam, Hastings silt loam-thin solum variant, Hastings complex-severely eroded, Hastings silty clay loam, Hersh-Kenesaw complex-undulating, Hobbs silt loam, Holder silt loam, Holder silt loam-thick surface, Holder silty clay loam, Holdrege silt loam, Holdrege-Colby complex-severely eroded, Holdrege-Hall silt loams, Holdrege-Uly silt loams, Hord silt loam, Hord silt loam-terrace, Hord silt loam-thin solum variant, Kenesaw silt loam, Nora silt loam, O'Neill loam, Ortello loam, Ortello loam-loamy substratum, Uly silt loam, Volin silt loam, Wood River silt loam	11 Upland grasses 13 Shrubby upland 16 Wooded upland 20 Agriculture, alfalfa 21 Agriculture, corn 22 Agriculture, other Crops 24 Agriculture, soy bean 25 Agriculture, mown field 26 Agriculture, winter wheat

Appendix E.

Outline of ArcView 3.1 Training

(by B. Whitesell and P. Wright)

(referenced on pages 3-9 and 4-1)

Course Outline
Using ARCVIEW 3.1
December 1998

1. Introduction of instructors

Patrick Wright - USBR/CDSI, D-8260
(303) 445-2288
Bruce Whitesell - USBR, D-8260 (303) 445-2287

2. GIS Overview

A. ArcView demonstration -
Upper Columbia Area GIS Data Base/Yakima Basin Interface
B. Terminology
C. Some GIS applications
D. Sources of data

3. Basic Cartography

A. Map Scales
1) Types - verbal, bar, representative fractions, etc.
2) Photocopies - enlargement & reduction
3) Large scale vs small scale

B. Map Projections
1) Representing the Earth - spheroid, ellipsoid, geoid
2) Describing 3D objects in 2D space
3) Areas, Angles, Shapes, and Distances
4) Types of projections
5) Selecting a projection
6) Dealing with data in different projections

C. Map Error
1) Types - locational, attribute, inherent & operational
2) National Map Accuracy Standards

D. Map Reading - USGS topographic maps
1) Projections
2) Datums
3) Coordinate systems

4. ArcView Lectures & Exercises

A. Exercise 1

1) Start ArcView from the Windows Program Manager
2) Open a project and display views and themes
3) Query the buttons for their functions
4) Get information about features
5) Display and modify a table
6) Create, display, and modify charts
7) Create a layout

B. Exercise 2
1) Create a project and a view
2) Add Features to a View
3) Edit themes to improve the display of the view
4) Edit View properties
5) Manage theme display with theme properties
6) Add and edit fields in a table, establish a Hot Link between a table and a theme

C. Exercise 3
1) Add tables to a view
2) Append 2 tables together
3) Add an event theme to your view

D. Exercise 4
1) Convert a theme into a shapefile
2) Edit the shapefile
3) Create point & polygon shape files using background
Images for reference

5. Transferring data between systems

A. Import/Export
B. AutoCad - DXF
C. dBase
D. ASCII .txt

6. Metadata

A. What is it?
B. Standards

7. Closing remarks and critique of the course.

Appendix F.

Observation Point Form
used for the
Central Platte River 1998 Land Cover/Use Mapping Project

(by TNC)

(referenced on page 3-6)

NATIONAL PARK VEGETATION MAPPING PROGRAM: OBSERVATION POINT FORM

IDENTIFIERS/LOCATORS

Plot Code_____ Polygon Code_____

Provisional Community Name___ _____ _____

State ___ Park Name _____ Park Site Name _____

Quad Name_____ Quad Code_____

GPS file name_____ Field UTM X___ ___ ___ ___ ___ ___ m E Field UTM Y___ ___ ___ ___ ___ ___ ___ m N

please do not complete the following information when in the field
Corrected UTM X___ ___ ___ ___ ___ ___ m E Corrected UTM Y___ ___ ___ ___ ___ ___ ___ m N UTM Zone_____

Survey Date_____ Surveyors_____

ENVIRONMENTAL DESCRIPTION

Elevation _____ Slope _____ Aspect_____

Topographic Position

Landform

Cowardian System	Hydrologic Regime		Salinity/Halinity Modifiers
___Upland	Non-Tidal		___Saltwater
___Riverine	___Permanently Flooded	___Saturated	___Brackish
___Palustrine	___Semipermanetly Flooded	___Temporarily Flooded/Saturated	___Freshwater
___Lacustrine	___Seasonally Flooded	___Intermittently Flooded	

Environmental Comments:	Unvegetated Surface: *(please use the cover scale below)*
	___ Bedrock ___ Litter, duff ___ Wood (> 1 cm)
	___ Large rocks (cobbles, boulders > 10 cm)
	___ Small rocks (gravel, 0.2-10 cm)
	___ Sand (0.1-2 mm) ___ Bare soil
	___ Other:_____

VEGETATION DESCRIPTION

Leaf phenology (of dominant stratum)	Leaf Type (of dominant stratum)	Physiognomic class	Cover Scale for Strata & Unvegetated Surface		Height Scale for Strata	
Trees and Shrubs		___Forest				
___Evergreen	___Broad-leaved	___Woodland	01	5%	01	< 0.5 m
___Cold-deciduous	___Needle-leaved	___Shrubland	02	10%	02	0.5-1m
___Drought-deciduous	___Mixed broad-leaved/Needle leaved	___Dwarf Shrubland	03	20%	03	1-2 m
___Mixed evergreen - cold-deciduous	___Microphyllous	___Herbaceous	04	30%	04	2-5 m
___Mixed evergreen - drought-deciduous	___Graminoid	___Nonvascular	05	40%	05	5-10 m
	___Forb	___Sparsely Vegetated	06	50%	06	10-15 m
Herbs	___Pteridophyte		07	60%	07	15-20 m
___Annual			08	70%	08	20-35 m
___Perennial			09	80%	09	35 - 50 m
			10	90%	10	> 50 m
			11	100%		

Strata	Height	Cover Class	Dominant species (mark any known diagnostic species with a *)	Cover Class
T1 Emergent	_____	_____	_____	
T2 Canopy	_____	_____	_____	
T3 Sub-canopy	_____	_____	_____	
S1 Tall shrub	_____	_____	_____	
S2 Short Shrub	_____	_____	_____	
S3 Dwarf-shrub	_____	_____	_____	
H Herbaceous	_____	_____	_____	
N Non-vascular	_____	_____	_____	
V Vine/liana	_____	_____	_____	
E Epiphyte	_____	_____	_____	

please see the table on the previous page for height and cover scales for strata

Other Comments

Cover Scale for Species

01 < 1%
02 1-5%
03 5-25%
04 25-50%
05 50-75%
06 75-100%

Appendix G.

Plot Survey Form
used for the
Central Platte River 1998 Land Cover/Use Mapping Project

(from The Nature Conservancy)

(referenced on page 3-6)

NATIONAL PARK MAPPING PROGRAM: PLOT SURVEY FORM

IDENTIFIERS/LOCATORS

Plot Code_____ Polygon Code_____

Provisional Community Name_____

State ___ Park Name_____ Park Site Name_____

Quad Name_____ Quad Code_____

GPS file name_____ Field UTM X___ ___ ___ ___ ___ ___ m E Field UTM Y___ ___ ___ ___ ___ ___ ___ m N

please do not complete the following information when in the field
Corrected UTM X___ ___ ___ ___ ___ ___ m E Corrected UTM Y___ ___ ___ ___ ___ ___ ___ m N UTM Zone_____

Survey Date_____ Surveyors_____

Directions to Plot

Plot length_____ Plot width_____ Plot Photos (y/n) ___ Roll Number _____ Frame Number _____ Plot Permanent (y/n) ____

Plot representativeness

ENVIRONMENTAL DESCRIPTION

Elevation _____ Slope _____ Aspect_____

Topographic Position

Landform

Surficial Geology

Cowardian System
___Upland
___Riverine
___Palustrine
___Lacustrine

Non-Tidal
___Permanently Flooded
___Semipermanetly Flooded
___Seasonally/Temporarily Flooded
___Saturated
___Seasonally Flooded/Saturated
___Intermittently Flooded

Environmental Comments:

Soil Taxon/Description

Unvegetated Surface: *(please use the cover scale on next page)*
___ Bedrock ___ Litter, duff ___ Wood (> 1 cm)
___ Large rocks (cobbles, boulders > 10 cm)
___ Small rocks (gravel, 0.2-10 cm)
___ Sand (0.1-2 mm) ___ Bare soil
___ Other:_____

Soil Texture
___ sand ____ loamy sand ___ sandy loam ___ loam
___ silt loam ____ silt ___ clay loam ____ silty clay

Soil Drainage
___ Rapidly drained ___ Well drained
___ Moderately well drained ___ Somewhat poorly drained

_ _ clay ___ peat ___ muck	___ Poorly drained ___ Very poorly drained

VEGETATION DESCRIPTION

Leaf phenology (of dominant stratum)	Leaf Type (of dominant stratum)	Physiognomic class	Cover Scale for Strata & Unvegetated Surface	Height Scale for Strata
		___Forest		01 < 0.5 m
Trees and Shrubs	___Broad-leaved	___Woodland	01 5%	02 0.5-1m
___Evergreen	___Needle-leaved	___Shrubland	02 10%	03 1-2 m
___Cold-deciduous	___Microphyllous	___Dwarf Shrubland	03 20%	04 2-5 m
___Drought-deciduous	___Graminoid	___Herbaceous	04 30%	05 5-10 m
___Mixed evergreen - cold-deciduous	___Forb	___Nonvascular	05 40%	06 10-15 m
	___Pteridophyte	___Sparsely Vegetated	06 50%	07 15-20 m
___Mixed evergreen - drought-deciduous			07 60%	08 20-35 m
			08 70%	09 35 - 50 m
			09 80%	10 > 50 m
Herbs			10 90%	
___Annual			11 100%	
___Perennial				

Strata	Height Class	Cover Class	Diagnostic species (if known)
T1 Emergent	_____	_____	_____
T2 Canopy	_____	_____	_____
T3 Sub-canopy	_____	_____	_____
S1 Tall shrub	_____	_____	_____
S2 Short Shrub	_____	_____	_____
H Herbaceous	_____	_____	_____
N Non-vascular	_____	_____	_____
V Vine/liana	_____	_____	_____
E Epiphyte	_____	_____	_____

please see above table for height and cover scales

Animal Use Evidence

Natural and Anthropogenic Disturbance Comments

Other Comments

Plot Code_____

Species/percent cover: Starting with the uppermost stratum, list all species with % cover for each species in the stratum. For forests and woodlands, on a separate line below each tree species, list the DBH of all trees above 10 cm diameter. Separate measurements with a comma. Put an asterisk next to any species that are known diagnostics for a particular community in the classification. Also list species outside the plot at the end of the table or designate with a 0 in in Cover Class column.

Species Name	Cover	Species Name	Cover	Species Name	Cover
				Cover Scale for Species	
				01 < 1%	
				02 1-5%	
				03 5-25%	
				04 25-50%	
				05 50-75%	
				06 75-100%	

Appendix H.

Metadata for the Central Platte River 1998 and 1982 GIS Databases

(by Beverly Friesen and Joy Nelson)

(referenced on pages 3-14 and 4-20)

Central Platte River 1998 Land Cover/Use Database

Metadata:

Identification_Information:

Citation:

Citation_Information:

Originator:

Platte River EIS Office, Bureau of Reclamation, in conjunction with the Fish and Wildlife Service, PL-100, PO 25007, Denver CO 80225

Publication_Date: 1998

Title: Central Platte River 1998 Land Cover/Use Database

Geospatial_Data_Presentation_Form: map

Publication_Information:

Publication_Place: Denver, CO

Publisher: Bureau of Reclamation

Description:

Abstract:

These metadata are for all bridge segments associated with the 1998 land cover/use geospatial database for the Central Platte River. This project was authorized by the Platte River EIS Office, formed to write the environmental impact statement for the Cooperative Agreement for Platte River research and other efforts relating to endangered species habitats along the Central Platte River, Nebraska. The mapping effort was performed by the Remote Sensing and Geographic Information Group (RSGIG) of the Bureau of Reclamation's Technical Service Center.

Purpose:

The land cover/use information will be used to evaluate alternatives for the Platte River EIS.

Supplemental_Information:

The following vegetation and land use classes were mapped for this project: LAND USE: 1 emergents; 2 wetted channel; 3 open water canal; 4 open water slough; 5 open water pit, pond or lake; 6 barren beach/bar; 7 open water; 10 shrubs inside floodplain; 11 upland grasses; 12 lowland grasses; 13 shrubs outside floodplain; 15 wooded river within flood; 16 woody outside floodplain; 17 mown lowland grasses; 18 herbaceous riparian; 20 agriculture alfalfa; 21 agriculture corn; 22 agriculture other crops; 23 agriculture bare ground; 24 agriculture soy bean; 25 agriculture mown field; 26 agriculture winter wheat; 30 bridge; 31 development commercial; 32 development residential; 33 development single swelling; 34 powerline; 35 road interstate; 37 road paved 38 railroad; 39 other road; 40 sand/gravel operation; and 42 barren surface. Classification was in accordance with the Federal Geographic Data Committee's National Vegetation Classification Standard.

Time_Period_of_Content:
- Time_Period_Information:
  - Single_Date/Time:
    - Calendar_Date: 199808
  - Currentness_Reference: Dates of aerial photography

Status:
- Progress: Complete
- Maintenance_and_Update_Frequency: None planned

Spatial_Domain:
- Bounding_Coordinates:
  - West_Bounding_Coordinate: -99.8102
  - East_Bounding_Coordinate: -98.0766
  - North_Bounding_Coordinate: 41.0354
  - South_Bounding_Coordinate: 40.6077

Keywords:
- Theme:
  - Theme_Keyword_Thesaurus: None
  - Theme_Keyword: land cover
  - Theme_Keyword: land use
  - Theme_Keyword: land cover/use
  - Theme_Keyword: vegetation
  - Theme_Keyword: wetted channel
  - Theme_Keyword: development
  - Theme_Keyword: road
  - Theme_Keyword: bridge segment
  - Theme_Keyword: unvegetated

Theme_Keyword: herbaceous
Theme_Keyword: water
Theme_Keyword: floodplain
Theme_Keyword: meadow
Theme_Keyword: agriculture
Theme_Keyword: wooded
Theme_Keyword: shrubs
Theme_Keyword: upland grasses
Place:
Place_Keyword_Thesaurus: None
Place_Keyword: Nebraska
Place_Keyword: Central Platte River
Place_Keyword: Platte River
Place_Keyword:
Big Bend Taxonomy: Taxonomic_Keywords: vegetation Taxonomic_Keywords: plants Taxonomic_Keywords: National Vegetation Classification System Taxonomic_Coverage: Specific_Taxonomic_Information: General_Taxonomic_Coverage: Complete list of mapped classes under Supplemental Information above
Access_Constraints: None
Use_Constraints:
Acknowledgment of U.S. Bureau of Reclamation and Fish and Wildlife Service would be appreciated in products derived from these data. Any person using the information presented here should fully understand the data collection and compilation before beginning analysis. The burden for determining fitness for use lies entirely with the user.
Point_of_Contact:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization: Bureau of Reclamation
Contact_Person: Platte River GIS Analyst
Contact_Address:
Address_Type: mailing address
Address: PO 25007, PL-100
City: Denver
State_or_Province: CO
Postal_Code: 80225-0007
Country: USA
Contact_Voice_Telephone: 303-445-2096
Contact_Facsimile_Telephone: 303-445-6331

Contact_Electronic_Mail_Address: platte@www.usbr.gov
Hours_of_Service: Monday through Friday, 7:00 a.m. to 4:30 p.m. Mountain Time

Native_Data_Set_Environment: UNIX Arc/Info

Data_Quality_Information:

Attribute_Accuracy:

Attribute_Accuracy_Report:

These data have an overall accuracy of 88.8% (85.3% Kappa index) within a 90% confidence interval of 85.0 to 91.9%).

Logical_Consistency_Report:

All polygon features are checked for topology and existence of label points using the Arc/Info software. Each polygon begins and ends at the same point with the node feature. All nodes are checked for error so that there are no unintentional dangling features. There are no duplicate lines or polygons. All nodes will snap together and close polygons based on a specified tolerance. If the node is not within the tolerance it is adjusted manually. Logical consistency is performed in Arc/Info.

Completeness_Report:

All data that can be interpreted are digitized in accordance with the minimum mapping unit (MMU) of 1/2 acre for all but the agricultural classes which have an MMU of 10 acres. This includes selected features that fall into the NVCS vegetation classification and the Anderson Level II land use classification. Some classes below the MMU are included such as wetlands and beach bar areas and polygons cut off by other features and borders. Roads (to visible right-of-way or fence line) and streams/drainages wider than 10 meters were digitized as polygons and attributed accordingly. Roads and wet drainages visible on the orthophotos but thinner than 10 meters were digitized as lines. Dry drainages thinner than 10 meters were not digitized.

Positional_Accuracy:

Horizontal_Positional_Accuracy:

Horizontal_Positional_Accuracy_Report:

Vegetation and land cover/use units were identified through stereoscopic examination of 1:24,000-scale color infrared (CIR) aerial photographs taken in August 1998. Every other photograph was enlarged to a scale of 1:12,000 to provide a larger-scale image for the interpretation. The vegetation boundaries were transferred to the GIS database using digital orthophoto quadrangles as the basemap. The mapped vegetation and land cover/use reflect conditions that existed during the time of photography. The attribute accuracy stated above may also reflect horizontal positional accuracy.

Vertical_Positional_Accuracy:

Vertical_Positional_Accuracy_Report: This database contains no elevation or vertical data.

Lineage:

Source_Information:

Source_Citation:

Citation_Information:

Originator: USGS

Publication_Date: 1993

Title:

Digital Orthophoto Quarter Quadrangle. See Other_Citations_Details for list.

Geospatial_Data_Presentation_Form: Remote-sensing image

Publication_Information:

Publication_Place: Rolla, Missouri

Publisher: USGS

Other_Citation_Details:

List of DOQQs used as basemaps: Abbott, Alda, Alfalfa Center, Bertrand NW, Central City West, Chapman, Cozad, Denman, Doniphan, Elm Creek East, Elm Creek SW, Elm Creek West, Elwood NW, Gibbon North, Gibbon South, Giltner, Grand Island, Hastings NW, Heartwell, Johnson Lake, Kearney, Kearney SW, Kearney SE, Lexington East, Lexington West, Minden North, Murphy, Newark, Overton, Phillips, Prosser, Shelton, and Wood River.

Online_Linkage: <http://www.nrc.state.ne.us/docs/frame3.html>

Source_Scale_Denominator: 12000

Type_of_Source_Media: CD-ROM

Source_Time_Period_of_Content:

Time_Period_Information:

Single_Date/Time:

Calendar_Date: 1993

Source_Currentness_Reference: Ground condition

Source_Citation_Abbreviation: DOQQ

Source_Contribution:

Interpreted data on Mylars were marked with control points from features located on the DOQQs for bridge segments 3, 4, 5, 6, and 7; the DOQQs were also used for making geometric corrections to land cover/use lines and polygons.

Source_Information:
Source_Citation:
Citation_Information:
Originator: Bureau of Reclamation
Publication_Date: 19990603
Title: Platte River Color-Infrared (CIR) Digital Orthophotos
Geospatial_Data_Presentation_Form: Remote-sensing image
Publication_Information:
Publication_Place: Denver, Colorado
Publisher: Bureau of Reclamation
Other_Citation_Details:
See metadata for Color-Infrared Digital Orthophotos at <http://mcmcweb.er.usgs.gov/platte/cir_doq/metadata.html.>
Online_Linkage:
<http://mcmcweb.er.usgs.gov/platte/cir_doq/cir.html>
Source_Scale_Denominator: 24000
Type_of_Source_Media: Color-infrared aerial photographs
Source_Time_Period_of_Content:
Time_Period_Information:
Single_Date/Time:
Calendar_Date: 199808
Source_Currentness_Reference:
Ground condition determined by aerial photos taken August 19, 21, and 24, 1998
Source_Citation_Abbreviation: none
Source_Contribution:
Interpreted data on Mylars were marked with control points from features located on the DOQQs for bridge segments 1,2, 8 18; the DOQQs were also used for making geometric corrections to land cover/use lines and polygons.
Process_Step:
Process_Description:
Color-infrared digital and hardcopy orthophotos were specially produced for this project from aerial photography acquired by Horizons, Incorporated of Rapid City, South Dakota. (Platte River Color-Infrared Digital Orthophotos discussed in source citation above.) A planimetric basemap image was prepared by Horizons, Incorporated by registering the August 1998 aerial photographs. Orthophotos were

produced at a scale of 1:12,000 and were used for photo-interpretation. The original poster-sized sheets were cut into more manageable sizes for the photo-interpreters (~16- (20-inches). Each orthophoto portion had an identification number corresponding to the bridge segment number, the photo sheet number, and the photo sheet portion (e.g., Bridge Segment 08, Sheet 6, Portion 2 or 08062). The procedure for classifying vegetation followed guidelines set forth in the Vegetation Classification Standard (FGDC 1997) which was developed from the Standardized National Vegetation Classification System (NVCS). The Platte River Color-Infrared Digital Orthophotos discussed in the source citation above were used for photo-interpretation of the map classes.

Each orthophoto portion was covered with drafting film (Mylar) overlays and registration points corresponding to the tic marks on the orthophotos (points representing known surface coordinates) were traced onto each overlay. Aerial photo portions with the overlays were backlit on a light table and visually scanned for photographic signatures using magnification. The entire photograph portion was systematically interpreted, delineated, and each polygon labeled with the appropriate map unit number. A stereoscope was used to investigate vegetation, land use, and topographic position on the related 9- (9-inch (1:24,000-scale) aerial photographs, as an interpretive aid for the smaller-scale (1:12,000) base photographs. The actual interpretation of aerial photography for the Central Platte River involved three basic steps. First, all of the photos were interpreted into broad land-cover and land-use classes based solely on standard photo-interpretation signature characteristics. These included tone, texture, color, pattern, topographic position, size, and shadow. Second, field note overlays and observation point locations were used, if available, to refine the preliminary delineation into the appropriate map units. Using the broad interpretation and site-specific data points, the final interpretation into map units was performed. Finally, in order to ensure completeness and accuracy, digital transfer specialists reviewed all of the interpreted photos for consistency and recommended further review and/or changes where necessary.

Interpreted linework marked on the overlays was then transferred into the GIS database to create land cover/use polygons. Transfer of information from the interpreted aerial photographs to a digital, geo-referenced database involved scanning the Mylar overlays using

two scanners and software systems. ANATech Scansmith Scan-C software (version 4.1) was used to run an Eagle 3640C scanner; each resulting raster image was converted to a vector (line) coverage using the Arc/Info GRIDLINE command in the GRID module for bridge segments 3, 4, 5, 6, and 7. The remaining bridge segments (1, 2, 8-13) were scanned using another vectorizing software, PROVEC (version 3.0), to run a black-and-white Eagle 4080ET scanner. The resulting raster images were vectorized within the PROVEC environment. Each registration point on the interpreted photo was matched electronically to the corresponding registration point on the digital orthophoto for both transfer methods. The line/vector coverage of each photo was then edited to correct scanning flaws using the ARCEDIT module in Arc/Info. Each polygon was attributed according to the features identified during photo-interpretation, along with other pertinent data. The entire transfer and editing sequence was automated via in-house Arc/Info AML programs. Linear features that were not part of an existing polygon were put into a separate coverage.

Process_Date: 1998
Process_Contact:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization: Platte River EIS Office, Reclamation
Contact_Person: Platte River GIS Analyst
Contact_Address:
Address_Type: mailing address
Address: PO 25007, PL-100
City: Denver
State_or_Province: Colorado
Postal_Code: 80225-0007
Country: USA
Contact_Voice_Telephone: 303-445-2096
Contact_Facsimile_Telephone: 303-445-6331
Contact_Electronic_Mail_Address: platte@www.usbr.gov
Hours_of_Service: Monday through Friday, 7:00 a.m. to 4:30 p.m. Mountain Time
Cloud_Cover: 0
Spatial_Data_Organization_Information:
Indirect_Spatial_Reference: USGS 7.5-minute quadrangles for Central Platte River area

Direct_Spatial_Reference_Method: Vector
Point_and_Vector_Object_Information:
SDTS_Terms_Description:
SDTS_Point_and_Vector_Object_Type: GT-polygon composed of chains
Point_and_Vector_Object_Count: 36840
Spatial_Reference_Information:
Horizontal_Coordinate_System_Definition:
Geodetic_Model:
Horizontal_Datum_Name: North American Datum 1983
Ellipsoid_Name: Geodetic Reference System 1980
Semi-major_Axis: 6378137
Denominator_of_Flattening_Ratio: 298.257
Entity_and_Attribute_Information:
Overview_Description:
Entity_and_Attribute_Overview:
Polygon coverages include labels with unique items, (e.g., veg_code - 3 3 i, coded with vegetation classification number). See Supplemental Information above for complete listing of attribute codes and their descriptions. Arc attributed classes 1, 2, 4, 7, 30, 35, 37, and 39 were extracted and put into separate (line) coverages named lca98_x (where x equals the bridge segment number). Some of these arcs remained in the lcu98_x coverages if they also delineated a unique polygon.
Entity_and_Attribute_Detail_Citation:
Platte River EIS Office, PO Box 25007, PL-100, Denver CO 80225
Detailed_Description:
Entity_Type:
Entity_Type_Label: lcu98.dbf
Entity_Type_Definition: Shapefile Attribute Table
Entity_Type_Definition_Source: None
Attribute:
Attribute_Label: Area
Attribute_Definition: Area of polygon
Attribute_Definition_Source: Software computed
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: 15.49079
Range_Domain_Maximum: 8187761.77432
Attribute:
Attribute_Label: Perimeter

Attribute_Definition: Perimeter of polygon
Attribute_Definition_Source: Software computed
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: 24.92747
Range_Domain_Maximum: 91263.31391

Attribute:
Attribute_Label: Lcu98_
Attribute_Definition: Internal feature number
Attribute_Definition_Source: User Defined
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: 2
Range_Domain_Maximum: 1670

Attribute:
Attribute_Label: Lcu98_id
Attribute_Definition: Feature identification number
Attribute_Definition_Source: User Defined
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: 1
Range_Domain_Maximum: 2756

Attribute:
Attribute_Label: Veg_code
Attribute_Definition:
Code for vegetation classification (See Supplemental_Information for complete listing of vegetation codes)
Attribute_Definition_Source: User Defined
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: 1
Range_Domain_Maximum: 42

Attribute:
Attribute_Label: Photo
Attribute_Definition:
Corresponding CIR photo from 9- x 9-inch photos (3-digit number) or cut portions of hardcopy orthophotos (4-digit number)
Attribute_Definition_Source: User Defined
Attribute_Domain_Values:

Range_Domain:
Range_Domain_Minimum: 0
Range_Domain_Maximum: 5095
Attribute:
Attribute_Label: Veg_desc
Attribute_Definition: Description of veg_code numbers
Attribute_Definition_Source: User Defined
Attribute_Domain_Values:
Unrepresentable_Domain: Character field
Attribute:
Attribute_Label: Fp_code
Attribute_Definition: 1998 floodplain code (1 = inside fp, 0 = outside fp)
Attribute_Definition_Source: User Defined
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: 0
Range_Domain_Maximum: 1
Attribute:
Attribute_Label: Welut_code
Attribute_Definition: Code for comparing the 1982 WELUT land cover/use database
Attribute_Definition_Source: User Defined
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: 1
Range_Domain_Maximum: 40
Attribute:
Attribute_Label: Welut_desc
Attribute_Definition: Description of the Welut_code numbers
Attribute_Definition_Source: User Defined
Attribute_Domain_Values:
Unrepresentable_Domain: Character field
Attribute:
Attribute_Label: Fp82_code
Attribute_Definition: 1982 floodplain code (1=inside fp, 0=outside fp)
Attribute_Definition_Source: User Defined
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: 0

Range_Domain_Maximum: 1

Attribute:

Attribute_Label: Tcode

Attribute_Definition: Trend analysis code for comparing 1982 and 1998 datasets

Attribute_Definition_Source: User Defined

Attribute_Domain_Values:

Range_Domain:

Range_Domain_Minimum: 1

Range_Domain_Maximum: 40

Distribution_Information:

Distributor:

Contact_Information:

Contact_Organization_Primary:

Contact_Organization: Bureau of Reclamation

Contact_Person: Platte River GIS Analyst

Contact_Address:

Address_Type: mailing address

Address: PO 25007, PL-100

City: Denver

State_or_Province: CO

Postal_Code: 80225-0007

Country: USA

Contact_Voice_Telephone: 303-445-2096

Contact_Facsimile_Telephone: 303-445-6331

Contact_Electronic_Mail_Address: platte@www.usbr.gov

Hours_of_Service: Monday through Friday, 7:00 a.m. to 4:30 p.m. Mountain Time

Distribution_Liability:

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Standard_Order_Process:

Digital_Form:

Digital_Transfer_Information:

Format_Name: ArcView shapefiles or Arc/Info Interchange
Digital_Transfer_Option:
Offline_Option:
Offline_Media: CD-ROM
Recording_Format: ISO 9660
Fees: Media, Shipping, and Handling
Metadata_Reference_Information:
Metadata_Date: 20000501
Metadata_Review_Date: 20000714
Metadata_Contact:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization: Bureau of Reclamation
Contact_Person: Platte River GIS Analyst
Contact_Address:
Address_Type: Mailing address
Address: PO 25007, PL-100
City: Denver
State_or_Province: CO
Postal_Code: 80225-0007
Country: USA
Contact_Voice_Telephone: 303-445-2096
Contact_Facsimile_Telephone: 303-445-6331
Contact_Electronic_Mail_Address: platte@www.usbr.gov
Hours_of_Service: Monday through Friday, 7:00 a.m. to 4:30 p.m. Mountain Time
Metadata_Standard_Name:
NBII Content Standard for National Biological Information Infrastructure Metadata
Metadata_Standard_Version: FGDC-STD-001-1998
Metadata_Access_Constraints: None
Metadata_Use_Constraints:
None SMMS Metadata report generated 5/31/2000
Generated by mp version 2.5.6 on Mon Nov 20 11:19:54 2000

Platte River (Nebraska) 1982 Surface Cover Type

Metadata:

Identification_Information:

Citation:

Citation_Information:

Originator:

Western Energy and Land Use Team (WELUT) of the U.S. Fish and Wildlife Service, for the Platte River Whooping Crane Habitat Maintenance Trust (Platte River Trust)

Publication_Date: 19831000

Title: Platte River (Nebraska) Surface Cover Type

Geospatial_Data_Presentation_Form: Map

Publication_Information:

Publication_Place: Fort Collins, CO

Publisher: U.S. Fish and Wildlife Service

Description:

Abstract:

Data set contains surface cover/land use types for the Platte River within 3 1/2 miles of the outer edge of the Platte and North Platte Rivers. The three river stretches, proceeding from east to west, extend from Chapman to Overton, (80 river miles); North Platte to Hershey (20 river miles); and the upper end of Lake McConaughy to Lewellen (10 river miles) in a polygon and line format.

Purpose:

To document land cover/use to assist with habitat monitoring in the Big Bend area of the Platte River in Nebraska. The species of primary concern are migratory birds, especially whooping cranes.

Time_Period_of_Content:

Time_Period_Information:

Range_of_Dates/Times:

Beginning_Date: 1983

Ending_Date: 1983

Currentness_Reference:

Ground condition determined by aerial photographs taken September 2 and 3, 1982.

Status:

Progress: Complete

Maintenance_and_Update_Frequency: As needed

Spatial_Domain:

Bounding_Coordinates:

West_Bounding_Coordinate: -102.2147

East_Bounding_Coordinate: -98.0713

North_Bounding_Coordinate: 41.4088

South_Bounding_Coordinate: 40.5602

Keywords:

Theme:

Theme_Keyword_Thesaurus: None

Theme_Keyword: land use

Theme_Keyword: sandhill cranes

Theme_Keyword: surface cover

Theme_Keyword: whooping cranes

Place:

Place_Keyword_Thesaurus: None

Place_Keyword: Nebraska

Place_Keyword: Platte River

Access_Constraints: Restricted, subject to approval by the Platte River Trust

Use_Constraints: Restricted, subject to approval by the Platte River Trust

Native_Data_Set_Environment:

Original dataset created with Map Overlay and Statistical System (MOSS); MOSS files were subsequently converted into Arc/Info coverages.

Data_Quality_Information:

Attribute_Accuracy:

Attribute_Accuracy_Report:

Photography was interpreted by USFWS. Digital data entry was performed off the original photographs.

Logical_Consistency_Report: not available

Completeness_Report:

Data set contains surface cover/land use types for the Platte River in a line/polygon format. No polygons smaller than 0.5 acres were delineated. No point data were entered into the completed database.

Surface cover types which are listed as having "line data present" (see attribute information for this listing) may be represented as either polygon or line data depending on the minimum width of the feature. Five polygons were attributed as 'UNKNOWN'.

The following pertains to the original data and refers to attributes that are no longer included in this

database. A blank attribute indicates that the area was not mapped. The percent of total coverage as computed in the WAMS will be misleading unless the total quadrangle has been mapped.

For data summary purposes, the percent of the area of a quadrangle with a certain cover type should be computed by dividing cover type acres by 'total acreage for attributes' minus acres with a blank attribute. The river segment segment attribute code is composed of an s, standing for segment, and a numeric value, 1 through 14. The numeric value identifies the presence of a specific bridge segment within the river segment. As such, each attribute contains the river/bridge segment intersection.

Lineage:

Process_Step:

Process_Description:

Color-infrared photography taken on September 2 and 3, 1982 at a scale of 1:24,000 was acquired by Horizons, Inc., and interpreted by USFWS (WELUT).

Roost/feed and disturbance file construction steps proceeded through the steps of AMS digitizing, ADDWAMS, and ADDMOSS. Steps 1 through 3 document database construction activities after ADDMOSS. MOSS data files served as input to step 1.

Step 1. Roost/feed and disturbance file construction began by overlaying surface cover (SC) line and polygon datasets onto the appropriate bridge segment boundary/outline. This step utilized the MOSS overlay commands LPOVER for line data and POVERLY for polygon data. The naming conventions used for identifying line and polygon overlay output are LPO#_____ and POV#_____, respectively. Line and polygon SC data which were located outside the bridge segment boundary were removed during the overlay process. If a map's location was included within more than one bridge segment, only one "lpover" and "poverly" dataset was necessary to provide SC data for the bridge segment line and polygon overlay construction step 2.

RVSBS# datasets were constructed by executing the MOSS MERGE command on river segment data within each bridge segment.

Step 2. Bridge segment line and polygon overlay composite datasets were constructed by merging overlaid quads which composed or were within each bridge segment. This step utilized the MOSS MERGE command.

Step 3. Line and polygon roost/feed [BS#RF (line) and BS#PRF (polygon) (# = bridge segment No.)] and development BS#DV (line) and BS#PDV (polygon)] datasets were constructed by selecting specific MOSS map subjects from the appropriate bridge segment line or polygon overlay

file (SCLSEG# OR SCTSEG#) and performing a subject merge. This process utilized the MOSS SELECT (with subject option) and MERGE commands.

Output maps (by bridge segment) included maps for line development, line roost/feed, polygon development, and polygon roost/feed.

Data were transferred on an archive tape provided to the Platte River Trust containing AMS and MOSS files (by quad) to include river segments, surface cover (line), surface cover (polygon); and MOSS files (by quad). MOSS roost/feed and disturbance files (by bridge segment) were also separated into disturbance (line), disturbance (polygon), roost/feed (line) and roost/feed (polygon) files. Intermediate files created during the roost/feed and disturbance database construction steps were not delivered as part of the original contract.

Process_Date: 19830900

Process_Contact:

Contact_Information:

Contact_Person_Primary:

Contact_Person: Sam Williamson

Contact_Organization:

Western Energy and Land Use Team (WELUT) of the Fish & Wildlife Service

Contact_Position: Project Manager, Rapid Assessment Methods Group

Contact_Address:

Address_Type: mailing and physical address

Address: Drake Creekside One, 2627 Redwing Road

City: Fort Collins

State_or_Province: CO

Postal_Code: 80526-2899

Country: USA

Contact_Voice_Telephone: 970-226-9362

Process_Step:

Process_Description:

The Midcontinent Ecological Science Center (MESC-Fort Collins, Colorado) subsequently created an Arc/Info polygon coverage of surface cover for each of the bridge segments using the MOSSARC command. Separate line coverages were also created for the surface cover arcs. Bridge segment coverages then were merged to create one coverage each for surface cover polygons and surface cover lines. Map index lines were removed using the DISSOLVE command.

Process_Date: 19981116

Process_Contact:

Contact_Information:

Contact_Person_Primary:

Contact_Person: Tammy Fancher

Contact_Organization: Midcontinent Ecological Science Center, USGS

Contact_Address:

Address_Type: mailing and physical address

Address: 4512 McMurry Avenue

City: Fort Collins

State_or_Province: CO

Postal_Code: 80525

Country: USA

Contact_Voice_Telephone: 970-226-9306

Spatial_Data_Organization_Information:

Direct_Spatial_Reference_Method: Vector

Point_and_Vector_Object_Information:

SDTS_Terms_Description:

SDTS_Point_and_Vector_Object_Type: GT-polygon composed of chains

Point_and_Vector_Object_Count: 20445

Spatial_Reference_Information:

Horizontal_Coordinate_System_Definition:

Planar:

Grid_Coordinate_System:

Grid_Coordinate_System_Name: Universal Transverse Mercator

Universal_Transverse_Mercator:

UTM_Zone_Number: 14

Transverse_Mercator:

Scale_Factor_at_Central_Meridian: .09996

Longitude_of_Central_Meridian: -99

Latitude_of_Projection_Origin: 0.0

False_Easting: 500000.

False_Northing: 0.0

Planar_Coordinate_Information:

Planar_Coordinate_Encoding_Method: Coordinate pair

Coordinate_Representation:

Abscissa_Resolution: .61

Ordinate_Resolution: .61

Planar_Distance_Units: Meters

Geodetic_Model:

Horizontal_Datum_Name: North American Datum of 1983

Ellipsoid_Name: GRS1980

Semi-major_Axis: 6378137

Denominator_of_Flattening_Ratio: 294.98

Entity_and_Attribute_Information:

Detailed_Description:

Entity_Type:

Entity_Type_Label: sctpltmj.pat

Entity_Type_Definition: Polygon Attribute Table

Entity_Type_Definition_Source: None

Attribute:

Attribute_Label: Area

Attribute_Definition: Area of polygon

Attribute_Definition_Source: Software computed

Attribute_Domain_Values:

Range_Domain:

Range_Domain_Minimum: 138.08870

Range_Domain_Maximum: 69216296.61613

Attribute:

Attribute_Label: Perimeter

Attribute_Definition: Perimeter of polygon

Attribute_Definition_Source: Software computed

Attribute_Domain_Values:

Range_Domain:

Range_Domain_Minimum: 47.76995

Range_Domain_Maximum: 214498.28703

Attribute:

Attribute_Label: sctpltmj#

Attribute_Definition: Internal feature number

Attribute_Definition_Source: Software computed

Attribute_Domain_Values:

Range_Domain:

Range_Domain_Minimum: 2

Range_Domain_Maximum: 20446

Attribute:

Attribute_Label: sctpltmj-id

Attribute_Definition: Feature identification number

Attribute_Definition_Source: User defined

Attribute_Domain_Values:

Range_Domain:

Range_Domain_Minimum: 1

Range_Domain_Maximum: 20445

Attribute:

Attribute_Label: Data

Attribute_Definition:

Type of land use. Listed below are 1) code, 2) minimum polygon, 3) line data present, and 4) definition for each type of land use.

CODE	MINIMUM	LINE	DEFINITIONS

	POLYGON	DATA PRESENT	
FP	N/A	Only	Floodplain: Outer boundary remnant of contiguous natural historic floodplain
CH	0.5AC	No	Channel: The inundated channels, bank to bank (indicates open water)
BB	0.5AC	No	Beach/Bar: Any unvegetated sand bar or gravel/cobble/sand (less than 30% total cover)
WO	0.5AC	YES	Woody: Any woody vegetation over 12 feet tall inside floodplain (greater than 30% cover)
SH	0.5AC	YES	Shrubs: Any woody vegetation 3 to 12 feet tall inside floodplain (greater than 30% cover)
HE	0.5AC	NO	Herbaceous: Includes herbs/woody seedlings under 3 feet tall inside floodplain; also known as 'wet meadows' (greater than 30% cover)
WI	0.5AC	NO	Woody on Island: Any woody vegetation over 12 feet tall on an 'island' (greater than 30% cover). An 'island' for this classification system, is surrounded by water or beach/bar and less than 25 acres in size and 100 meters wide.
SI	0.5AC	NO	Shrubs on Island: Any woody vegetation 3 to 12 feet tall on an 'island' (greater than 30% cover).
HI	0.5AC	NO	Herbaceous on island: Includes herbs/woody seedlings under 3 feet tall on an 'island' (greater than 30% cover)
CO	10AC	NO	Corn: Corn and seed sorghum crops
AL	10AC	NO	Alfalfa: May include both alfalfa and clover
OC	10AC	NO	Other Crops: Any crop not specifically dealt with in the above classes including small grain crops and fallow
WS	0.5AC	YES	Woods/Shrubs: Any tree/shrub stand or row outside the floodplain (greater than 30% cover)
GR	5AC	NO	Grassland: Native grass species outside the floodplain; may show evidence of haying (greater than 30% cover)
OW	0.5AC	YES	Open water: Any open water outside the river channels
EM	0.5AC	NO	Emergents: Any emergent 'wet grassland' vegetation
CD	0.5AC	NO	Commercial Development: Any commercial development
UD	0.5AC	NO	Urban Development: Any housing tract
PA	0.5AC	NO	Paved Road: Any publicly maintained paved road

GA	0.5AC	YES	Gravel Road: Any publicly maintained gravel road
PR	0.5AC	YES	Private Road: Any private road considered as primary; does not include travel lanes within the floodplain
BR	0.5AC	YES	Bridge: Any bridge within the floodplain
PL	0.5AC	YES	Powerline: Any major transmission line
RR	0.5AC	YES	Railroad: Any railroad line
SD	0.5AC	NO	Single Dwelling: Any single dwelling observed
SG	0.5AC	NO	Sand/Gravel Operation: All operations

Attribute_Definition_Source: User Defined

Attribute_Domain_Values:

Range_Domain:

Range_Domain_Minimum: not available

Range_Domain_Maximum: not available

Distribution_Information:

Distributor:

Contact_Information:

Contact_Organization_Primary:

Contact_Organization: Platte River Whooping Crane Habitat Maintenance Trust

Contact_Person: Paul Currier

Contact_Position: Executive Director

Contact_Address:

Address_Type: mailing and physical address

Address: 6611 W Whooping Crane Drive

City: Grand Island

State_or_Province: NE

Postal_Code: 68883-8554

Country: USA

Contact_Voice_Telephone: 308-384-4633

Resource_Description: Platte River (Nebraska) Surface Cover Type

Distribution_Liability:

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Metadata_Reference_Information:

Metadata_Date: 19990606

Metadata_Contact:

Contact_Information:

Contact_Organization_Primary:

Contact_Organization: Bureau of Reclamation

Contact_Address:

Address_Type: mailing and physical address

Address: PO Box 25007, PL-100

City: Denver

State_or_Province: CO

Postal_Code: 80225-0007

Country: USA

Contact_Voice_Telephone: 303-445-2096

Contact_Facsimile_Telephone: 303-445-6331

Contact_Electronic_Mail_Address: <http://www.platteriver.org>

Hours_of_Service: Monday through Friday, 7:00 a.m. to 4:30 p.m. Mountain Time

Metadata_Standard_Name: FGDC Content Standard for Digital Geospatial Metadata

Metadata_Standard_Version: FGDC-STD-001-1998

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Appendix I.

Tables of GIS Map Units and Corresponding NVCS Plant Associations

(referenced on page 4-2 and M-2)

Table I.1. Natural and semi-natural land cover map units and corresponding NVCS plant associations

Map Unit	Description	Provisional NVCS Association (Common Name)
1	Emergents (EM)	*Typha* spp. - *Scirpus* spp. Great Plains Herbaceous Vegetation (Cattail - Bulrush Great Plains Herbaceous Vegetation) *Spartina pectinata* - *Scirpus americanus* Herbaceous Vegetation (Prairie Cordgrass - Three-square Bulrush Herbaceous Vegetation)
10	Shrub - Floodplain (SHF)	*Salix exigua* - *(Cornus drummondii)* Temporarily Flooded Shrubland (Sandbar Willow - (Rough- leaved Dogwood) Temporarily Flooded Shrubland) Weedy Grass / Forb / Short Shrub Great Plains Herbaceous Vegetation (shrubs on islands)
11	Grassland - Upland (UG)	Not sampled for this study because of access
12	Lowland Grasses (LG)	*Andropogon gerardii* - *Panicum virgatum* Mesic Tallgrass Prairie (Big Bluestem - Switchgrass Mesic Tallgrass Prairie) *Poa pratensis* - *(Andropogon gerardii)* Semi-natural Herbaceous Vegetation (Kentucky Bluegrass - (Big Bluestem) Semi-natural Herbaceous Vegetation *Bromus inermis* - *(Andropogon gerardii)* Semi-natural Herbaceous Vegetation (Smooth Brome - (Big Bluestem) Semi-natural Herbaceous Vegetation *Agropyron intermedium* - (*Andropogon gerardii*) Semi-natural Herbaceous Vegetation (Intermediate Wheatgrass - (Big Bluestem) Semi-natural Herbaceous Vegetation See Also: Map Unit 1- Emergents

13 Shrub - Upland (SHO)	Not sampled for this study because of access
15 Wooded - Flood-plain (WR)	*Populus deltoides - Fraxinus pennsylvanica / Cornus drummondii* Temporarily Flooded Woodland (Plains Cottonwood - Green Ash / Rough- leaved Dogwood Temporarily Flooded Woodland) *Fraxinus pennsylvanica - Ulmus* (*rubra, americana*) / *Cornus drummondii* Temporarily Flooded Woodland (Green Ash - Slippery Elm - American Elm / Rough- leaved Dogwood Temporarily Flooded Woodland) *Fraxinus pennsylvanica - (Acer negundo) / Cornus drummondii* Temporarily Flooded Woodland (Green Ash - (Boxelder) / Rough- leaved Dogwood Temporarily Flooded Woodland) *Juniperus virginiana* - (*Morus rubra*) Floodplain Woodland (Eastern Red Cedar - (Red Mulberry) Floodplain Woodland)
16 Wooded - Upland (WO)	*Fraxinus pennsylvanica - Ulmus americana* Woodland Alliance (Green Ash - American Elm Woodland Alliance (Draws)) *Juniperus virginiana* Woodland Alliance (Eastern Red Cedar Woodland Alliance)
17 Mown Lowland Grasses (MWM)	See Map Unit 12: Lowland Grasses
18 Herbaceous Riparian (HR)	Weedy Grass / Forb / Short Shrub Great Plains Herbaceous Vegetation

Table I.2. Non-natural land cover, water, and land use map units

Map Code	Abbr.	Description
2	CH	**Channel**: Active, inundated channels, bank-to-bank (indicates open water).
3	OWC	**Open Water Canal** or drainage ditch.
4	OWS	**Open Water Slough**.
5	OWP	**Open Water Pit**, pond, or lake.
6	BBB	**Barren Beach Bar**: Unvegetated sand bar or gravel/cobble/sand (w/ annual vegetation cover < 30%) within the active channel area.
7	OW	**Open Water**: Any OW outside the river channels. In general, this will include deeper water and not transitory sloughs.
20	AAL	**Agriculture Alfalfa**: May include alfalfa & clover, ditches, or travel lanes.
21	ACO	**Agriculture Corn**: Corn & seed sorghum crops plus ditches or travel lanes.
22	AOC	**Agriculture Other Crops**
23	ABG	**Agriculture Bare Ground**: Fallow fields plus berms and disturbed areas.
24	ASB	**Agriculture Soy Bean**
25	AMF	**Agriculture Mown Field**
26	AWW	**Agriculture Winter Wheat**
30	BR	**Bridge**: Any bridge within the floodplain.
31	DC	**Development Commercial**: Any commercial/industrial development.
32	DR	**Development Residential**: Any housing tract (more than one dwelling).
33	DRS	**Development Residential Single** dwelling
34	PL	**Powerline**: Any major transmission line or electrical substation.
35	RG	**Road Gravel**: Any public maintained gravel road.
36	RI	**Road Interstate**.
37	RP	**Road Paved**: Any public maintained paved road.
38	RR	**Railroad**
39	RS	**Roads**: Other roads, private, does not include travel lanes within the floodplain.
40	SG	**Sand/Gravel**: Areas within sand and gravel operations.
41	SGO	**Sand/Gravel Operation**: All operations.
42	BS	**Barren Surface**: Transportation related rest stops, weigh stations, pull outs.

Appendix J.

Field Key to the Vegetation, Hydrology, and Land Use Map Units of the Central Platte River 1998 Land Cover/Use Mapping Project

(referenced on page 4-2)

KEY TO THE VEGETATION, HYDROLOGY, AND LAND USE TYPES OF THE CENTRAL PLATTE RIVER CORRIDOR

Note: these dichotomous keys are designed to support the vegetation, hydrology, and land use mapping project being undertaken by USFWS and BOR/RSGIG, therefore, the vegetation units identified may contain more than one NVCS plant community or association.

HOW TO USE THIS KEY: 1) examine the vegetation, hydrology, or land use on/of the site on which you are interested, 2) determine the major study category present, using Key I, and 3) refer to the appropriate Key II or III to determine the mapping units.

Key I. A Key to the Major Land Use, Hydrology, Agricultural Crops and Habitat Types of the Central Platte River Corridor.

1. Vegetation absent or highly maintained as landscape or for safety of the traveling public, site developed, in a transportation corridor, inundated, barren, or recently tilled……..…….Key II
1. Vegetation present, includes native and introduced plant species, and Agricultural crops.....……...Key III

Key II. A Key to the Major Land Use, Hydrology, and Barren Ground Sites.

1. Vegetation absent from the site, or in the case of Platte River sand bars, <30% vegetated.....….....2
1. Vegetation may be present, but is associated with developed land use (residential/commercial, transportation, communication), or site of open water (standing or flowing).....…….....6

2. Site a barren to <30% vegetated sand bar or other exposed area within the active channel of the Platte River.....(Map Unit 6) - Barren Beach/Bar
2. Site barren and located outside the active Platte River channel.…….....3

3. Barren site along travel corridor; rest stop, pullout, etc …....……(Map Unit 42) - Barren Surface
3. Barren site of/or within agricultural croplands or sand and gravel operations.....…….....4

4. Site a barren agricultural field or barren berm or disturbed area within cropland..... (Map Unit 23) - Agriculture Bare Ground/Fallow
4. Site of barren land within sand and gravel operations.....5

5. Site an area of barren sand or gravel or sand and gravel piles .....(Map Unit 40) - Sand/Gravel Areas within Sand/Gravel Operations
5. Site containing sand and gravel operation equipment or under active mining .....…...(Map Unit 41) - Sand/Gravel Operation: All Operations

18. Land use of commercial development and associated landscaping .....(Map Unit 31) - Development Commercial
18. Land use of single or multiple residential dwellings and associated landscaping …….....19

19. Land use of more than one residential dwelling.....….....… (Map Unit 32) - Development Residential: Multiple Dwellings
19. Land use of a single dwelling.....……..... (Map Unit 33) - Development Residential: Any Single Dwelling

III. A Key to Agricultural Crops and Habitat Types of the Central Platte River Corridor.

1. Vegetation an agricultural crop (does not include native grasses mown for hay)...2
1. Vegetation a native or exotic wildlife habitat .....……...7

2. Agricultural crop perennial and mown for hay.....….....3
2. Agricultural crop annual row crops...….....4

3. Agricultural crop alfalfa.....(Map Unit 20) - Agriculture Alfalfa
3. Agricultural crop mown, includes grasses.....……...……. (Map Unit 25) - Agriculture Mown Field

4. Agricultural crop annual, broad-leaved.....(Map Unit 24) - Agriculture Soy Bean
4. Agricultural crop annual, grass or grass-like.....….....5

5. Agricultural crop less than 1m tall, wheat harvested by July .....……..(Map Unit 26) - Agriculture Winter Wheat
5. Agricultural crop greater than 1m tall at maturity or is another crop, not winter wheat……6

6. Agricultural crop greater than 1m tall, corn and seed sorghum harvested by November.....(Map Unit 21) - Agriculture Corn
6. Agricultural crops other than those described above.....(Map Unit 22) - Agriculture Other Crops

7. Vegetation woody or appearing woody; predominantly trees and shrubs.....8
7. Vegetation non-woody; predominantly grasses, grass-like herbs, and broad-leaf herbs, some of which may be quite tall and coarse.....11

8. Vegetation woody (trees and tall shrubs), over 4m tall.....9
8. Vegetation woody (shrubs and small trees), 1-4m tall.....10

9. Vegetation woody, over 4m tall, within the Platte River floodplain ..... Map Unit 15) - Wooded: >30% Cover Within Floodplain

9. Vegetation woody, over 4m tall, outside the Platte River floodplain .....(Map Unit 16) - Wooded: >30% Cover Outside Floodplain

10. Vegetation woody, 1-4m tall, within the Platte River floodplain .....…...Map Unit 10) - Shrubs: >30% Cover Within Floodplain

10. Vegetation woody, 1-4m tall, outside the Platte River floodplain .....…..Map Unit 13) - Shrubs: >30% Cover Outside Floodplain

11. Vegetation grasslands, <1m tall, outside the Platte River floodplain .....(Map Unit 11) - Upland Grasses

11. Vegetation grasslands (may be mown), mixed herbaceous species and woody seedlings, or emergent wetlands, 0.5-2m tall, inside the Platte River floodplain.....……...12

12. Vegetation of mixed herbs, grasses, and woody seedlings to 1m tall, inside the Platte River floodplain.....….....(Map Unit 18) - Herbaceous Riparian

12. Vegetation of grasslands or emergent wetlands.....….....13

13. Vegetation of wet depressions, drainages, ditches and other wet soils .....……Map Unit 1) - Emergents: Out of Channel Wetlands

13. Vegetation of mesic grasslands, may be mown, and is usually grazed.....14

14. Vegetation of tall, mesic grasses with <30% cover of herbs, shrubs, or trees .....…….....(Map Unit 12) - Lowland Grassland

14. Vegetation of mown tall, mesic grasses.....……... ……..(Map Unit 17) - Mown Lowland Grassland

Appendix K.

Accuracy Assessment Confidence Interval Calculations

(by Doug Crawford)

(referenced on page 5-4)

Accuracy Assessment Confidence Interval Calculations

1. Large Sampling Sizes (n gt 30).

Class	x	n	p	n x p	np ge 5?	n(1-p)	n(1-p) ge 5?	.2 lt p lt .8?	Result
12 (Actual)	85	92	0.92391	85	True	7	True	False	Use 1a
15 (Actual)	52	54	0.96296	52	True	2	False	False	Use 1a
21 (Actual)	51	53	0.96226	51	True	2	False	False	Use 1a
12 (Int.)	85	94	0.90426	85	True	9	True	False	Use 1a
15 (Int.)	52	55	0.94545	52	True	3	False	False	Use 1a
21 (Int.)	51	53	0.96226	51	True	2	False	False	Use 1a
Overall	222	250	0.888	222	True	28	True	False	Use 1a

x = Number of correct classifications; n = Total samples; p= Ratio of x/n

1a. When any test above was 'false', used the following table to calculate confidence intervals:

Class	x	n	Lower Confidence Limit Degrees of Freedom		Upper Confidence Limit Degrees of Freedom		Lower 90% Conf. Limit	Upper 90% Conf. Limit
			L1 v1	L1 v2	L2 v1	L2 v2		
12 (Actual)	85	92	16	170	172	14	0.862	0.964
15 (Actual)	52	54	6	104	106	4	0.888	0.993
21 (Actual)	51	53	6	102	104	4	0.886	0.993
12 (Int.)	85	94	20	170	172	18	0.839	0.949
15 (Int.)	52	55	8	104	106	6	0.865	0.985
21 (Int.)	51	53	6	102	104	4	0.886	0.993
Overall	222	250	58	444	446	56	0.850	0.919

Formulas:

v1 for L1:	2*(n-x+1)	v1 for L2:	2*(X+1)	Lower CL L1:	x/(x+(n-x+1)*FDIST(0.05,v1,v2,1))
v2 for L1:	2x	v2 for L2:	2*(n-x)	Upper CL L2:	((x+1)*F(.05,v1,v2,1))/(n-x+(x+1)*F(0.05,v1,v2,1))

1b. When all tests are true, used formula in NBS report "Accuracy Assessment Procedures":

None

CI Formula: z*SQRT((p*(1-p))/n))+1/(2*n)

2. For small sampling sizes (n le 30), used Table A-22 in Natrella, "Experimental Statistics" (1963).

Appendix L.

Species List
for the
Central Platte River Mapping Area

(by J. Von Loh)

(referenced on page 4-22)

Common and Representative Plant Species of the Central Platte River

This list of plant species for the Central Platte River is derived from data forms and field notes, from sites where access was permitted, and while representative of the project corridor, is by no means exhaustive. No access was sought to the area outside the Platte River floodplain, so the upland flora is not included here. An alphabetical format is used for convenience, beginning with *Family*, then *Genus* and *Species*. Species nomenclature follows Flora of the Great Plains, 1986.

ACERACEAE: Maple Family
Acer negundo L. — Box elder

AMARANTHACEAE: Pigweed Family
Amaranthus sp. — Pigweed

ANACARDIACEAE: Cashew Family
Toxicodendron rydbergii (Small) Greene — Poison ivy

APIACEAE: Carrot Family
Sanicula canadensis L. — Black snakeroot

APOCYNACEAE: Dogbane Family
Apocynum cannabinum L. — Indian hemp/Prairie dogbane

ASCLEPIADACEAE: Milkweed Family
Asclepias incarnata L. — Swamp milkweed
A. speciosa Torr. — Showy milkweed
A. syriaca L. — Common milkweed
A. verticillata L. — Whorled milkweed

ASTERACEAE: Sunflower Family
Achillea millifolium L. — Yarrow
Ambrosia artemisiifolia L. — Common ragweed
A. psilostachya DC. — Western ragweed
A. trifida L. — Giant ragweed
Arctium minus Bernh. — Common burdock
Artemisia dracunculus L. — Silky wormwood
A. ludoviciana Nutt. — White sage
Aster simplex Willd. — Panicled aster
Carduus nutans L. — Musk thistle
Cirsium altissimum (L.) Spreng. — Tall thistle
C. flodmanii (Rydb.) Arthur — Flodman's thistle
C. vulgare (Savi) Ten. — Bull thistle
Conyza canadensis (L.) Cronq. — Horse-weed
Erigeron philadelphicus L. — Fleabane
Erigeron sp. — Fleabane
Eupatorium perfoliatum L. — Boneset
Helenium autmnale L. — Sneezeweed
Helianthus annuus L. — Common sunflower
H. maximilianii Schrad. — Maximilian sunflower
Iva annua L. — Marsh elder
Lactuca ludoviciana (Nutt.) Ridd. — Western wild lettuce
L. oblongifolia Nutt. — Blue lettuce
L. serriola L. — Prickly lettuce
Ratibida columnifera (Nutt.) Woot. & Standl. - Prairie coneflower
Rudbeckia hirta L. — Black-eyed susan
Solidago canadensis L. — Canada goldenrod
S. gigantea Ait. — Late goldenrod
Solidago sp. — Goldenrod
Taraxacum officianale Weber — Common dandelion
Tragopogon dubius Scop. — Goat's beard/Western salsify
Vernonia baldwinii Torr. — Western ironweed
V. fasciculata Michx. — Ironweed

BORAGINACEAE: Borage Family
Lappula redowskii (Hornem.) Greene — Stickseed

BRASSICACEAE: Mustard Family
Camelina microcarpa Andrz. Ex DC. — Small-seeded false-flax
Lepidium densiflorum Schrad. — Peppergrass

CACTACEAE: Cactus Family
Opuntia polyacantha Haw. — Plains prickly-pear

CANNABACEAE: Hemp Family
Cannabis sativa L. — Hemp

CAPRIFOLIACEAE: Honeysuckle Family
Symphoricarpos occidentalis Kook. — Western snowberry/Wolfberry
S. orbiculatus Moench. — Coralberry/Buckbrush

CHENOPODIACEAE: Goosefoot Family
Chenopodium album L. — Lamb's quarters
Kochia scoparia (L.) Schrad. — Kochia/Fireweed

CONVOLVULACEAE: Morning-glory Family
Calystegia sepium (L.) R. Br. — Hedge bindweed

CORNACEAE: Dogwood Family
Cornus drummondii C. A. Mey. — Rough-leaved dogwood

CUPRESSACEAE: Cypress Family
Juniperus virginiana L. — Eastern red cedar

CYPERACEAE: Sedge Family
Carex brevior (Dew.) Mack. Ex Lunell. — Sedge
C. eleocharis Bailey. — Sedge
C. emoryi Dew. — Sedge
Carex sp. — Sedge
Eleocharis sp. — Spikerush
Scirpus americanus Pers. — Three-square bulrush
S. fluviatalis (Torr.) A. Gray — River bulrush
Scirpus validus Vahl. — Soft-stem bulrush
Scirpus sp. — Bulrush

ELAEAGNACEAE: Oleaster Family
Elaeagnus angustifolia L. — Russian-olive
Shepherdia argentea (Pursh) Nutt. — Silver buffaloberry

EQUISITACEAE: Horsetail Family
Equisetum arvense L. — Field horsetail
E. laevigatum A. Br. — Smooth scouring rush

EUPHORBIACEAE: Spurge Family
Croton sp. — Croton
Euphorbia esula L. — Leafy spurge
E. marginata Pursh — Snow-on-the-mountain
Euphorbia sp. — Spurge

FABACEAE: Pea Family
Amorpha fruticosa L. — False indigo
Dalea purpurea Vent. — Purple prairie clover
Desmodium illinoense A. Gray — Illinois tickclover
Glycyrrhiza lepidota Pursh — Wild licorice
Medicago lupulina L. — Black medic

M. sativa L.	Alfalfa
Melilotus alba Medic.	White sweetclover
M. officianalis (L.) Pall.	Yellow sweetclover
Psoralea argophylla Pursh	Silver-leaf scurf pea
Trifolium repens L.	White clover/Ladino clover
IRIDACEAE: Iris Family	
Sisyrinchium campestre Bickn.	White-eyed grass
JUNCACEAE: Rush Family	
Juncus balticus Willd.	Baltic rush/Arctic rush
Juncus dudleyi Wieg.	Dudley rush
Juncus torreyi Cov.	Torrey rush
LAMIACEAE: Mint Family	
Lycopus americana Muhl. Ex Bart.	American bugleweed
Marrubium vulgare L.	Common horehound
Mentha arvensis L.	Field mint
Nepeta cataria L.	Catnip
Teucrium canadense L.	American germander/Wood sage
LILIACEAE: Lily Family	
Allium textile A. Nels. & Macbr.	Onion
Asparagus officianalis L.	Asparagus
Smilacina stellata (L.) Desf.	Spikenard
MALVACEAE: Mallow Family	
Malva neglecta Wallr.	Common mallow
Callirhoe involucrata (T. & G.) A. Gray	Purple poppy mallow
MIMOSACEAE: Mimosa Family	
Desmanthus illinoensis (Michx.) MacM.	Illinois bundleflower
MORACEAE: Mulberry Family	
Morus alba L.	White mulberry
M. rubra L.	Red mulberry
OLEACEAE: Olive Family	
Fraxinus pennsylvanica Marsh.	Green ash
ONAGRACEAE: Evening-primrose Family	
Oenothera biennis L.	Common evening-primrose
OXALIDACEAE: Wood Sorrel Family	
Oxalis sp.	Wood sorrel
PLANTAGINACEAE: Plantain Family	
Plantago major L.	Common plantain
P. patagonica Jacq.	Patagonian plantain
POACEAE: Grass Family	
Agropyron intermedium (Host) Beauv.	Intermediate wheatgrass
A. repens (L.) Beauv.	Quackgrass
Agrostis stolonifera L.	Redtop
Andropogon gerardii Vitman	Big bluestem
Aristida purpurea Nutt.	Purple three-awn
Bouteloua curtipendula (Michx.) Torr.	Sideoats grama
B. gracilis (H.B.K.) Lag. Ex Griffths	Blue grama
Bromus inermis Leyss.	Smooth brome
B. japonicus Thunb. Ex Murr.	Japanese brome
B. tectorum L.	Cheatgrass/Downy brome
Calamagrostis stricta (Timm.) Koel.	Reedgrass
Calamovilfa longifolia (Hook.) Scribn.	Prairie sandreed
Chloris verticillata Nutt.	Windmill grass
Dactylis glomerata L.	Orchardgrass
Dicanthelium oligosanthes (Schult.) Gould	Scribner dichanthelium
D. wilcoxianum (Vasey) Freckmann	Wilcox dichanthelium
Digitaria sanguinalis (L.) Scop.	Hairy crabgrass
Distichlis spicata (L.) Greene	Inland saltgrass
Echinochloa crus-galli (L.) Beauv.	Barnyard grass
Eleusine indica (L.) Gaertn.	Goosegrass
Elymus canadensis L.	Canada wild rye
E. virginicus L.	Virginia wild rye
Festuca arundinacea Schreb.	Tall fescue
Hordeum jubatum L.	Foxtail barley
H. pusillum Nutt.	Little barley
Koeleria pyramidata (Lam.) Beauv.	Junegrass
Leersia oryzoides (L.) Sw.	Rice cutgrass
Muhlenbergia schreberi J. F. Gmel.	Nimblewill
Muhlenbergia sp.	Muhlenbergia
Panicum capillare L.	Common witchgrass
P. virgatum L.	Switchgrass
Pascopyrum smithii Rydb.	Western wheatgrass
Paspalum setaceum Michx.	Paspalum
Paspalum sp.	Paspalum
Phalaris arundinacea L.	Reed canarygrass
Phleum pratense L.	Timothy
Phragmites australis (Cav.) Trin. Ex Steud.	Common reed
Poa compressa L.	Canada bluegrass
P. pratensis L.	Kentucky bluegrass
Schizachyrium scoparium Michx.	Little bluestem
Setaria viridis (L.) Beauv.	Green foxtail
Setaria sp.	Foxtail
Spartina pectinata Link	Prairie cordgrass
Sporobolus asper (Michx.) Kunth	Rough dropseed
S. cryptandrus (Torr.) A. Gray	Sand dropseed
Stipa comata Trin. & Rupr.	Needle-and-thread
Triplasis purpurea (Walt.) Chapm.	Sandgrass
POLYGONACEAE: Buckwheat Family	
Polygonum persicaria L.	Lady's thumb
P. punctatum Ell.	Water smartweed
Rumex altissimus Wood.	Pale dock
Rumex crispus L.	Curly dock
RANUNCULACEAE: Buttercup Family	
Clematis ligusticifolia Nutt.	Western clematis
Ranunculus sp.	Buttercup
RHAMNACEAE: Buckthorn Family	
Rhamnus lanceolata Pursh	Lance-leaved buckthorn
ROSACEAE: Rose Family	
Geum canadense Jacq.	White avens
Potentilla norvegica L.	Norwegian cinquefoil
Prunus virginiana L.	Choke cherry
Rosa arkansana Porter	Prairie wild rose
R. woodsii Lindl.	Western wild rose
RUBIACEAE: Madder Family	
Galium aparine L.	Catchweed bedstraw
G. boreale L.	Northern bedstraw
Galium sp.	Bedstraw
RUTACEAE: Citrus Family	
Zanthoxylum americanum P. Mill.	Prickly ash
SALICACEAE: Willow Family	
Populus deltoides Marsh.	Eastern cottonwood
Salix amygdaloides Anderss.	Peachleaf willow
S. exigua Nutt.	Sandbar willow/Coyote willow
S. nigra Marsh.	Black willow
SAXIFRAGACEAE: Saxifrage Family	
Heuchera richardsonii R. Br.	Alumroot
SCROPHULARIACEAE: Figwort Family	
Mimulus ringens L.	Alleghany monkey-flower
Verbascum thapsus L.	Common mullein

SMILACACEAE: Catbriar Family

Smilax herbacea L.	Carrion-flower

SOLANACEAE: Potato(e) Family

Physalis heterophylla Nees	Clammy ground cherry
Solanum interius Rydb.	Plains black nightshade
S. rostratum Dun.	Buffalo bur

TAMARICACEAE: Tamarisk Family

Tamarix ramosissima Ledeb.	Salt cedar

TYPHACEAE: Cattail Family

Typha latifolia L.	Broad-leaved cattail

ULMACEAE: Elm Family

Celtis occidentalis L.	Hackberry
Ulmus americana L.	American elm
Ulmus pumila L.	Siberian elm
U. rubra Muhl.	Slippery elm

URTICACEAE: Nettle Family

Bohmeria cylindrica (L.) Sw.	False nettle
Urtica dioica L.	Stinging nettle

VERBENACEAE: Vervain Family

Lippia lanceolata (Michx.) Greene	Northern fog-fruit
Verbena bracteata Lag. & Rodr.	Prostrate vervain
V. hastata L.	Blue vervain
V. stricta Vent.	Hoary vervain
V. urticifolia L.	Nettle-leaved vervain

VIOLACEAE: Violet Family

Viola pratincola Greene	Blue prairie violet

VITACEAE: Grape Family

Parthenocissus quinquefolia (L.) Planch.	Virginia creeper
Vitis riparia Michx.	River-bank grape

Appendix M.

Preliminary NVCS Descriptions

(by J. Von Loh)

(referenced on page 4-2)

The following preliminary NVCS descriptions are based on an office review of field data collected during 1999. These data require a more intensive evaluation using The Nature Conservancy's PLOTS software for final NVCS classification. TNC's quantitative analysis includes using ordination techniques (Detrended Correspondence Analysis and Non-Metric Multidimensional Scales), a clustering algorithm, Unweighted Pair-Group Method Using Arithmetic Means, and Two-Way Indicator Species Analysis.

As a result of initial data review, two woodland communities, one shrub community, two grass communities, one grassland alliance, and one emergent wetland were described. The grassland alliance includes *Bromus inermis*, *Poa pratensis*, and *Agropyron intermedium*, exotic grass species which are widely distributed in the Platte River floodplain. Further analyses of field data may result in each of these dominant, exotic grass species being described at the association/community level, as they are listed in Appendix I (Natural and Semi-natural Vegetation Map Units and Corresponding NVCS Plant Associations). Another provisional vegetation alliance that may be described under these exotic grass associations is the weedy grass / forb / short shrub Great Plains herbaceous vegetation type.

Woodland communities, too, may be differently aligned following thorough data analyses. In particular, a woodland association dominated by *Juniperus virginiana* could emerge. Those provisional woodland types where *Fraxinus pennsylvanica* is the dominant tree would most likely be merged into one association following data analysis.

Spartina pectinata - Scirpus pungens Herbaceous Vegetation

COMMON NAME:	Prairie Cordgrass - Three-square Bulrush Herbaceous Vegetation
SYNONYM:	Prairie Cordgrass - Three-square Bulrush Wet Meadow
PHYSIOGNOMIC CLASS:	Herbaceous Vegetation (V.)
PHYSIOGNOMIC SUBCLASS:	Perennial graminoid vegetation (V.A.)
PHYSIOGNOMIC GROUP:	Temperate or Subpolar grassland (V.A.5)
PHYSIOGNOMIC SUBGROUP:	Natural/Semi-natural (V.A.5.N.)
FORMATION:	Temporarily flooded temperate or subpolar grassland (V.A.N.j)
ALLIANCE:	SPARTINA PECTINATA TEMPORARILY FLOODED HERBACEOUS ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL: Unknown

USFWS WETLAND SYSTEM: Palustrine

RANGE

Central Platte River

Prairie cordgrass - three-square bulrush wetlands occasionally occur along the Platte River in central Nebraska, occupying moist to saturated soils on the upper margins of emergent wetlands and the lower margins of big bluestem- switchgrass tallgrass prairie stands. Stands occupy old channels, oxbows, and depressions that have near-to-surface ground water tables.

Globally

This type is found in the northwestern to central Great Plains in eastern Montana, western North and South Dakota, central Nebraska, and central Kansas. Prairie cordgrass wetlands are common within Cheyenne Bottoms Wildlife Area of central Kansas occupying moist to saturated soils on the upper margins of cattail wetlands and the lower margins of western wheatgrass - inland saltgrass stands.

ENVIRONMENTAL DESCRIPTION

Central Platte River

Prairie cordgrass - three-square bulrush wetlands occur in shallow drainages, depressions, along river and channel banks, and along canals and ditches.

Globally

At Wind Cave and Badlands NPs in South Dakota, stands occur in drainage bottoms where soil is wet for at least part of the growing season. At Theodore Roosevelt NP in North Dakota, stands occupy old oxbow depressions in the floodplain of the Little Missouri River. Prairie cordgrass stands occur mostly on the upper margin of the Cheyenne Bottoms (Kansas) basin and along drainages, canals, and ditches.

MOST ABUNDANT SPECIES

Central Platte River

Stratum	Species
Herbaceous	*Spartina pectinata, Scirpus pungens*

Globally

Stratum	Species
Graminoid	*Spartina pectinata*

CHARACTERISTIC SPECIES

Central Platte River

Spartina pectinata, Scirpus pungens

Globally

Spartina pectinata

OTHER NOTABLE SPECIES
Central Platte River
Hordeum jubatum

Globally

Stratum	Species
Graminoid	*Carex nebrascencis, Hordeum jubatum*

VEGETATION DESCRIPTION
Central Platte River
In the Platte River floodplain, prairie cordgrass - three-square bulrush stands are moderate in size and sometimes linear in shape when growing in abandoned side channels or along river and flowing channel banks. Aerial cover is dense, between 75-100%, and prairie cordgrass (*Spartina pectinata*) is the dominant species of most stands. Some stands are co-equally dominated by prairie cordgrass and three-square bulrush (*Scirpus pungens*), and the cover values of these stands exceeds 75%, as well. Stands that are completely dominated by three-square bulrush are classified under the *Typha* spp. - *Scirpus* spp. Great Plains Herbaceous Vegetation type.

Globally
At Wind Cave and Badlands NPs in South Dakota and Theodore Roosevelt NP in North Dakota, this type has dense herbaceous cover, greater than 75% to 100%. Species dominance ranges from patchy, with various graminoids, to abundant excluding other species. In sampled stands, *Spartina pectinata, Carex nebrascensis, Eleocharis palustris, Hordeum jubatum,* and *Pascopyrum smithii* are the most commonly associated species. Species richness is generally low. The stands occupy moist soils and occur adjacent to *Eleocharis palustris, Polygonum amphibium, Typha angustifolia, Typha latifolia,* and *Scirpus americanus* (=*Scirpus pungens*) stands, these latter stands occupying saturated to inundated soils. Adjacent uplands are typically vegetated by *Pascopyrum smithii*. Prairie cordgrass stands in Cheyenne Bottoms (Kansas) are relatively large and always dense, excluding understory vegetation. Aerial cover is typically estimated at 75-100%. Prairie cordgrass (*Spartina pectinata*) is the dominant species and in most stands forms a monotype, merging with adjacent communities within narrow ecotones. The stands occupy moist soils and occur adjacent to western wheatgrass (*Pascopyrum smithii*) and inland saltgrass (*Distichlis spicata*) stands on drier soils and narrow-leaved cattail (*Typha angustifolia*) stands on saturated to inundated sites.

CONSERVATION RANK
Unknown. This type has a relatively restricted distribution, and occurs in somewhat specialized wetland habitats in an arid climate. In addition, many such wetland sites are subject to grazing pressure, often heavy, because cattle favor these moist sites. No element occurrences have been documented for this type, but at least several stands occur within three National Parks in the western Dakotas, a Wildlife Area in central Kansas, and along the Platte River in central Nebraska.

DATABASE CODE: Unknown

MAP UNITS
Prairie cordgrass stands are mapped as Class 1 (Emergents) on the Central Platte River vegetation map.

SIMILAR ASSOCIATIONS
Spartina pectinata - Calamagrostis stricta - Carex spp. Herbaceous Vegetation (This is the northern tallgrass region equivalent of 1477).
Spartina pectinata - Scirpus pungens Herbaceous Vegetation (This association may simply need to be split between a *Scirpus pungens* association and a *Spartina pectinata* association).

COMMENTS
Central Platte River

Prairie cordgrass stands tend to share dominance with three-square bulrush, and more stands are present that are completely dominated by three-square bulrush

Globally

Sites may occasionally flood from rivers or ponding of depressions. Prairie cordgrass stands in central Kansas are large, occupying the edge of a shallow basin and the margins of drainages, canals, and ditches.

REFERENCES

Brooks, R. E. and C. Kuhn. 1987. The vegetation of Cheyenne Bottoms in Cheyenne Bottoms: An Environmental Assessment. Kansas Biological Survey and Kansas Geological Survey. Kansas Game and Fish Commission, Contract #112. University of Kansas Grant #5447-0705. Lawrence, KS. 719pp.

Cogan, D., H. Marriott, J. Von Loh, and M. Pucherelli. 1999. USGS-NPS Vegetation Mapping Program, Wind Cave National Park, South Dakota: Final Report. Technical Memorandum #8260-99-03. U. S. Bureau of Reclamation Technical Service Center. Denver, Colorado. 77 pp. + Appendices.

Culwell, L.D. and K.L. Scow. 1982. Terrestrial vegetation inventory: Dominy Project Area, Custer County, Montana. 1979-1980. Unpublished technical report for Western Energy Company by Westech, Helena, Montana. 144 pp. + 15 pp. Appendix.

Von Loh, J., D. Cogan, D. Faber-Langendoen, D. Crawford, and M. Pucherelli. 1999. USGS-NPS Vegetation Mapping Program, Badlands National Park, South Dakota: Final Report. Technical Memorandum #8260-00-02. U. S. Bureau of Reclamation Technical Service Center. Denver, Colorado. 67 pp. + Appendices.

Von Loh, J., D. Cogan, J. Butler, D. Faber-Langendoen, D. Crawford, and M. Pucherelli. 2000. USGS-NPS Vegetation Mapping Program, Theodore Roosevelt National Park, North Dakota: Final Report. Technical Memorandum #8260-00-04. U. S. Bureau of Reclamation Technical Service Center. Denver, Colorado. 89 pp. + Appendices.

Von Loh, J. and J. Oliver. 1999. 1998 Annual Report - Geographic Information System Database, Cheyenne Bottoms Wildlife Area, Kansas. Technical Memorandum #8260-99-04. U. S. Bureau of Reclamation Technical Service Center. Denver, Colorado. 40 pp. + Appendices.

Typha spp. - Scirpus spp. - Mixed Herbs Great Plains Herbaceous Vegetation

COMMON NAME: Cattail species - Bulrush species - Mixed Herbs Great Plains Herbaceous Vegetation
SYNONYM: Great Plains Cattail - Bulrush Marsh
PHYSIOGNOMIC CLASS: Herbaceous Vegetation (V.)
PHYSIOGNOMIC SUBCLASS: Perennial graminoid vegetation (V.A.)
PHYSIOGNOMIC GROUP: Temperate or subpolar grassland (V.A.5.)
PHYSIOGNOMIC SUBGROUP: Natural/Semi-natural (V.A.5.N)
FORMATION: Semipermanently flooded temperate or subpolar grassland (V.A.5.N.l)
ALLIANCE: TYPHA (ANGUSTIFOLIA, LATIFOLIA) - (SCIRPUS SPP.) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL: 2

USFWS WETLAND SYSTEM: Palustrine

RANGE
Central Platte River
Broad-leaved cattail (*Typha latifolia*) stands grow on saturated to inundated soils around ponds, in depressions, and along river channels, drainages, ditches, and canals. Often, three-square bulrush (*Scirpus pungens*) is either co-dominant or is the stand dominant within the Platte River floodplain.

Globally
This community ranges broadly over the Great Plains of the United States.

ENVIRONMENTAL DESCRIPTION
Central Platte River
Broad-leaved cattail (*Typha latifolia*) wetlands occupy shallow to moderately deep standing water and saturated soils. Smaller stands occupy ponds, drainages, canal banks, and ditches, often completely vegetating shallower ditches. Small depressions in other wetland communities, e.g., prairie cordgrass (*Spartina pectinata*) are usually dominated by broad-leaved cattail (*Typha latifolia*) or three-square bulrush (*Scirpus pungens*).

Globally
Cattail - Bulrush stands occur in basin-like depressions, backwater areas of floodplains and shallow margins of lakes and ponds. Hydrology varies from seasonally flooded to semipermanently flooded.

MOST ABUNDANT SPECIES
Central Platte River

Stratum	Species
Herbaceous	*Scirpus pungens, Typha latifolia, Hordeum jubatum, Juncus balticus*

Globally

Stratum	Species
Herbaceous	*Scirpus acutus, Scirpus tabernaemontani, Typha angustifolia, Typha latifolia*

CHARACTERISTIC SPECIES
Central Platte River
Typha latifolia, Scirpus pungens, Hordeum jubatum

Globally
Scirpus acutus, Scirpus tabernaemontani, Typha angustifolia

OTHER NOTABLE SPECIES
Central Platte River

Andropogon gerardii, Panicum virgatum, Rumex crispus, Poa pratensis, Phalaris arundinacea

Globally

Stratum	Species
Graminoid	*Eleocharis palustris, Leersia oryzoides*

VEGETATION DESCRIPTION

Central Platte River

Areas occupied by broad-leaved cattail (*Typha latifolia*) are relatively small, e.g., the bottoms of deeper depressions, on seeps, and linear strips along pond margins, river channels, and water conveyance structures. Larger emergent wetlands along the Platte River are dominated by three-square bulrush (*Scirpus pungens*) and occupy more extensive drainage channels and depressions. These emergent wetlands are quite diverse, with curly dock *(Rumex crispus*), foxtail barley *(Hordeum jubatum*), smooth brome *(Bromus inermis*), reed canarygrass (*Phalaris arundinacea*), Kentucky bluegrass (*Poa pratensis*), Arctic rush (*Juncus balticus*), and switchgrass (*Panicum virgatum*) all providing up to 25% aerial cover depending on the location.

Globally

Vegetation varies from zones dominated by tall emergents, 1-2m tall to those with floating-leaved or submerged aquatics in the deeper margins and perennial forbs <1m tall in the shallower margins. In the tall emergent zone, *Scirpus* spp. (*tabernaemontani, fluviatilis, acutus*) and *Typha* spp. (*angustifolia, latifolia*) may dominate, with a variety of other herbaceous species, such as *Leersia oryzoides, Eleocharis palustris, Juncus* spp., and *Sparganium* spp. Floating-leaved and submerged aquatics are sometimes present, including *Azolla caroliniana, Lemna* spp., *Spirodela polyrrhiza*, and *Potamogeton* spp. (Steinauer and Rolfsmeier 1997). In a recent study by Von Loh and Oliver (1999) dense, nearly monotypic stands of narrow-leaved cattail covered approximately 7,000 acres of the 19,857 acre Cheyenne Bottoms, Kansas site.

CONSERVATION RANK: G4G5. Although sometimes occurring in small patches in the Great Plains, this relatively simple floristic association may be very widespread. Brooks and Kuhn (1987) state that the type dominated by narrow-leaved cattail (*Typha angustifolia*) is known in every county in Kansas, but that prior to 1950 the species was virtually unrecorded in the state.

DATABASE CODE: CEGL002228

MAP UNITS

Cattail-Bulrush wetlands are mapped as Class 1 (Emergents) on the Platte River vegetation map when larger than the minimum mapping unit. Small stands are often include in the larger Lowland Grassland mapping unit (12).

SIMILAR ASSOCIATIONS

Scirpus tabernaemontani - Typha spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation
Scirpus tabernaemontani Temperate Herbaceous Vegetation
Typha latifolia Western Herbaceous Vegetation
Typha spp. Great Plains Herbaceous Vegetation

COMMENTS

Central Platte River

Cattail stands are not the most common emergent community in the Platte River Valley. Much of this association is dominated by three-square bulrush, indicating a high reliance on near-to-surface groundwater, rather than seeps, springs, and surface flows. It is also possible that the water present in these sites is too alkaline or fluctuates to widely to support cattail or other bulrush species.

REFERENCES

Brooks, R. E. and C. Kuhn. 1987. The Vegetation of Cheyenne Bottoms in Cheyenne Bottoms: An Environmental Assessment. Kansas Biological Survey and Kansas Geological Survey. Kansas Fish and Game Commission, Contract #112. University of Kansas Grant #5447-0705. Lawrence, Kansas. 719 pp.

Steinauer, G. and S. Rolfsmeier. 1997. Terrestrial natural communities of Nebraska. Draft - 1997. Nebraska Game and Parks Commission. Lincoln, Nebraska. 117 pp.

Von Loh, J., D. Cogan, D. Faber-Langendoen, D. Crawford, and M. Pucherelli. 1999. USGS-NPS Vegetation Mapping Program, Badlands National Park, South Dakota: Final Report. Technical Memorandum #8260-00-02. U. S. Bureau of Reclamation Technical Service Center. Denver, Colorado. 67 pp. + Appendices.

Von Loh, J. and J. Oliver. 1999. 1998 Annual Report - Geographic Information System Database, Cheyenne Bottoms Wildlife Area, Kansas. Technical Memorandum #8260-99-04. U. S. Bureau of Reclamation Technical Service Center. Denver, Colorado. 40 pp. + Appendices.

Bromus inermis - Poa pratensis - Agropyron intermedium (Andropogon gerardii) Semi-natural Herbaceous Vegetation

COMMON NAME:	Smooth Brome - Kentucky Bluegrass - Intermediate Wheatgrass (Big Bluestem) Semi-natural Herbaceous Vegetation
SYNONYM:	Introduced Grassland
PHYSIOGNOMIC CLASS:	Herbaceous Vegetation (V.)
PHYSIOGNOMIC SUBCLASS:	Perennial graminoid vegetation (V.A.)
PHYSIOGNOMIC GROUP:	Temperate or subpolar grassland (V.A.5.)
PHYSIOGNOMIC SUBGROUP:	Natural/Semi-natural (V.A.5.N.)
FORMATION:	Medium-tall bunch temperate or subpolar grassland (V.A.5.N.d.)
ALLIANCE:	BROMUS INERMIS - POA PRATENSIS - AGROPYRON INTERMEDIUM (ANDROPOGON GERARDII) SEMI-NATURAL HERBACEOUS ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL: Unknown

USFWS WETLAND SYSTEM: Terrestrial

RANGE

Central Platte River

This grassland type occupies revegetated roadsides and ditchbanks, has been introduced into pastures and fields for a hay crop, and is present on historically farmed lands. Many areas of formally native grasslands have been invaded by these exotic species.

Globally

The type occurs widely throughout the northern and central Great Plains, wherever pastures and grass hay crops have been planted, disturbed lands have been revegetated with exotic species, and native grasslands have been "improved" using exotic species.

ENVIRONMENTAL DESCRIPTION

Central Platte River

Smooth brome (*Bromus inermis*), Kentucky bluegrass (*Poa pratensis*), and intermediate wheatgrass (*Agropyron intermedium*) are found in a wide variety of habitats within the Platte River floodplain. They are especially prominent along roadways (introduced for erosion control plantings), tame pastures, grass hay fields, and in historic agricultural fields (introduced as grass hay crops then allowed to "go-back"), where they have spread into native grasslands.

Globally

This type can occur in a wide variety of human-disturbed habitats, including highway rights-of-way, pastures and hay fields, abandoned crop fields, and landscape plantings; it has escaped into a variety of native habitats.

MOST ABUNDANT SPECIES

Central Platte River

Stratum	Species
Herbaceous	*Bromus inermis, Poa pratensis, Agropyron intermedium*

Globally

Stratum	Species
Graminoid	*Bromus inermis, Poa pratensis, Agropyron intermedium*

CHARACTERISTIC SPECIES

Central Platte River

Bromus inermis, Poa pratensis, Agropyron intermedium, Bromus japonicus, Ambrosia psilostachya, Solidago gigantea, Verbena stricta, Melilotus alba, Melilotus officianalis, Conyza canadensis

Globally
Bromus inermis, Poa pratensis, Agropyron intermedium, Pascopyrum smithii, Andropogon gerardii

OTHER NOTABLE SPECIES
Central Platte River
Panicum virgatum, Festuca arundinacea, Agrostis stolonifera, Phleum pratense, Dactylis glomerata, Helianthus maximilianii, Medicago lupulina

VEGETATION DESCRIPTION
Central Platte River
Stands of introduced grasses typically have moderate to heavy herbaceous cover, ranging from 75-100%, and produce very dense litter over the ground surface if they are not mown or grazed. They are dominated by exotic medium-tall graminoids and medium to tall forbs. Along the Platte River, a native component is still present, typically the tall grasses big bluestem (*Andropogon gerardii*) and switchgrass (*Panicum virgatum*). Native grasses rarely exceed 25% vegetative cover in these grasslands. Along roadsides, smooth brome (*Bromus inermis*) is strongly dominant, while pastures, hay fields, and abandoned agricultural fields are much more diverse.

Globally
This vegetation is dominated by medium-tall graminoids. The dominant grasses include *Bromus inermis*, *Poa pratensis*, and *Agropyron intermedium*, naturalized species from Europe and Asia. Other weedy species may occur as well, but native species are generally less than 10% cover. Native species may include mixed-grass prairie grasses, including *Pascopyrum smithii*.

CONSERVATION RANK: GW. This is a naturalized type from Europe and Asia, widely planted for cover, pasture, and hay, and has escaped into a variety of habitats.

DATABASE CODE: CEGL005264

MAP UNITS
Smooth brome, Kentucky bluegrass, and intermediate wheatgrass grasslands are mapped as part of the Lowland Grassland Map Unit (12). Where grown for grass hay, this type may be mapped under Agricultural Mown Field (Map Unit 25), or Agriculture Other Crops (Map Unit 22).

SIMILAR ASSOCIATIONS
Central Platte River
There are several minor associations of introduced grass species, including orchardgrass (*Dactylis glomerata*), timothy (*Phleum pratense*), fescue (*Festuca arundinacea*), and crested wheatgrass (*Agropyron cristatum*).

COMMENTS
Central Platte River
Introduced grasslands are present because of disturbance related to pasture and crop introduction, roadway construction projects and subsequent revegetation, and because of historic agricultural activity. Some historic agricultural fields in the region have been planted to native tallgrass and mixedgrass prairie grasses, as well. Nearly all of these introduced fields are either mown or grazed annually, or both.

Globally
This type could be defined very broadly to include almost any *Bromus inermis, Poa pratensis,* or *Agropyron intermedium* dominated stand, in which case the variability of the minor species associated with the type may be very high.

REFERENCES
Cogan, D., H. Marriott, J. Von Loh, and M. Pucherelli. 1999. USGS-NPS Vegetation Mapping Program, Wind Cave National Park, South Dakota: Final Report. Technical Memorandum #8260-99-03. U. S. Bureau of Reclamation Technical Service Center. Denver, Colorado. 77 pp + Appendices.

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Von Loh, J. and J. Oliver. 1999. 1998 Annual Report - Geographic Information System Database, Cheyenne Bottoms Wildlife Area, Kansas. Technical Memorandum #8260-99-04. U. S. Bureau of Reclamation Technical Service Center. Denver, Colorado. 40 pp +Appendices.

Andropogon gerardii - Panicum virgatum Central Great Plains Herbaceous Vegetation (Provisional)

COMMON NAME:	Big Bluestem - Switchgrass Central Great Plains Herbaceous Vegetation
SYNONYM:	Western Big Bluestem Tallgrass Prairie
PHYSIOGNOMIC CLASS:	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS:	Perennial graminoid vegetation (V.A)
PHYSIOGNOMIC GROUP:	Temperate of subpolar grassland (V.A.5)
PHYSIOGNOMIC SUBGROUP:	Natural/Semi-natural (V.A.5.N)
FORMATION:	Tall sod temperate grassland (V. A. 5. N. a)
ALLIANCE:	Andropogon gerardii - (Sorghastrum nutans) Herbaceous Alliance

CLASSIFICATION CONFIDENCE LEVEL: Unknown

USFWS WETLAND SYSTEM: Terrestrial

RANGE

Central Platte River

This is the common native grass association of the Platte River floodplain in central Nebraska. It occupies large islands and portions of the floodplain that have not been converted to grass hay or alfalfa hay (*Medicago sativa*) production.

Globally

The *Andropogon gerardii - Panicum virgatum* Central Great Plains Herbaceous Vegetation association has been observed in both Kansas and Nebraska, and is probably best represented along the Central Platte River in Nebraska (Butler 2000). Only one, small stand occurs on the southern Cheyenne Bottoms Wildlife Area (Kansas) boundary. This site has relatively deep, sandy soils that are elevated above the ground water table approximately one meter.

ENVIRONMENTAL DESCRIPTION

Central Platte River

Stands located along the central Platte River occur on subirrigated loess and sediments deposited by the Platte River. They are typically in excess of 70% herbaceous cover and are interspersed with linear and depressional wetlands dominated by *Scirpus pungens*, *Carex* spp., and *Typha latifolia*. Most stands are either mown for hay or grazed annually, or both. Several sites that represent formerly disturbed agricultural fields have been planted back to the dominant tallgrass species along with Indian-grass (*Sorghastrum nutans*), little bluestem (*Schizachyrium scoparium*), western wheatgrass (*Pascopyrum smithii*), and sideoats grama (*Bouteloua curtipendula*).

Globally

The only other big bluestem - switchgrass stand documented, occurs on a small, elevated sandy lens along the southern boundary fence of Cheyenne Bottoms Wildlife Area (Kansas).

MOST ABUNDANT SPECIES

Central Platte River

Stratum	Species
Herbaceous	*Andropogon gerardii, Panicum virgatum, Poa pratensis, Bromus inermis, Hordeum jubatum*

Globally

Stratum	Species
Herbaceous	*Andropogon gerardii, Panicum virgatum, Sorghastrum nutans*

CHARACTERISTIC SPECIES

Central Platte River

Andropogon gerardii, Panicum virgatum, Poa pratensis, Bromus inermis

Globally

Andropogon gerardii, Panicum virgatum, Sorghastrum nutans

OTHER NOTABLE SPECIES

Central Platte River

Stratum	Species
Herbaceous	*Agrostis stolonifera, Ambrosia psilostachya, Solidago spp.*

Globally

Stratum	Species
Herbaceous	*Schizachyrium scoparium, Scirpus americanum*

VEGETATION DESCRIPTION

Central Platte River

Big bluestem (*Andropogon gerardii*) - switchgrass (*Panicum virgatum*) tallgrass prairie dominates many areas within the floodplain. The stands are diverse and generally provide about 80% vegetative cover. Common associated species include Kentucky bluegrass (*Poa pratensis*), smooth brome (*Bromus inermis*), foxtail barley (*Hordeum jubatum*), and western ragweed (*Ambrosia psilostachya*). Platte River stands tend to be dominated by either big bluestem or switchgrass, depending on the distance to ground water at the site. A higher ground water table will promote switchgrass growth. Cover values for the Nebraska stands typically exceed 70%. Big bluestem is a warm-season grass, becoming more dominant in the stand as the growing season nears the end.

Globally

Most descriptions currently available for *Andropogon gerardii* are for stands that occur at relatively high elevations, on gravelly or rocky soils, and with little bluestem (*Schizachyrium scoparium*) as the co-dominant grass. These stands are not representative of the one at Cheyenne Bottoms Wildlife Area, Kansas , which is similar to stands being investigated along the Platte River in Nebraska (Butler, personal communication, 2000).

CONSERVATION RANK: Unknown

DATABASE CODE: Unknown

MAP UNITS

Big bluestem-Switchgrass stands are interpreted and mapped under Map Unit 12 (Lowland Grassland). When mown, this tallgrass association is mapped under Map Unit 17 (Mown Lowland Grassland).

SIMILAR ASSOCIATIONS

Andropogon gerardii - Schizachyrium scoparium Western Great Plains Herbaceous Vegetation
Panicum virgatum Herbaceous Vegetation (Provisional)

COMMENTS

This association and similar types will require future review and revisions as more becomes known about distribution and community structure. It is used heavily for production of grass hay and for grazing cattle along the Platte River in Nebraska, and is becoming heavily invaded by exotic grasses. The historic agricultural fields planted back to these native tallgrass species should be monitored to determine if recovery to a more natural community is possible.

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Populus deltoides - Fraxinus pennsylvanica / Cornus drummondii Woodland (Provisional)

COMMON NAME:	Eastern Cottonwood - Green Ash / Rough-leaved Dogwood Temporarily Flooded Woodland
SYNONYM:	Cottonwood - Green Ash Floodplain Woodland
PHYSIOGNOMIC CLASS:	Woodland (II.)
PHYSIOGNOMIC SUBCLASS:	Deciduous Woodland (II.B.)
PHYSIOGNOMIC GROUP:	Cold-deciduous Woodland (II.B.2.)
PHYSIOGNOMIC SUBGROUP:	Natural/Semi-natural (II.B.2.N.)
FORMATION:	Tempoprarily flooded cold-deciduous woodland (II.B.2.N.b)
ALLIANCE:	POPULUS DELTOIDES TEMPORARILY FLOODED WOODLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL: Unknown

USFWS WETLAND SYSTEM: Riparian

RANGE

Central Platte River

Eastern cottonwood (*Populus deltoides*) is the common large tree of the central Platte River riparian habitat. The cottonwood type is widespread and regenerating where overbank flooding still occurs.

Globally

Variations of the cottonwood community are found in southern Manitoba, North and South Dakota, central and western Nebraska, western Kansas, eastern Colorado, and Oklahoma; it may occur in Texas and New Mexico.

ENVIRONMENTAL DESCRIPTION

Central Platte River

The cottonwood - green ash / rough-leaved dogwood association occurs across the floodplain and exists as many even-aged stands as a product of flooding events. Younger stands have formed closer to the flowing water and the most mature stands are usually furthest removed, both horizontally and vertically, from the main channel.

Globally

This community is found within the floodplain of streams and rivers, usually in close proximity to the stream channel. It develops on newly deposited (cottonwood - willow) to older (green ash, elm) beds of alluvium, typically sand, silt, clay, loam, or gravel/cobble. Recently deposited soils are poorly developed. The water table fluctuates with the level of the stream or river and flooding is common, particularly in the Spring. In Wyoming, height of this community above the stream varies from 1-3m (Jones and Walford 1995).

MOST ABUNDANT SPECIES

Central Platte River

Stratum	Species
Tree Canopy	*Populus deltoides, Fraxinus pennsylvanica, Juniperus virginiana, Morus rubra, Ulmus americana, Acer negundo, Salix nigra*
Shrub	*Cornus drummondii, Salix exigua*
Herbaceous	*Phalaris arundinacea, Poa pratensis, Bromus inermis, Spartina pectinata, Ambrosia psilostachya, Glycyrrhiza lepidota, Solidago spp., Melilotus officianalis*

Globally

Stratum	Species
Tree Canopy	*Populus deltoides, Salix amygdaloides*
Shrub	*Salix exigua, Symphoricarpos occidentalis*
Forb	*Ambrosia psilostachya, Glycyrrhiza lepidota, Helianthus petiolaris*
Fern	*Equisetum arvense*

Graminoid *Carex emoryi, Carex lanuginosa, Pascopyrum smithii, Poa pratensis, Spartina pectinata, Sporobolus cryptandrus*

CHARACTERISTIC SPECIES
Central Platte River
Populus deltoides, Fraxinus pennsylvanica, Cornus drummondii

Globally
Populus deltoides, Salix amygdaloides, Salix exigua

OTHER NOTABLE SPECIES
Elaeagnus angustifolia

VEGETATION DESCRIPTION
Central Platte River
The floodplain woodland along the Platte River is currently dominated by eastern cottonwood (*Populus deltoides*) with green ash (*Fraxinus pennsylvanica*), elm (*Ulmus rubra, americana*), boxelder (*Acer negundo*), and eastern red cedar (*Juniperus virginiana*). The common understory shrub is rough-leaved dogwood (*Cornus stolonifera*). In a more typical situation, peach-leaved willow (*Salix amygdaloides*) would be the sub-canopy dominant, in place of green ash (*Fraxinus pennsylvanica*), elm (*Ulmus americana, rubra*), boxelder (*Acer negundo*), and eastern red cedar (*Juniperus virginiana*). The shrub dominant in a more typical floodplain woodland is sandbar willow (*Salix exigua*). Vegetative cover values typically exceed 100% and over 50 species may be present in an individual plot. The canopy is typically closed by overarching tall trees and dense understory trees and tall shrubs. In some stands, high cover values are recorded for the short shrubs false-indigo (*Amorpha fruticosa*), poison ivy (*Toxicodendron rydbergii*), and western snowberry (*Symphoricarpos occidentalis*), and the vine riverbank grape (*Vitis riparia*). The most common understory grass species recorded is Kentucky bluegrass (*Poa pratensis*).

Globally
This community has an open canopy, 6-12m tall, and is typically dominated by *Populus deltoides* and *Salix amygdaloides*, although peachleaf willow can be absent in some examples of this community. *Fraxinus pennsylvanica* may be present on the upland side of this community, and *Elaeagnus angustifolia* or *Juniperus* spp. May invade some sites. This woodland community has closely spaced shrubs and small trees. *Salix exigua* is usually more abundant along the streamside margins of this community and where the canopy of taller trees is most open, which may occur following a scouring (flooding) event. It is from 2-5m tall. Other, shorter shrubs that are found include *Symphoricarpos occidentalis* and *Toxicodendron rydbergii*. Graminoids adapted to mesic sites dominate the understory of most sites, the most common species include *Carex emoryi, C. pellita, Elymus canadensis, Hordeum jubatum, Muhlenbergia racemosa, Pascopyrum smithii, Poa pratensis,* and *Spartina pectinata*. Forbs that are frequently abundant in relatively undisturbed sites include *Equisetum arvense* and *Glycyrrhiza lepidota*. Flooding often creates open patches in the herbaceous layer that are available for colonization by nearby species. The floristic composition of these patches is greatly affected by the species that are near and can invade the disturbed areas. Because of the high permeability of the sandy floodplain soils, species typical of upland prairie may invade in addition to annual forbs typical of disturbed sites. Widely distributed species that are adapted to these sites include *Ambrosia psilostachya, Artemisia campestris ssp. caudata, A. ludoviciana, Calamovilfa longifolia, Cenchrus longispinus, Euphorbia serpyllifolia, E. esula, Grindelia squarrosa, Helianthus petiolaris, Heterotheca villosa, Lippia lanceolata, Opuntia macrorhiza, Poa pratensis,* and *Sporobolus cryptandrus.* These sites are prone to invasion by exotic grasses and forbs, the most widely established being *Agrostis stolonifera, Bromus tectorum, Cirsium arvense, Kochia scoparia, Melilotus spp., Taraxacum officinale*, and *Tragopogon dubius.*

CONSERVATION RANK: Unknown. In the absence of regular flooding, many sites are undergoing succession to later seral stages. Many sites are overgrazed and invaded by exotic woody and herbaceous species.

DATABASE CODE: Unknown

MAP UNITS
This woodland type is mapped as map unit 15 (Wooded - Floodplain) on the Central Platte River vegetation map.

SIMILAR ASSOCIATIONS
Populus deltoides / Panicum virgatum - Schizachyrium scoparium Woodland (CEGL001454)(may be a subtype of this community whose character is maintained by winter grazing).

COMMENTS
Flooding and scouring by sand and ice are common in most examples of this community. During floods, erosion and deposition of material may occur. Drought stress affects shallow rooted plants when the water table drops. This community is a seral community and is subject to and maintained by periodic flooding. Lack of significant flooding over much of the Platte River floodplain is resulting in a conversion from dominance by cottonwood to that of green ash and eastern red cedar.

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Salix exigua - (Cornus drummondii) Temporarily Flooded Shrubland

COMMON NAME:	Sandbar (Narrowleaf) Willow - (Rough-leaved Dogwood) Temporarily Flooded Shrubland
SYNONYM:	Sandbar Willow Shrubland
PHYSIOGNOMIC CLASS:	Shrubland (III.)
PHYSIOGNOMIC SUBCLASS:	Deciduous shrubland (III.B.)
PHYSIOGNOMIC GROUP:	Cold-deciduous shrubland (III.B.2.)
PHYSIOGNOMIC SUBGROUP:	Natural/Semi-natural (III.B.2.N.)
FORMATION:	Temporarily flooded cold-deciduous shrubland (III.B.2.N.d.)
ALLIANCE:	SALIX EXIGUA TEMPORARILY FLOODED SHRUBLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL: 1

USFWS WETLAND SYSTEM: Palustrine Shrub-Scrub

RANGE

Central Platte River

This shrubland occurs immediately adjacent to the Platte River and its side channels, on point bars, and islands. The substrate is saturated sand, exposed/deposited following flooding events, as the flows recede annually, or as the river meanders across its floodplain. Narrow stands often form around ponds created by excavation, and in ditches that are saturated most of the year. These stands are often narrow bands and may be tall enough to include with floodplain woodland mapping.

Globally

This community is found along rivers and streams in Oregon, Washington, Idaho, Montana, southern Manitoba, North Dakota, Wyoming, Colorado, Oklahoma, Nebraska, South Dakota, and, Iowa.

ENVIRONMENTAL DESCRIPTION

Central Platte River

Sandbar willow shrublands grow predominantly on stabilized point bars and islands along/within the Platte River. These sites are relatively level and subirrigated from the river, occasionally they are overtopped by high flows. In some sites, sandbar willow is spreading into prairie cordgrass (*Spartina pectinata*) grasslands and in other sites, sandbar willow is codominant with rough-leaved dogwood (*Cornus drummondii*). Rough-leaved dogwood is the common understory shrub of adjacent riparian woodlands, and the area where it and sandbar willow intermix is probably an ecotone between the two types.

Globally

This community is found on recently deposited or disturbed alluvial material. The parent material is alluvial sand, although silt, clay, or gravel may be present. Soil development is poor to absent.

MOST ABUNDANT SPECIES

Central Platte River

Stratum	Species
Tree Canopy	*Populus deltoides, Salix amygdaloides, Salix nigra*
Tall Shrub	*Salix exigua, Cornus drummondii*
Short Shrub	*Salix exigua, Cornus drummondii*
Herbaceous	*Spartina pectinata, Phalaris arundinacea, Poa pratensis, Typha latifolia*

Globally

Stratum	Species
Shrub	*Salix exigua*

CHARACTERISTIC SPECIES

Central Platte River

Salix exigua, Cornus drummondii, Spartina pectinata

Globally
Salix exigua

VEGETATION DESCRIPTION
Central Platte River
Salix exigua is the dominant species, usually forming dense cover (>80%) in the tall shrub (between 2m and 5m tall) layer. Several sapling *Populus deltoides* and *Salix amygdaloides* trees are typically present in the stand, ocurring as tall shrubs (between 3m and 6m tall). The saturated soils of this type result in *Spartina pectinata* and *Phalaris arundinacea* becoming the common understory species. Where *Salix exigua* is growing adjacent to riparian woodlands, *Cornus drummondii* becomes co-dominant in the stand. One stand sampled also had *Amorpha fruticosa* as a codominant short-shrub.

Globally
This community is dominated by shrubs, generally between 2m and 4m tall. The most common of these is *Salix exigua*. *Salix irrorata* and saplings of *Populus deltoides* or *Salix amygdaloides* are also frequently found in the shrub layer. This stratum can have moderate to high stem density throughout the stand. The species in the shrub layer do not form a closed canopy, allowing significant light to reach the ground. There are often patches where the shrub layer is absent. The herbaceous cover ranges from sparse to moderate. Older stands and places with less competition from the shrubs have greater herbaceous cover. The composition of the herbaceous layer can vary greatly. Species that are often found in this community are *Cenchrus longispinus, Polygonatum lapathifolium, Scirpus americanus, Triglochin maritimum,* and *Xanthium strumarium.*

CONSERVATION RANK: G5. This type is widespread and common throughout its range.

DATABASE CODE: Unknown

SIMILAR ASSOCIATIONS
Salix exigua / Mesic Graminoids Shrubland

COMMENTS
In another Nebraska study, Steinauer and Rolfsmeier (1997) report that *Amorpha fruticosa, Cornus sericea,* and *Salix lutea* are also present in the shrub layer. In the herbaceous layer they reported *Ambrosia artemisiifolia* and *Aster lanceolatus.*

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Fraxinus pennsylvanica - (Ulmus rubra, americana) / Cornus drummondii Temporarily Flooded Woodland

COMMON NAME:	Green ash - Slippery, American elm / Rough-leaved Dogwood Temporarily Flooded Woodland
SYNONYM:	
PHYSIOGNOMIC CLASS:	Woodland (II.)
PHYSIOGNOMIC SUBCLASS:	Deciduous woodland (II.B.)
PHYSIOGNOMIC GROUP:	Cold-deciduous woodland (II.B.2.)
PHYSIOGNOMIC SUBGROUP:	Natural/Semi-natural (II.B.2.N.)
FORMATION:	Temporarily flooded cold-deciduous woodland (II.B.2.N.b.)
ALLIANCE:	GREEN ASH - AMERICAN ELM WOODLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL: 2

USFWS WETLAND SYSTEM: Riparian

RANGE

Central Platte River

This woodland is common within the floodplain of the Platte River and appears to be succeeding stands of eastern cottonwood (*Populus deltoides*). The type occurs along the river, its tributary channels, mesic oxbows, and depressions; it also comprises the understory of cottonwood - willow woodlands.

Globally

This type is found primarily in the northwestern Great Plains.

ENVIRONMENTAL DESCRIPTION

Central Platte River

This community is found within the floodplain of the Platte River, immediately adjacent to, and often intermixed with, the *Populus deltoides* woodland and the *Salix exigua - Cornus drummondii* shrubland.

Globally

Stands are found on nearly level floodplains and lower terraces of rivers and streams, generally away from the river on older, stabilized sites. The water table may be relatively deep on higher terraces, allowing drier species to establish (Girard, et al. 1989). Soils are typically clays or silty clays.

MOST ABUNDANT SPECIES

Central Platte River

Stratum	Species
Tree Canopy	*Fraxinus pennsylvanica, Ulmus rubra, Ulmus americana, Acer negundo, Juniperus virginiana, Elaeagnus angustifolia*
Shrub	*Cornus drummondii, Juniperus virginiana, Toxicodendron rydbergii, Amorpha fruticosa*
Herbaceous	*Phalaris arundinacea, Poa pratensis, Nepeta cataria, Solidago* spp.

Globally

Stratum	Species
Tree Canopy	*Fraxinus pennsylvanica, Ulmus americana*

CHARACTERISTIC SPECIES

Central Platte River

Fraxinus pennsylvanica, Ulmus rubra, Cornus drummondii, Poa pratensis, Phalaris arundinacea, Nepeta cataria

Globally

Fraxinus pennsylvanica, Ulmus americana

OTHER NOTABLE SPECIES
Vitis riparia

VEGETATION DESCRIPTION
Central Platte River
Fraxinus pennsylvanica dominates the canopy with *Ulmus rubra* as the most common secondary species. This type may occur as relatively pure stands, as an understory woodland to mature *Populus deltoides* stands, or in a mixed stand with *Juniperus virginiana, Ulmus americana, Acer negundo, Morus rubra, Elaeagnus angustifolia*, and *Salix nigra*, among other tree species. One relatively rare occurrence was a stand dominated by *Ulmus americana* / *Cornus drummondii* woodland with *Spartina pectinata* as the understory dominant. *Fraxinus pennsylvanica* trees are typically 5m-10m tall and stands usually exceed 75% aerial cover for the tree canopy. Most sites exceed 100% aerial cover for all physiognomic classes. In many cases, scattered old *Populus deltoides* trees, in excess of 25m tall are also present in these stands. The most common shrub is *Cornus drummondii* and the grasses *Poa pratensis* and *Phalaris arundinacea* are the common understory herbs. This community appears to be successional, replacing *Populus deltoides* stands as they become decadent and in the absence of channel-modifying flood events. Tree speceies such as *Juniperus virginiana* and *Elaeagnus angustifolia* may become the eventual stand dominants.

Globally
The tree layer is variable in structure, ranging from open (25-50%) to closed (50% or more) canopy. *Fraxinus pennsylvanica* is the leading dominant. In some parts of the range *Juniperus scopulorum* is present in the subcanopy, particularly where the canopy is still open. *Populus deltoides* may be present as an emergent. Emergent *Populus deltoides* may also occur under a canopy of *Fraxinus pennsylvanica*, reflecting a successional shift in some stands (Girard et al. 1989). *Fraxinus pennsylvanica* is common in the subcanopy and sapling layer, and, in some stands, *Ulmus americana* may be an associate. Acer negundo may only be occasionally present in some parts of the range. The dominant shrub is *Symphoricarpos occidentalis*. Other shrub species may be present, including *Cornus sericea, Rosa woodsii*, and *Rhus aromatica*. A variety of herbs may be present, none at high cover values, including *Elymus canadensis, Maianthemum stellatum, Melilotus officianalis, Muhlenbergia racemosa, Parthenocissus vitacea, Poa pratensis, Thalictrum dasycarpum*, and *Toxicodendron rydbergii* (Hansen et al. 1984, Girard et al. 1989).

CONSERVATION RANK: Unknown

DATABASE CODE: CEGL002088

SIMILAR ASSOCIATIONS

COMMENTS
This type will apparently become the dominant woodland of the Platte River floodplain, because of the stable flows and lack of heavy overbank flooding to scour the land surface and promote the growth/regeneration of other species. It, in turn, may be replaced by a *Juniperus virginiana/Elaeagnus angustifolia* community.

REFERENCES
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Wali, M. K., K. T. Killingbeck, R. H. Bares, and L. E. Schubert. 1980. Vegetation-environment relationships of woodland and shrub communities, and soil algae in western North Dakota. ND REAP Project No. 7-01-1. Grand Forks, ND: University of North Dakota.

Appendix N.

Central Platte River
Land Cover/Use Mapping Project CD-ROM

Table of Contents (also Readme.txt file on the CD-ROM)

Central Platte River

Land Cover/Use Mapping Project CD-ROM

This CD-ROM contains digital files created for the Central Platte River mapping project, including digital land cover/use shapefiles, map files for each bridge segment, and the project report.

The files on this CD-ROM are organized as follows:

1. Main (top level) directory:
   readme.txt – This file (ACSI text format)

2. Shapefiles: This folder contains the ArcView shapefiles created for the land cover/use project. Files for arcs and polygons are included separately using a distinctive naming convention. The arc file for the full study area is named *lca98*. Arc files for individual bridge segments have the name *lca98_<bridge_segment#>* (e.g., *lca98_1* for bridge segment 1). Likewise, the polygon file for the full study area is called *lcu98*. Polygon files for individual bridge segments have the naming convention of *lcu98_<bridge_segment#>*.

3. Layout Folder: This folder contains all map layouts in an Adobe PDF format. Each map file has the name *seg* followed by the bridge segment number for that layout with a PDF extension (e.g., *seg1.pdf* for bridge segment 1).

4. Report Folder: lcu_rpt.pdf – This file contains all the text, maps, and metadata included as part of the final report in an Adobe PDF format for the 1998 Central Platte River land cover/use mapping project.

Appendix O.

Sample Map Plots

Central Platte River GIS Database CD-ROM

This cd-rom contains all coverages created for the CPRV mapping program plus other files used to produce the paper maps and report files.

The files on this cd-rom are organized as follows:

1. Main (top level) directory:

cprvmeta.htm	- Metadata file for the GIS database (html format)
cprvmeta.txt	- Metadata file for the GIS database (ASCI text format)
readme.txt	- This file (ACSI text format)

2. Export Folder. - This folder contains all the coverages created for this project. The files are in Arc/Info export format (.e00). Refer to the metadata for a complete explanation of each coverage.

(Bev - list files)

3. Plot Folder. - This folder contains all map plot files.

(Bev - list files plus any files used to make the plot files)

4. Report Folder. - Files used to create the final report are located in this directory and are as follows:

App_*.doc	(MS Word 6.0 format)	Appendix files (*1 thru 15)
App_11.wk4	(Lotus Spreadsheet)	AA Calculations
Content.doc	(MS Word 6.0 format)	Table of Contents
Exec_sum.doc	(MS Word 6.0 format)	Executive Summary
Hectares.wb2	(Corel Quatro Pro)	Table of Hectare Totals
List_abbr.doc	(MS Word 6.0 format)	List of Abbreviations
List_cntrib.doc	(MS Word 6.0 format)	List of Contributors
List_contact.doc	(MS Word 6.0 format)	List of Contacts
List_fig.doc	(MS Word 6.0 format)	List of Figures
List_tbl.doc	(MS Word 6.0 format)	List of Tables
Sect1_intro.doc	(MS Word 6.0 format)	Section 1 - Introduction
Sect2_area.doc	(MS Word 6.0 format)	Section 2 - Project Area
Sect3_method.doc	(MS Word 6.0 format)	Section 3 - Methods/Materials
Sect4_result.doc	(MS Word 6.0 format)	Section 4 - Results
Sect4_aatbl.xls	(MS Excel Worksheet)	Accuracy Assessment Table
Sect5_disc.doc	(MS Word 6.0 format)	Section 5 - Discussion
Sect6_biblio.doc	(MS Word 6.0 format)	Section 6 - Bibliography
Title.doc	(MS Word 6.0 format)	Title Page
Title_wc.doc	(MS Word 6.0 format)	Cover Title Page