APPENDIX G: Photo Interpretation and Visual Key to Vegetation Mapping Units.

Lacreek National Wildlife Refuge
Martin, SD

2000-2001

Introduction

This document is a photo interpretation guide and visual key to the map units for the Lacreek National Wildlife Refuge Vegetation Mapping Project. Its purpose is to:

- Provide a ground photo image for each map unit;
- Provide visual examples of each map unit with aerial photographs and delineated overlays;
- Provide descriptions of the visual examples;

This key does not attempt to show an exhaustive representation for all variations within each map unit; only the most common or significant representations are included herein. These should be sufficient to give the user a feel for the imagery and an understanding of the relationships between classification and mapping.

Organization of the Photo Interpretation Visual Key

This key presents descriptions and illustrations for every vegetation map unit used in the Lacreek National Wildlife Refuge Vegetation Mapping Project. The images are scanned portions of the 2000 color infrared (CIR) aerial photographs with matching transparent interpreted overlays. These images are of the same scale (1:12,000) as the aerial photographs unless noted and reveals the photo interpreter's hand drawn polygons. A current map code is included in yellow and represents the vegetation map class. A short explanation describes the location of the map unit within the project area and how it generally appears on the aerial photos. Other information about the map unit or the polygon is included if it adds to understanding or recognition of that particular map unit.

The map units are arranged according to ecological groups and land-use (agricultural lands and shelterbelts). Three ecological groups were used to organize the types at LNWR, Great Plains Wetland Vegetation, Northern Great Plains Prairie, and Nebraska Sandhills. These groups highlight the ecological diversity found on the Refuge and link the plant associations by common ecological processes.

Aerial Photographs

Horizons, Inc. (3600 Jet Drive P.O. Box 3134 Rapid City, SD 57709-3134) collected aerial photographs for Lacreek on July 27, 2000. The photos were taken at a flight altitude of 6,000 feet above sea level using Kodak Aerochrome Infrared 2443 film. The photo mission was designed to take photos with about 30% side lap (between each flight line) and 60% overlap (along each flight line). The scale of the color infrared 9 x 9-inch photos is 1:12,000 (1 inch = 1000 ft.). Two sets of contact prints were produced and used for stereoscopic interpretation. A total of 117 frames taken over 10 flightlines were used to cover the project area. (See **Figure 5** in the main report for flightline and photo locations).

Color Infrared Film (CIR)

CIR film was chosen as the format for LNWR vegetation project because of its ability to highlight subtle changes in deciduous and wetland vegetation. CIR film presents a "false color" picture that combines infrared reflectance within green and red visible bands. These differences in reflectance create differences in color that can be easily distinguished and delineated as different plant species and vegetation communities. Reflectance is influenced by structure of the canopy, the orientation of the plants and their leaves, and the thickness and pigment content of leaves.

Texture is also important to the photo interpreter for identification. For trees, texture is influenced by type and orientation of leaves, crown size and shape, and branch structure. An uneven canopy height will appear more broken than an even canopy. Similarly, trees having small crowns will have a finer texture than trees that have large crowns. Depending on the tree species, the texture can be rough or smooth, fine, lacy, billowy, compact, or any number of other descriptors. These are imprecise terms, but nonetheless impart important descriptive elements to the imagery. In contrast, herbaceous vegetation, including wetland and upland communities, generally tends to appear much smoother in texture than forests or woodlands.

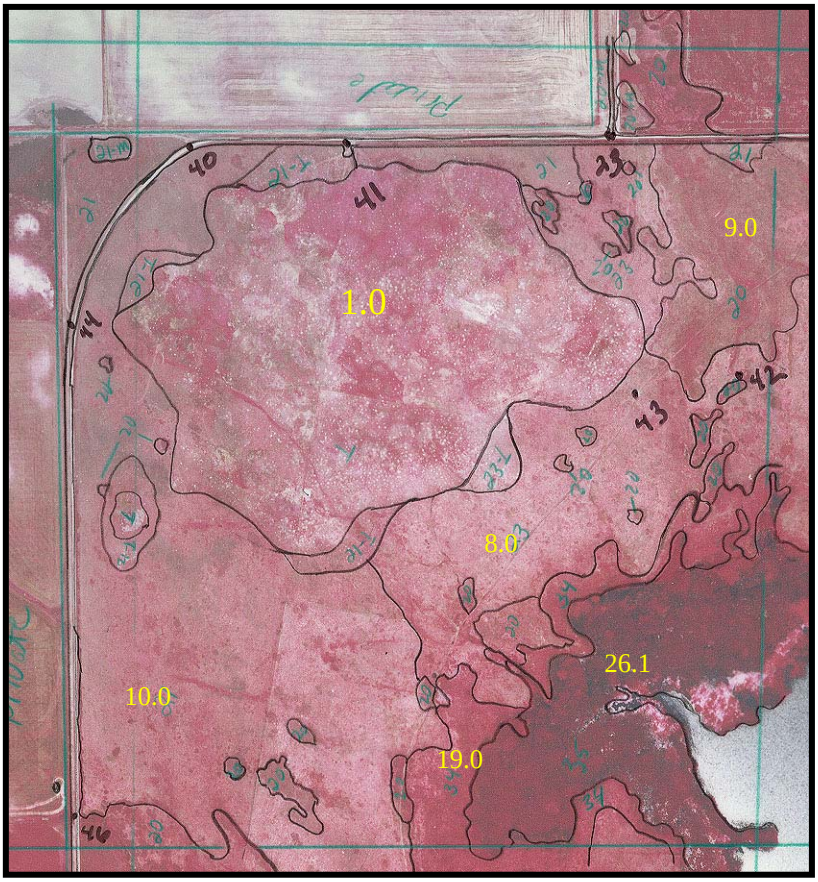
CIR photography is not consistent enough to allow a species or type to be described precisely. Film batch, printing process, sun angle, light intensity, shadow, and exposure can all affect the appearance of CIR photography. For accurate mapping at Lacreek, ground verification by both the photo interpreter and the refuge staff was very important for successful interpretation of types with confusing or similar signatures.

Please refer to Lacreek National Wildlife Refuge Vegetation Mapping Final Report Section 6 for a complete list of map units and their relationship to USNVC plant associations.

Prairie Dog Town Complex (Map Code 1.0)

Location: This sparse vegetation type occupies plains and gentle slopes within the northern portion of the project area. Other vegetation types often occur within the boundaries of individual towns.

Photo signature: Map code 1 appears as small, white stipples (burrows), usually somewhat interconnected by narrow trails and lying within dull, white, tan, gray-green, and medium green background colors. The class is delineated to the edge of the obviously grazed zone.



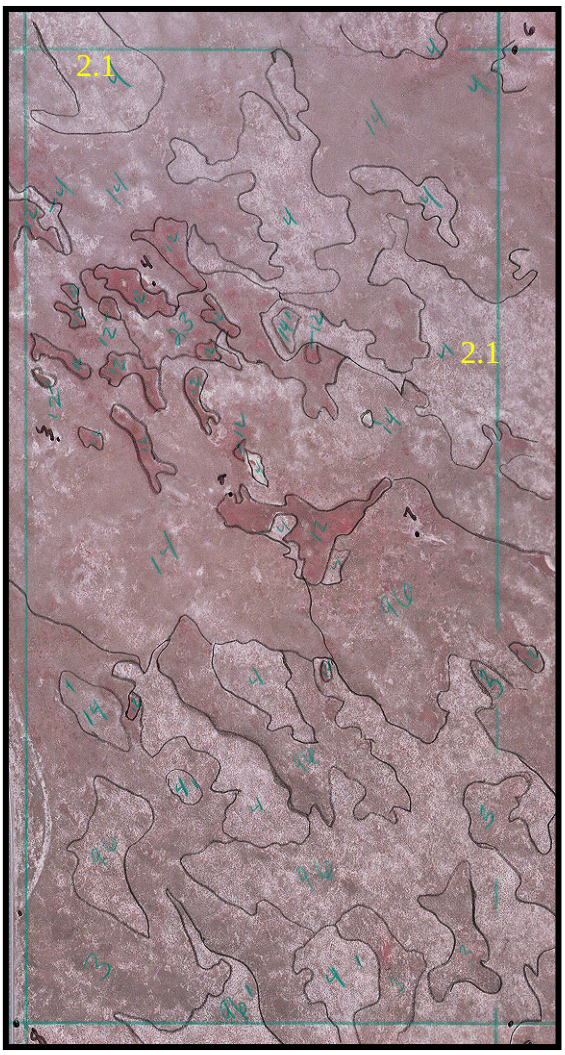
Comments: Associated vegetation in this photograph include Crested Wheatgrass (10.0), Smooth Brome (9.0), and Kentucky Bluegrass (8.0) Prairie Cordgrass (19.0); and Cattail Semi-Permanently Flooded Herbaceous Vegetation (26.1).

Photograph 5-3
with mylar overlay
Horizons Inc.

Soapweed Yucca (Sparse Understory) Shrub Herbaceous Vegetation (Map Code 2.1)

Location: This vegetation type is found on the undulating hills within the sandhills region located in southern portion of the Refuge. The type is especially prominent in the southwestern corner of the Refuge and is usually closely associated with map class 2.2 Soapweed yucca / Needle-and-thread, and class 3.1 Needle-and-thread / Soapweed yucca.

Photo signature: The signature is the result of a high cover of soapweed yucca with little herbaceous cover in the interstitial spaces. Color on the aerial photos is white to gray. Where cover of soapweed yucca is the highest, the signature is heavily stippled and slightly darker.



Photograph 9-3 with mylar
Horizons Inc.

Soapweed yucca / Needle-and-Thread Shrub Herbaceous Vegetation (Map Code 2.2)

Location: This is the most common vegetation type in the sandhills portion of the refuge. The type is especially prominent in the southwestern corner of the Refuge and is usually closely associated with map class 2.1 Soapweed yucca (Sparse understory), and class 3.1 Needle-and-thread / Soapweed yucca.

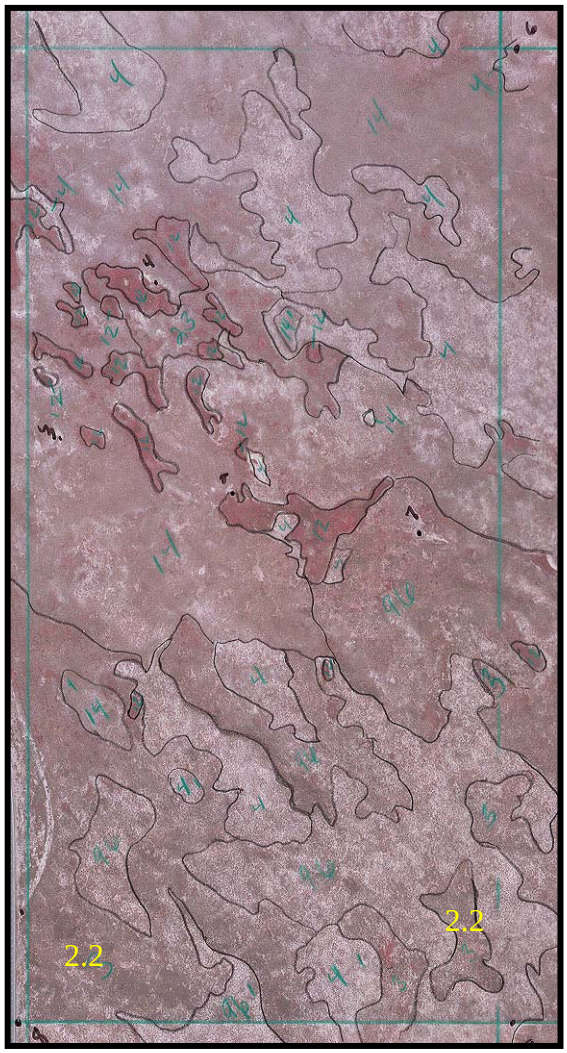


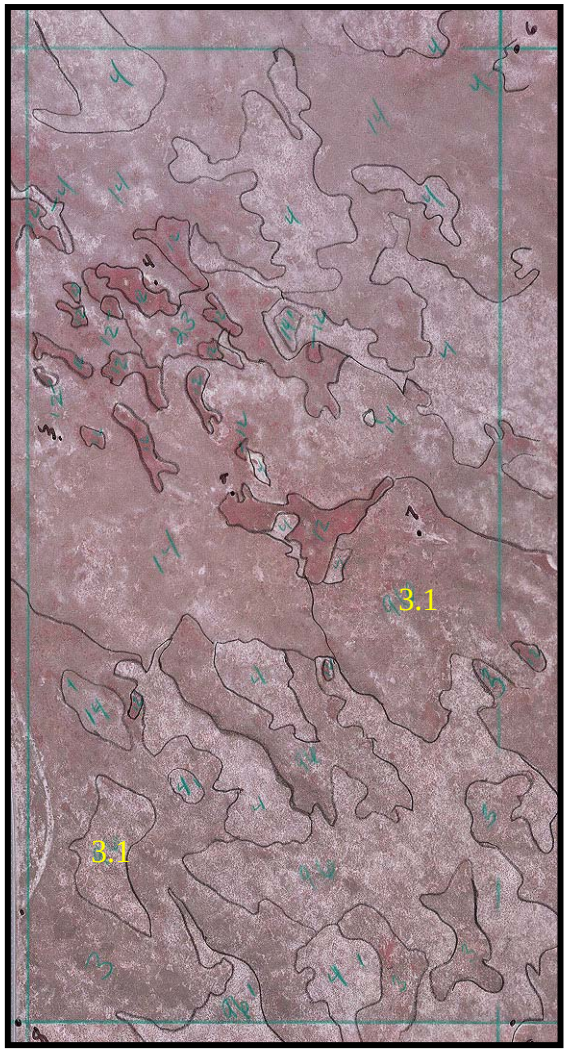
Photo signature: Color is light brown with a stippled appearance (depending on soapweed yucca density). Large stipples of white are common. Color, tone and texture are intermediate between class 3.1 Needle-and-Thread – Soapweed and class 5.0 Needle-and-Thread - Blue grama-Threadleaf Sedge.

Photograph 9-3 with mylar
Horizons Inc.

Needle-and-Thread / Soapweed Yucca Herbaceous Vegetation (Map Code 3.1)

Location: This type is common in the sandhills portion of the Refuge, usually on gently rolling sandy soils.

Photo Signature: Color is a lighter brown than class 2.2 Soapweed yucca / Needle-and-Thread and darker than class 2.1 Soapweed yucca (sparse understory), and more stippled than map class 3.3 Needle-and-Thread – Sunsedge Herbaceous Vegetation. Small spackles of white are common.



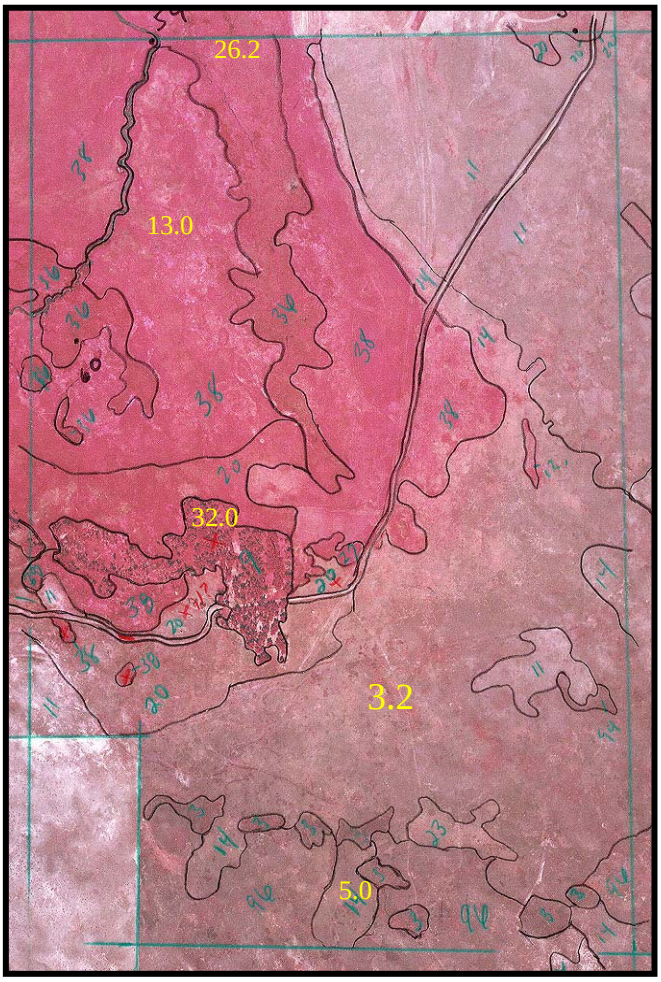
Photograph 9-3 with mylar
Horizons Inc.

Prairie Sandreed - Needle-and-Thread Herbaceous Vegetation (Map Code 3.2)

Location: Typically in scattered stands along the northern portion of the sandhills often appears as a transition zone between drier sandhills types and more mesic lowland types. Although widespread, most stands are smaller than the minimum mapping unit. The largest stands are found in the southeastern corner of the project area.

Photo Signature: Light tan and glossy with no stipules (lack of soapweed yucca), especially on summits and shoulders. Slight swales (probably inclusions of needle-and-thread and/or Kentucky bluegrass) are darker and appear duller in texture. Bare sandy soil, which is white, is common.

Comments: Associated vegetation types in this photograph include Mixed forblands (13.0), Cattail seasonally flooded (26.2), Needle-and-thread – Blue grama - Threadleaf sedge (5.0), and Peachleaf Willow Woodland (32.0).

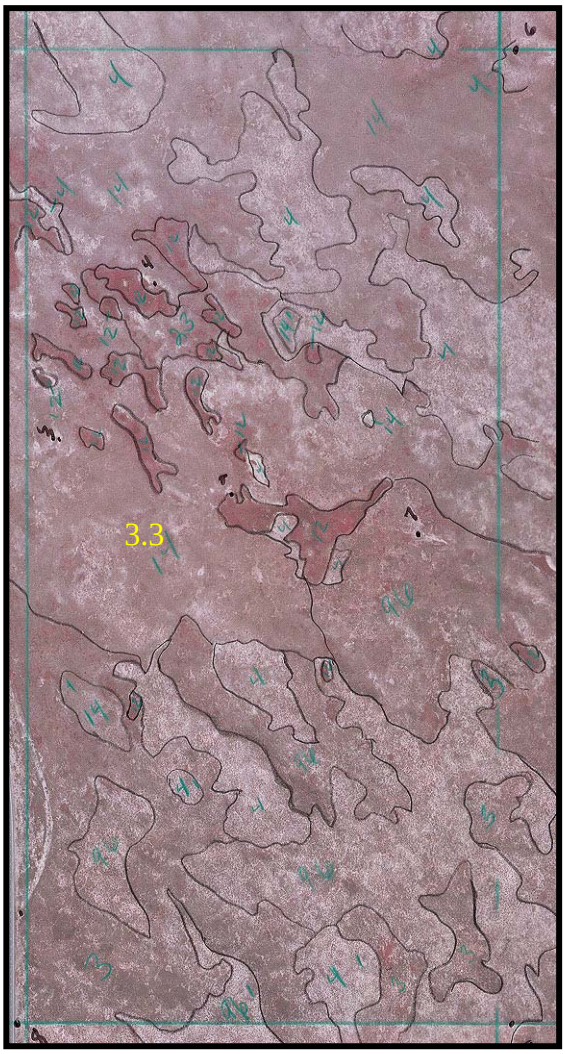


Photograph 9-10 with mylar
Horizons Inc.

Prairie Sandreed – Sun Sedge Herbaceous Vegetation (Map Code 3.3)

Location: This type is found on the nearly level to gently rolling sites within the sandhills portion of the Refuge. Large stands occur in the southwestern portion of the project area.

Photo Signature: Beige and glossy, almost smooth in appearance (low density of soapweed yucca). A distinct lack of white speckles may be an indication of the more stable nature of this type.

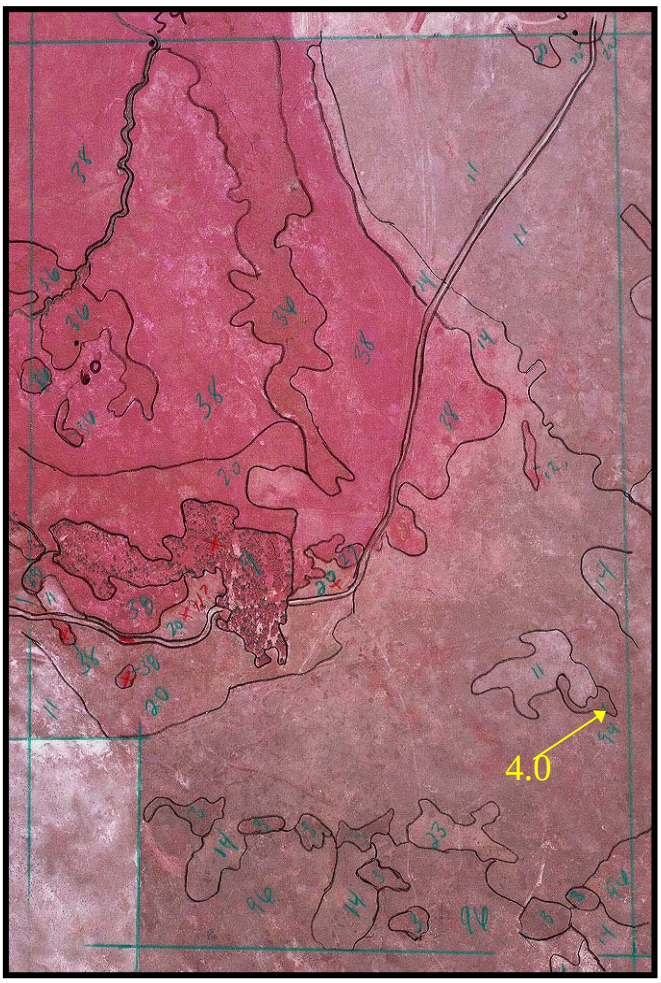


Photograph 9-3 with mylar
Horizons Inc.

Little Bluestem - Grama Grass (Sideoats, Blue) - Threadleaf Sedge Herbaceous Vegetation (Map Code 4.0)

Location: This class usually occurs on north facing hillsides and shoulders with , coarse textured soils; often is in small patches intermixed with other vegetation types. The best examples are found in the southeastern portion of the Refuge.

Photo Signature: Dull brown to dark brown and often "gravelly" (not stippled with soapweed), which probably reflects the bunchgrass growth form of little bluestem.



Photograph 9-10 with mylar
Horizons Inc.

Needle-and-Thread - Blue Grama - Threadleaf Sedge Herbaceous Vegetation (Map Code 5.0)

Location: This type is only found in few localized areas of the Refuge. It is likely a relict plant community that was more prevalent before disturbance.

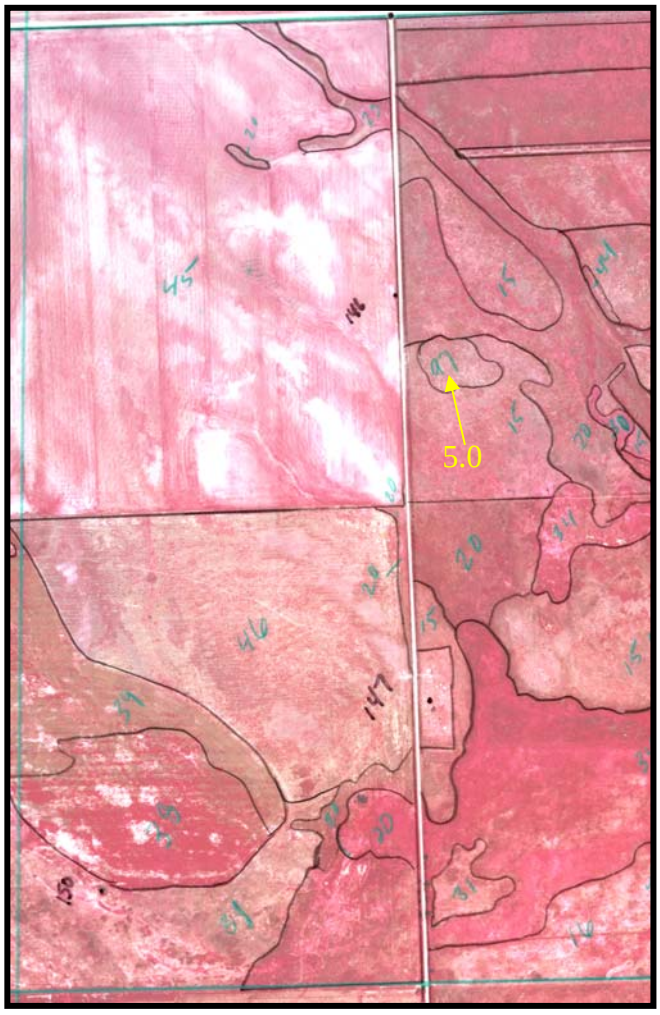


Photo Signature: Light tan to pink with no obvious signs of disturbance (field lines). A distinct lack of white speckles may be an indication of the more stable nature of this type.

Photograph 7-8 with mylar
Horizons Inc

Big Bluestem - Switchgrass - Sawtooth Sunflower Herbaceous Vegetation (Map Code 6.0)

Location: Widely scattered in mesic sites 0.5 ha or less in size. Best examples are located in the extreme southeastern corner of the Refuge.

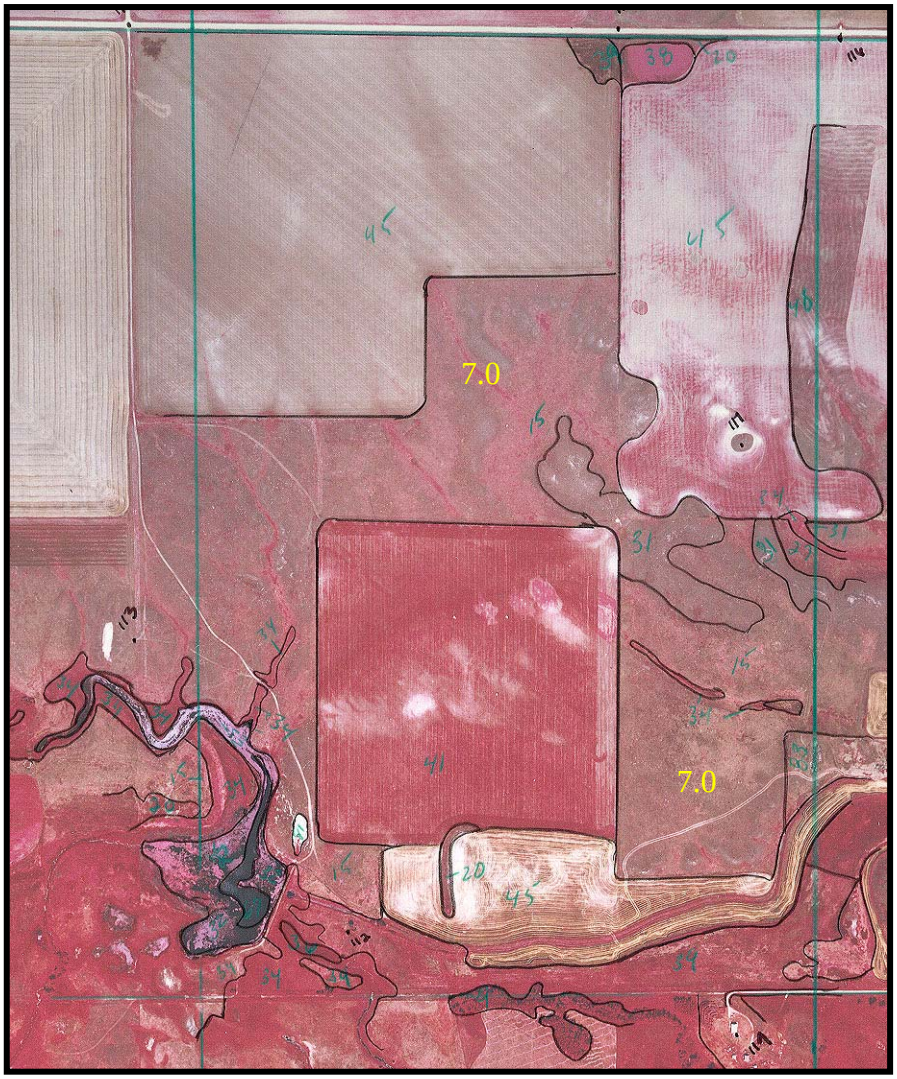
Photo Signature: Brown, with frequent patches of red that probably reflect inclusions of mixed forbs.

Photograph 8-12 with mylar
Horizons Inc.

Western Wheatgrass - Blue Grama - Threadleaf Sedge Herbaceous Vegetation (Map Code 7.0)

Location: Found on fine textured soils on nearly level sites just above several of the Refuge pools and on gently rolling uplands.

Photo Signature: Grainy (splotchy) appearance with a mixture of light red, light brown, and dull gray.



Photograph 7-4 with mylar

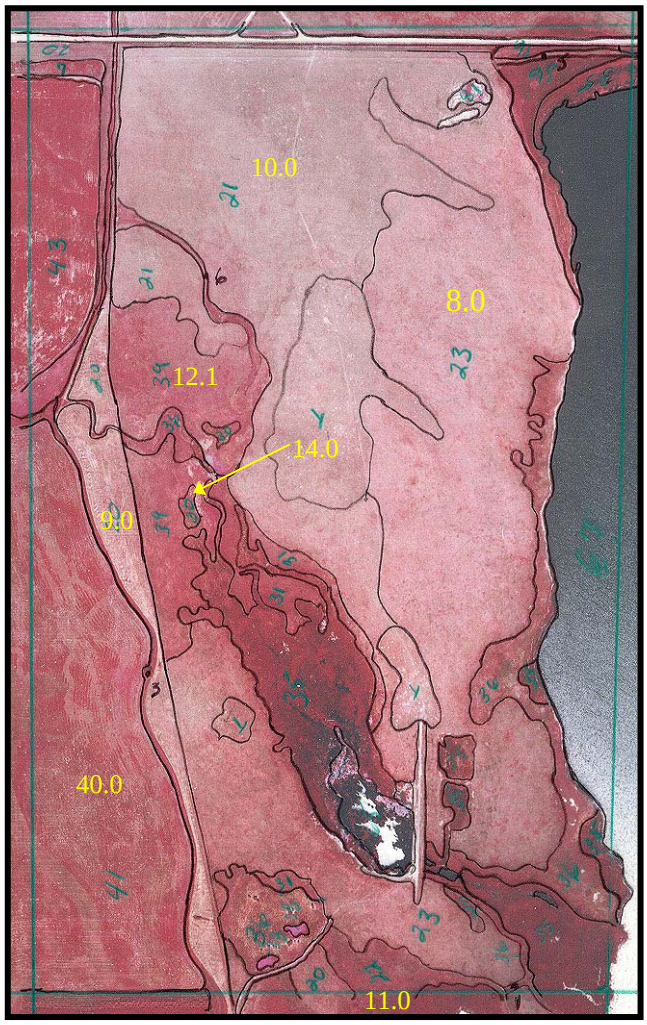
Horizons Inc.

Kentucky Bluegrass Semi-Natural Herbaceous Vegetation (Map Code 8.0)

Location: Widespread throughout the Refuge. Stands within the sandhills portion are generally found in broad, gentle swales, while stands outside the sandhills can be found in almost any topographic situation.

Photo Signature: Color is a dull pink with circles and swirls sometimes evident. Proximity to disturbed areas can sometimes be used to key into this type.

Comments: Associated vegetation in this photograph include Smooth Brome (9.0), Crested Wheatgrass (10.0) Intermediate Wheatgrass (11.0), Canada Thistle (14.0), and Agricultural Lands (40.0).



Photograph 3-3 with mylar
Horizons Inc.

Smooth Brome - (Western Wheatgrass) Semi-natural Herbaceous Vegetation (Map Code 9.0)

Location: Widespread throughout the Refuge, except in the sandhills.

Photo Signature: Smooth brome has a variety of signatures because of the diversity of management and ecological conditions in which stands occur. Mowed stands are light brown to light pink with lines. Stands burned the previous year are dark red. Inclusions of smooth brome in other grassland types appear as dull gray/brown, circular to irregular patches. Large stands are a uniform dull gray/brown color and usually patchy in distribution.

Photograph 3-3 with mylar
Horizons Inc

Crested Wheatgrass - (Western Wheatgrass, Needle-and-Thread) Semi Natural Herbaceous Vegetation (Map Code 10.0)

Location: Usually found on dry upland loamy sites in the northern portion of the Refuge.

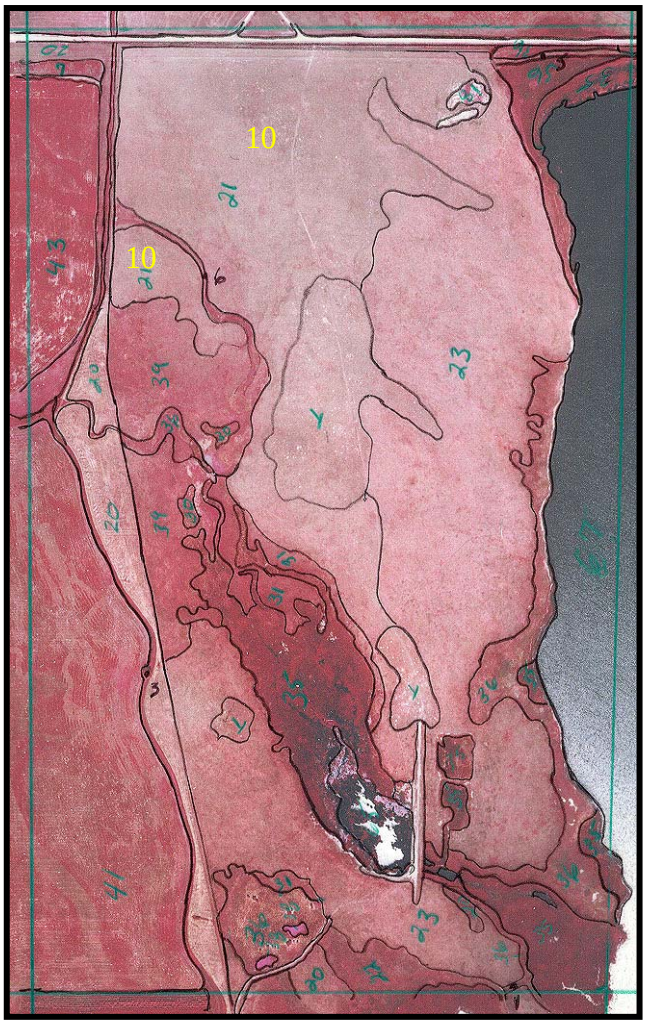


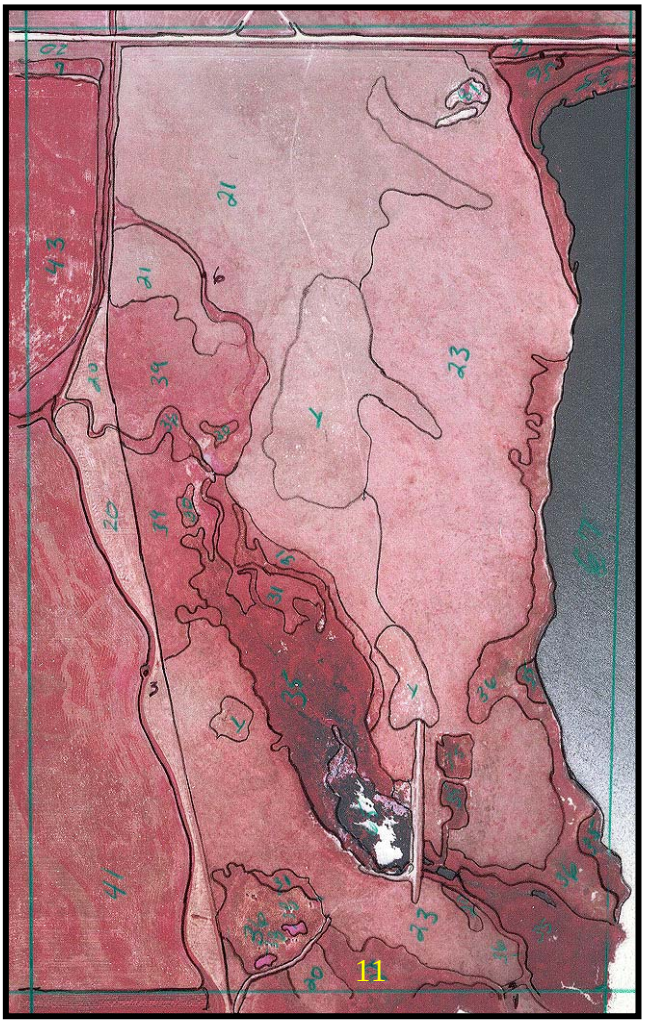
Photo Signature: Dull gray to very light brown, sometimes observed with a very light pink tone because of its frequent association with Kentucky bluegrass.

Photograph 3-3 with mylar
Horizons Inc

Intermediate Wheatgrass Semi-Natural Herbaceous Vegetation (Map Code 11.0)

Location: This type occurs in scattered stands in several areas in the northern portion of the Refuge.

Photo Signature: Large, irregular dark red, reddish brown, to brown spots (splotchy).

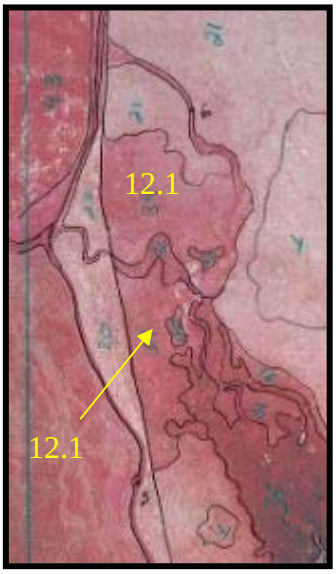


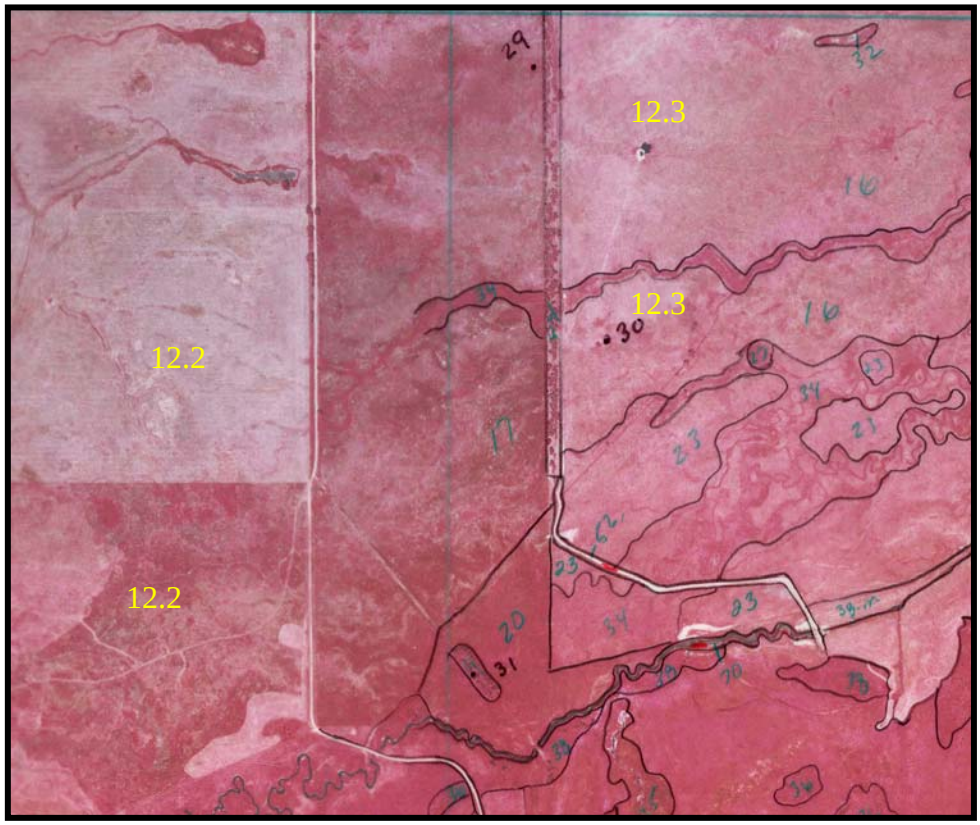
Photograph 3-3 with mylar
Horizons Inc

Mixed Grasslands (Map Code 12.1)
Mixed Grasslands (Warm Season Native) (Map Code 12.2)
Mixed Grasslands (Cool Season Natives) (Map Code 12.3)

Location: Patchy stands in a variety of shapes and sizes widely scattered in the northern portion of the Refuge; more common on private inholdings.

Photograph 8-9 inset with mylar Horizons, Inc.





Photograph 3-3
inset with mylar
Horizons, Inc.

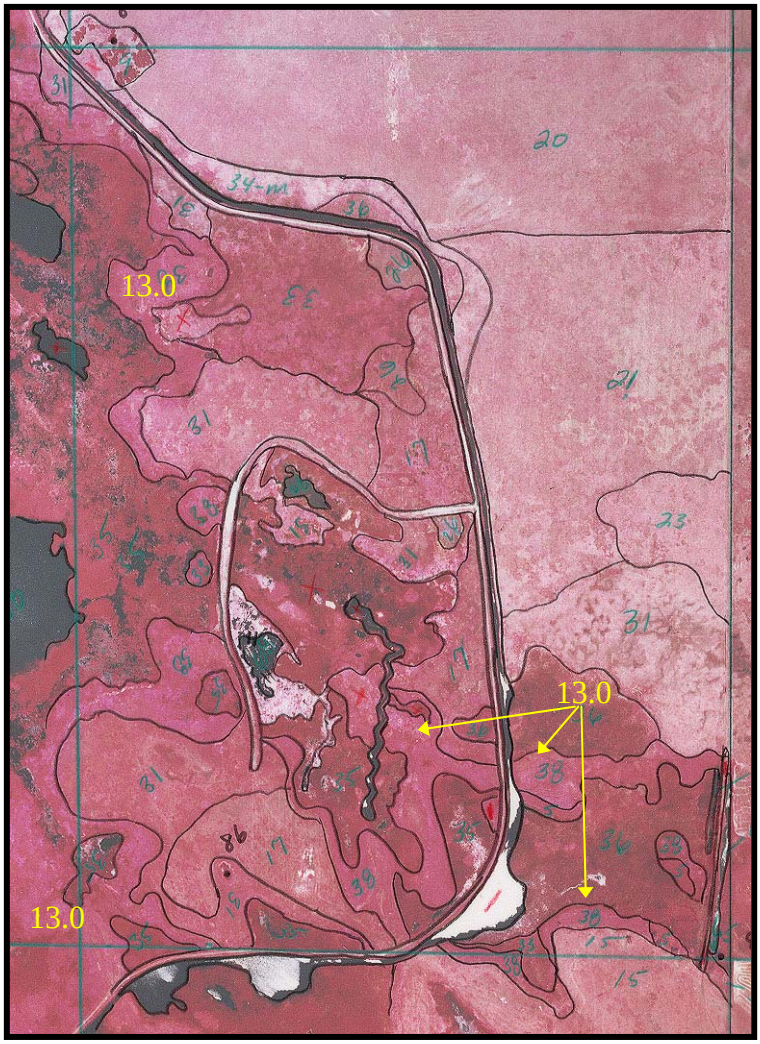
Photo Signatures: A mixture of dark red to light pink indicating a complex of graminoids and forbs. When graminoids are dominant the color is reddish brown to dull brown, often infused with large irregular dark spots. Determination of these types was based partially on ownership (private) and proximity to agricultural lands.

Mixed Forblands (Map Code 13.0)

Location: Scattered throughout the northern portion of the Refuge, usually found in close association with wetland community types including cattail, prairie cordgrass, and inland saltgrass.

(No Ground Photo)

Photo Signature: Appears very patchy with white, pink to dark red, spots.

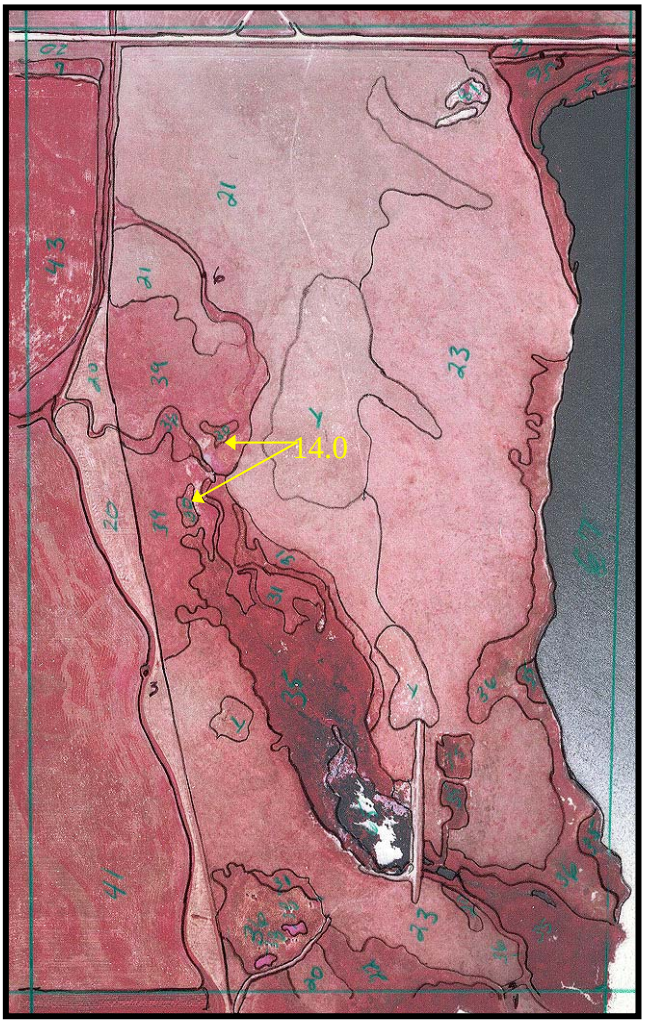


Photography 6-17 with mylar
Horizons, Inc

Canada Thistle Herbaceous Alliance (Map Code 14.0)

Location: This exotic forb occurs as small patches on moist sites and is mapped on an as-observed basis.

Photo Signature: A dark red patch of vegetation. Most of the patches have been mowed which appears as lines within the patch.



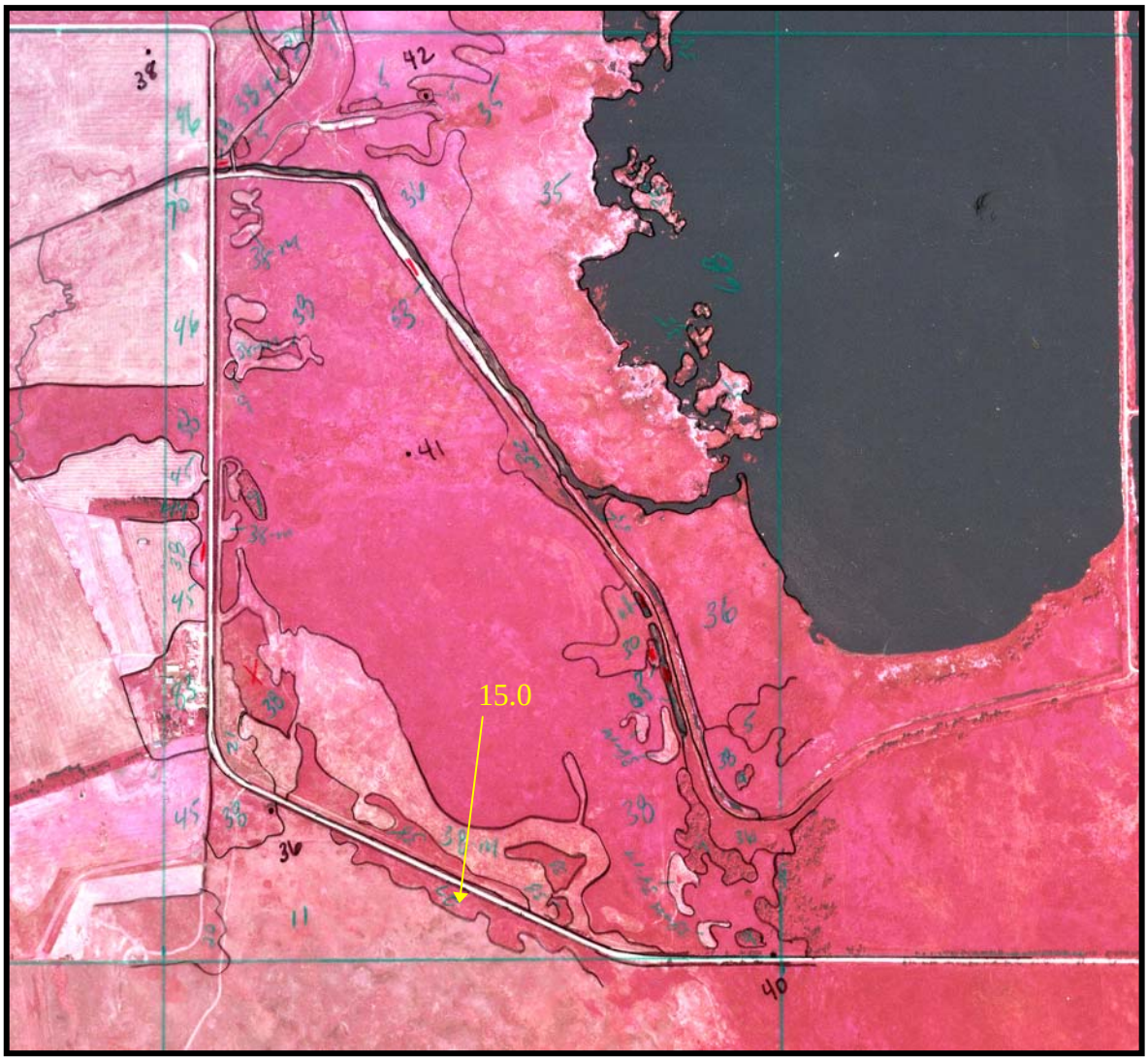
Photograph 3-3 with mylar
Horizons Inc

Wild Licorice Stands (Map Code 15.0)

Location: Stands of this type occurs around pools and managed areas of the Refuge. These are relatively rare and only mapped when the cover of wild licorice was high.

(No Ground Photo)

Photo Signature: The signature for this type is similar to other short shrubs and to some wetland types. Delineation of polygons for this type was based largely on ground verification.



Photograph 8-11 with mylar Horizons, Inc.

Water Smartweed Herbaceous Vegetation (Map Code 16.0)

Location: This type can be found adjacent to the shoreline of shallow pools.

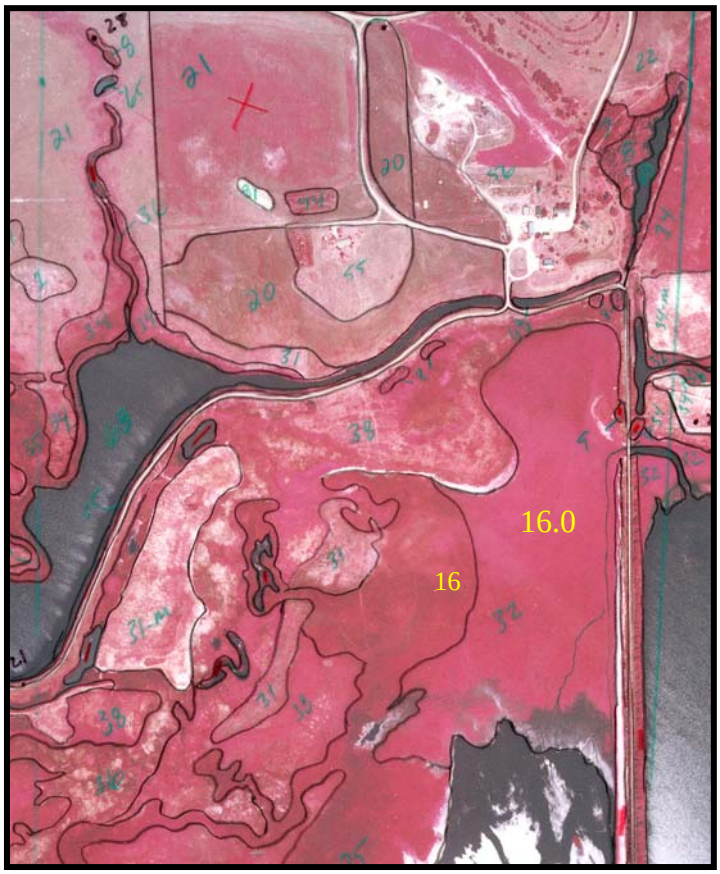


Photo Signature: Dense, dark red with irregular edges around pools and ponds.

Photograph 7-13 with mylar
Horizons, Inc

Switchgrass Herbaceous Vegetation (Map Code 17.0)

Location: The type is found in scattered, isolated swales and depressions throughout the sandhills portion of the Refuge. It is best represented in the southwestern corner.

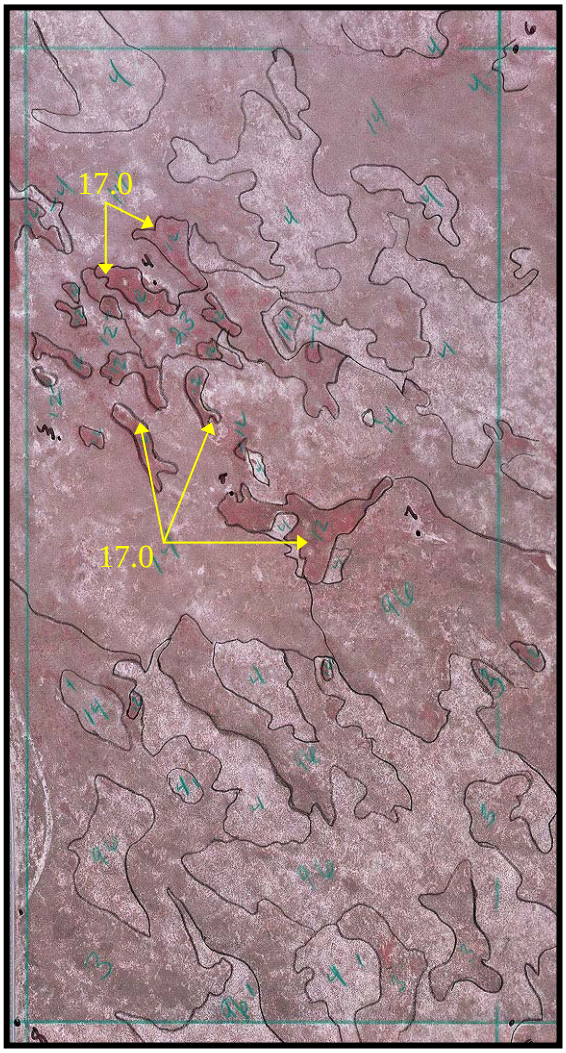


Photo Signature: Dull, reddish brown that contrasts with the brown of the surrounding soapweed and needle-and-thread types. Because the sites are usually situated in low-lying swales and depressions, the center is a typically darker reddish brown that gradually tapers to brown toward the edges of the polygon.

Photograph 9-3 with mylar
Horizons, Inc

Foxtail Barley Herbaceous Vegetation (Map Code 18.1)

Location: Small, sporadically distributed stands usually in close association with several wetland community types.

(No Ground Photo)

Photo Signature: Splotchy, light brown surrounded by red.

Photograph 6-17 with mylar
Horizons, Inc

Saltgrass Herbaceous Vegetation Alliance (Map Code 18.2)

Location: Usually occupies transitional areas between upland grasslands such as western wheatgrass and Kentucky bluegrass and wetland communities such as cattail and prairie cordgrass.

Photo Signature: Uniform in texture with a dull pink color when the stands occur adjacent to Refuge pools, and dull, brownish gray with patches of white when stands occur on upland sites.

Photograph 4-5 with mylar
Horizons Inc.

Prairie Cordgrass Temporarily Flooded Herbaceous Alliance (Map Code 19.0)

Location: Small to large stands occur throughout the Refuge. In wet areas prairie cordgrass forms the transition zone between cattail communities and upland grassland communities, as do inland saltgrass stands. Stands of prairie cordgrass are also located in ephemeral drainages and swales intermixed with drier upland grassland communities.

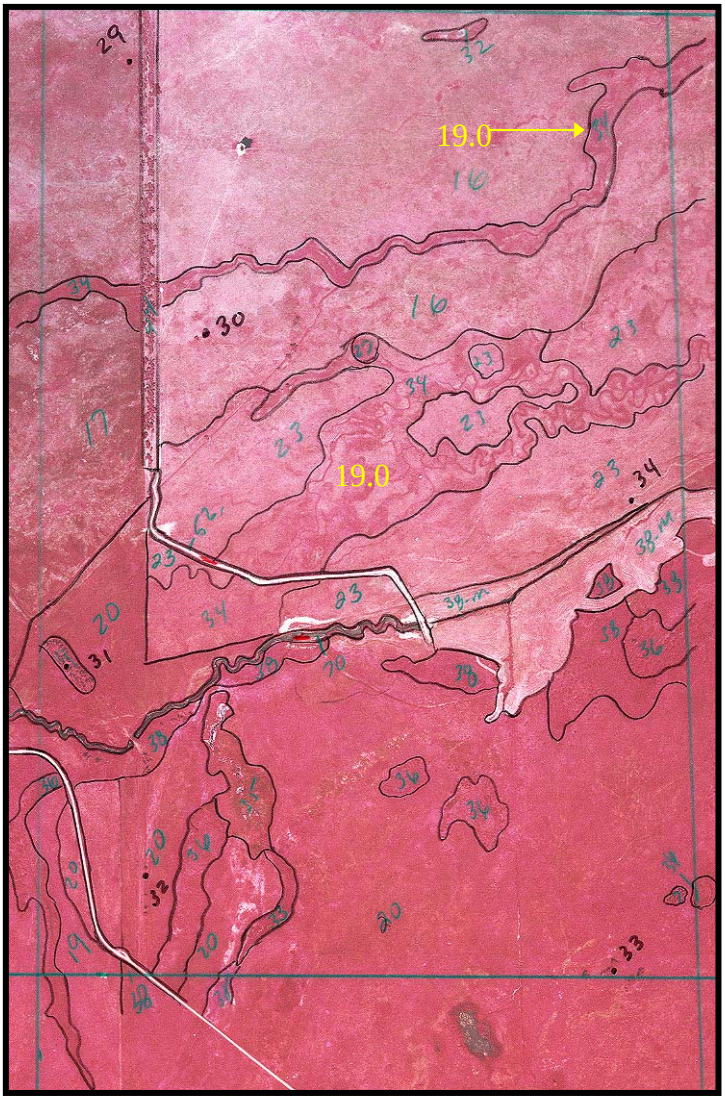


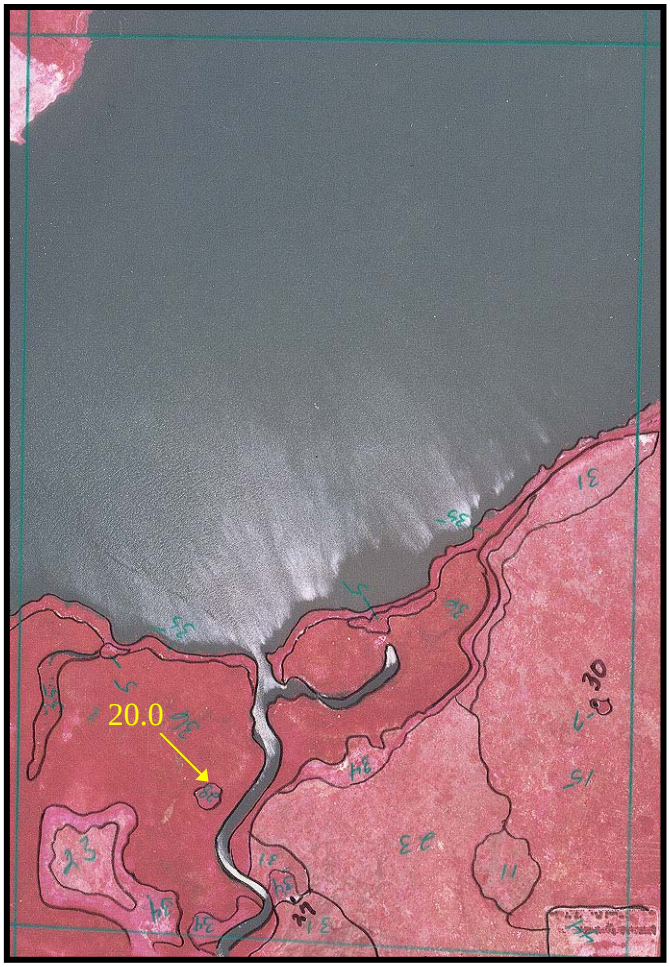
Photo Signature: Reddish brown to pink, depending on soil moisture. Some polygons have swirling due to hydrologic regimes as evidenced by the bottom example.

Photograph 7-9 with mylar
Horizons, Inc

Common Reedgrass Herbaceous Vegetation (Map Code 20.0)

Location: Infrequent stands within cattail communities.

Photo Signature: Occur as small, circular, isolated patches typically within stands of cattails. Color is usually a lighter red against a background of darker red.



Photograph 4-5 with mylar
Horizons Inc.

Baltic Rush Herbaceous Vegetation (Map Code 21.0)

Location: Widely scattered patches usually associated with ephemeral drainages. Mapped on an as-observed basis.

(No Ground Photo)

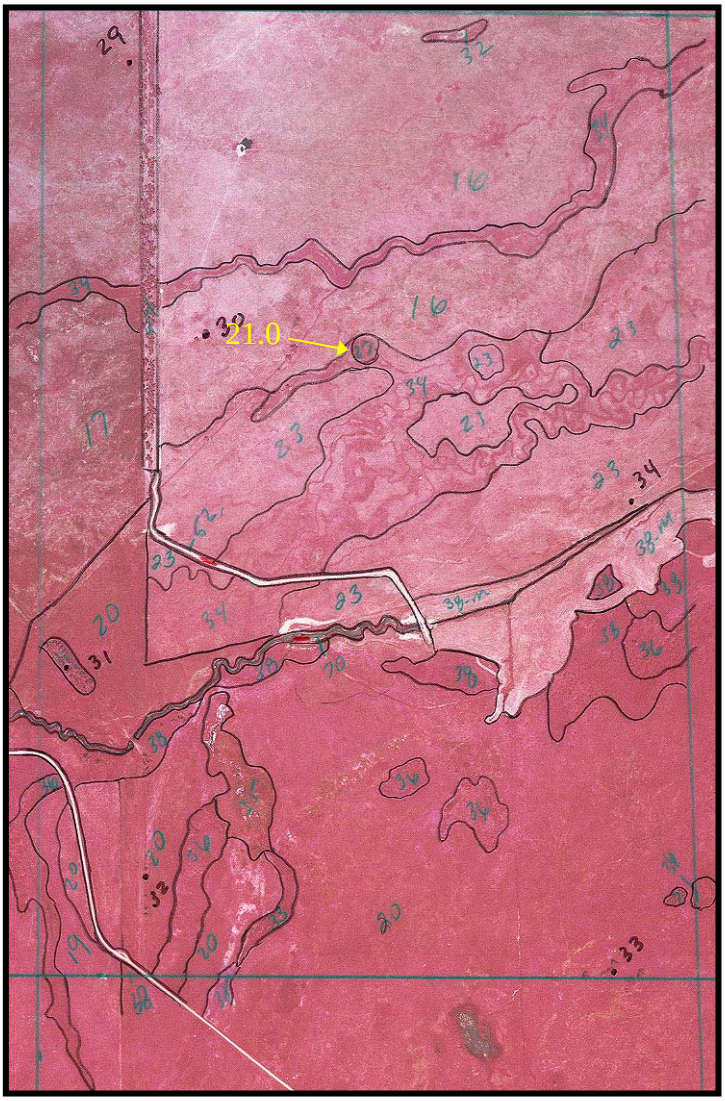


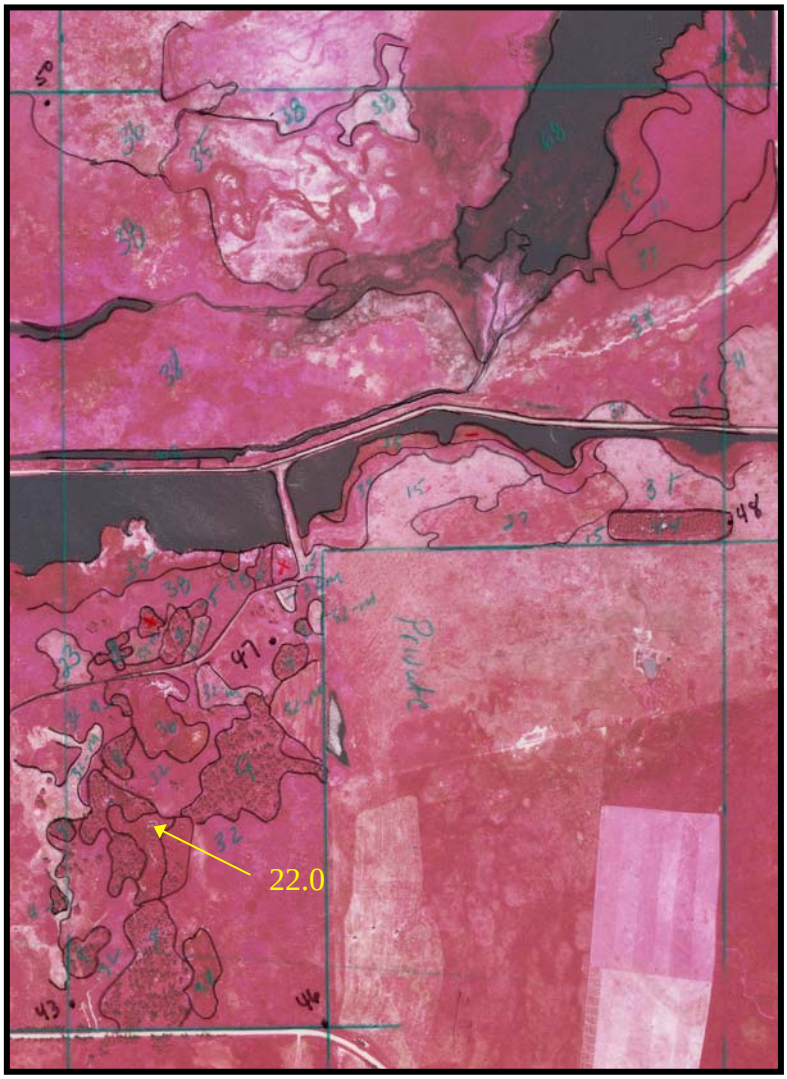
Photo Signature: A darker red circular patch usually within light red stands of prairie cordgrass.

Photograph 8-9 with mylar
Horizons, Inc

Nebraska Sedge Herbaceous Vegetation (Map Code 22.0)

Location: The distribution of this type on the Refuge is extremely patchy. Most stands are smaller than the minimum mapping unit of 0.5 ha. Stands are usually found in poorly drained sites adjacent to wetlands and near small drainages with few, if any, associated species.

Photo Signature: Dark red linear or oblong patches usually within light red stands of prairie cordgrass or other wetland types.

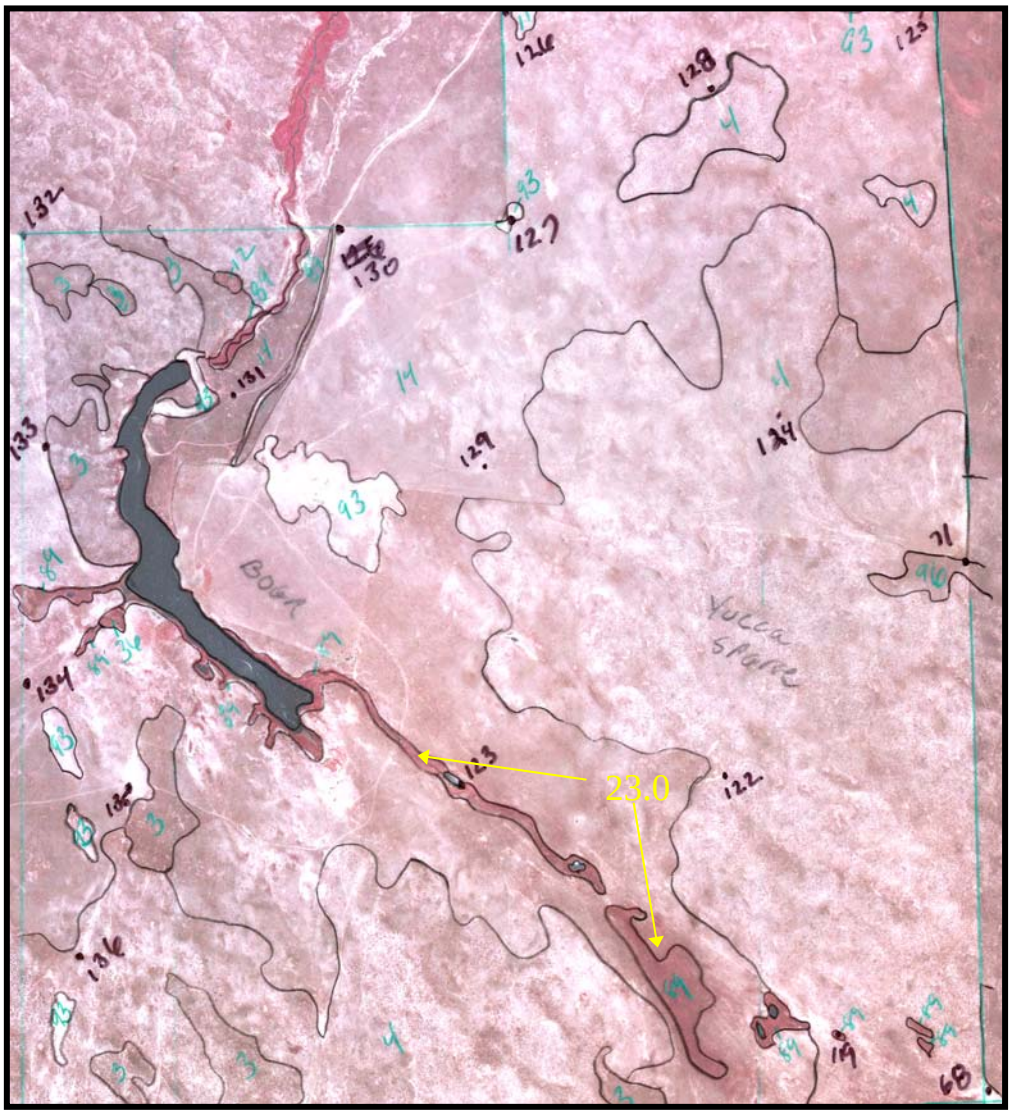


Photograph 8-13 with mylar
Horizons Inc.

Emergent Sandhills Wetland (Map Code 23.0)

Location: These wet pockets are scattered throughout the sandhills region on private lands next to the refuge. Most are located in moist swales or drainages. Cattle grazing may influence this type.

Photo signature: The signature for this type is similar to other wetland types; dark red to brown with coarse texture. The location of this type on private land and in the sandhills region helped in the interpretation.



Photograph 10-9
with mylar
Horizons, Inc

Threesquare Bulrush Herbaceous Vegetation (Map Code 24.0)

Location: This type is only present in a few known locations on the Refuge adjacent to pools and managed areas in the northern portion.

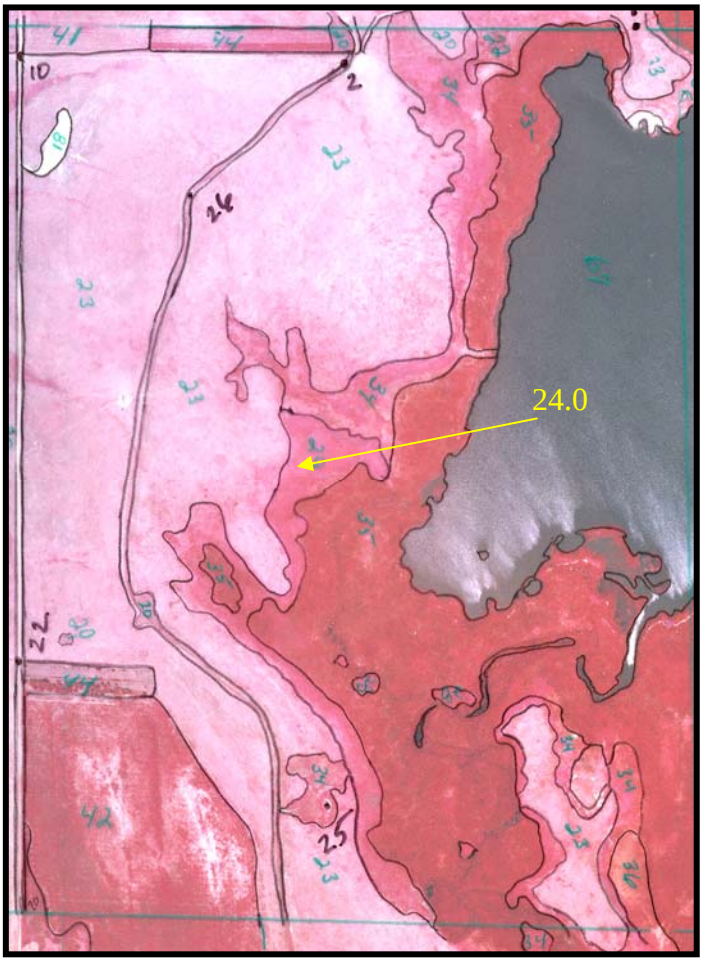


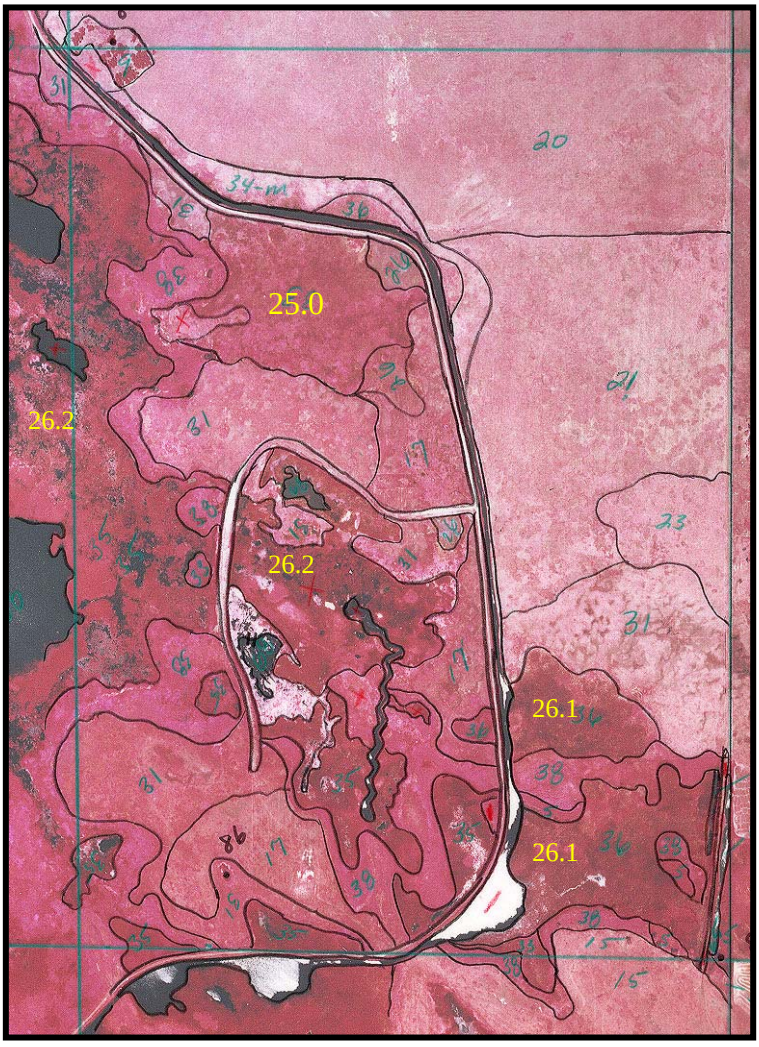
Photo Signature: The signature for this type is very similar to other wetland types but slightly more pink and less mottled. The mapping of this type was largely based on ground verification.

Photograph 4-4 with mylar
Horizons, Inc

Hardstem Bulrush - Broadleaf Cattail (Softstem Bulrush) Sandhills Herbaceous Vegetation (Map Code 25.0)

Location: Widely scattered, usually associated with the mixed forb and cattail communities.

Photo Signature: Irregular-shaped patches that are lighter red than the surrounding dark red of cattails but darker than mixed forbs.



Photograph 6-17 with mylar
Horizons, Inc

Cattail spp. Great Plains Herbaceous Vegetation (Semipermently Flooded) (Map Code 26.1)
Cattail spp. Great Plains Herbaceous Vegetation (Seasonally Flooded) (Map Code 26.2)

Location: Widespread throughout the Refuge near pools, ponds, stock ponds, and streams. The semi-permanently flooded type is typically found adjacent to permanent sources of water, while the seasonally flooded type is located on ephemeral sites.

Photo Signature: The semi permanently flooded type (26,1) is very dark red (almost black), while the seasonally flooded type (26.2 usually adjacent to 26.1) is bright red.

Photograph 3-5 with mylar
Horizons Inc.

Western Snowberry Shrubland (Map Code 27.0)

Location: This type occurs as small circular patches and was mapped based on field data and observation.

Photo Signature: Small, dark red to black isolated circular patches.

Photograph 3-5 with mylar

Horizons Inc.

American Plum Stands (Map Code 28.0)

Location: This type occurs in scattered, isolated stands throughout the Refuge. It is common along roadside ditches, alongside shelterbelts, and in moist drainages

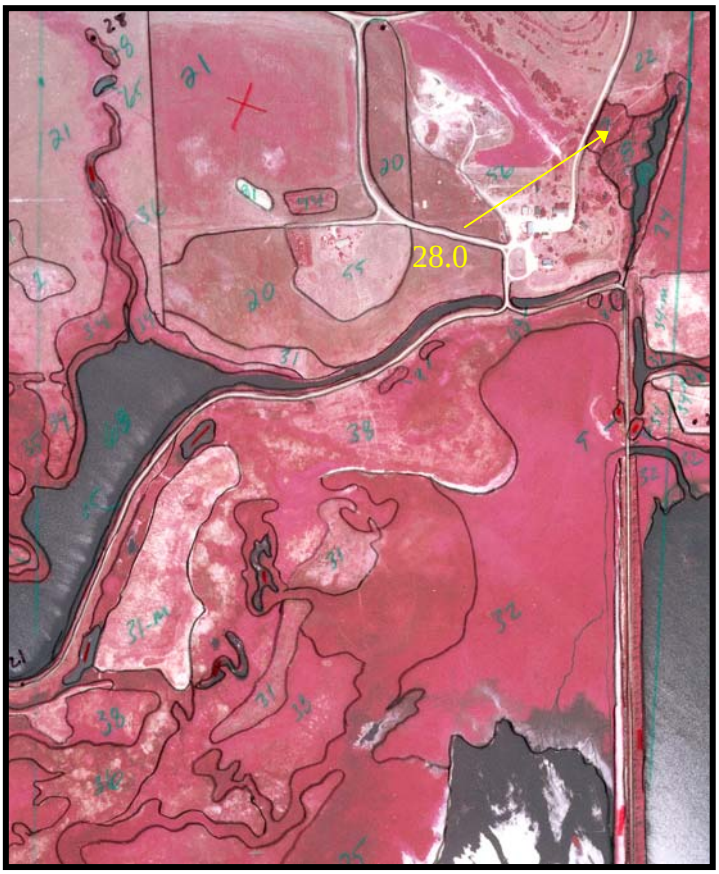


Photo Signature: This type occurs as small, isolated, circular patches on upland sites, or linear communities often on the fringes of shelterbelts. The signature for this type has a brushy appearance and a dark red color, often in contrast to a lighter red background in upland situations, or against the brushy, pebbly pattern of shelterbelts.

Photograph 7-3 with mylar
Horizons Inc

False Indigobush Stands (Map Class 29.0)

(No Ground Photo)

Location: This type is found only in a few isolated patches in the eastern portion of the Refuge. This shrub type is not a true community but occurs along some drainages and streams.

Photo Signature: This type occurs on the photos as a coarse textured bright pink to pink color. The signature is similar to other shrub types and was mapped for this project based on field verification.

Photograph 8-8 with mylar
Horizons, Inc

Sandbar Willow Temporarily Flooded Shrubland (Map Code 30.0)

Location: This wetland shrub community occurs sporadically throughout the northern portion of the Refuge, usually adjacent to pools, ponds, dikes, and levees.

Photo Signature: A smooth to brushy texture and a dark red color.

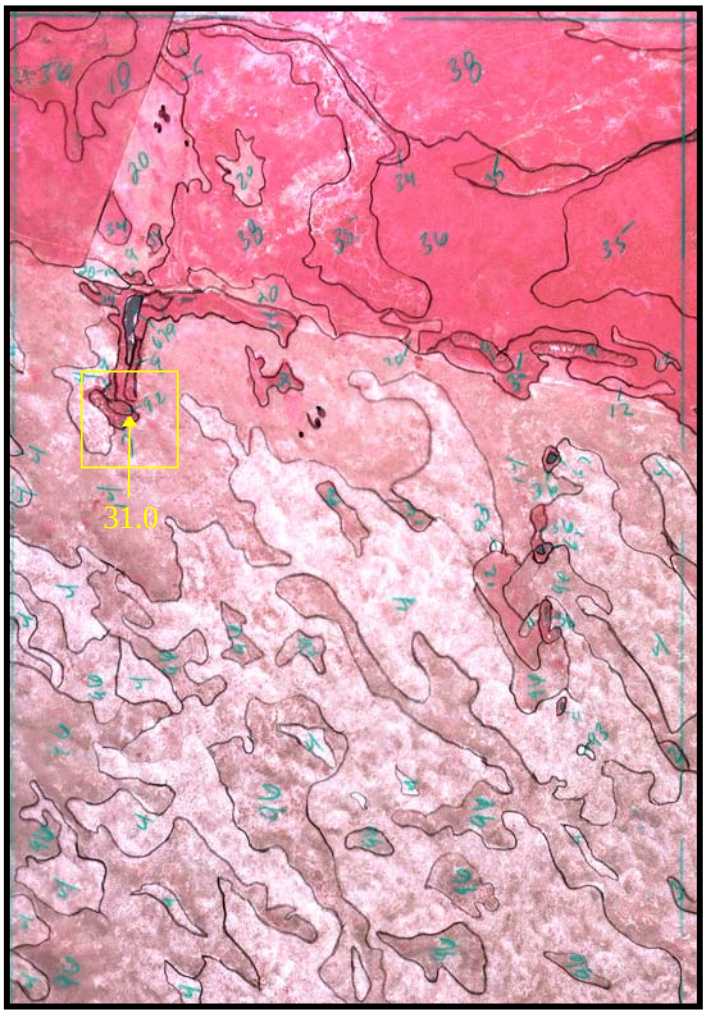
Photograph 4-5 with mylar
Horizons, Inc

American Hackberry Stands (Map Code 31.0)

Location: Two small stands occur in the sandhills portion of the Refuge adjacent to a pond and a stream.

(No Ground Photo)

Photo Signature: This type is very similar to willow and plum stands. This type was mapped based on field verification.

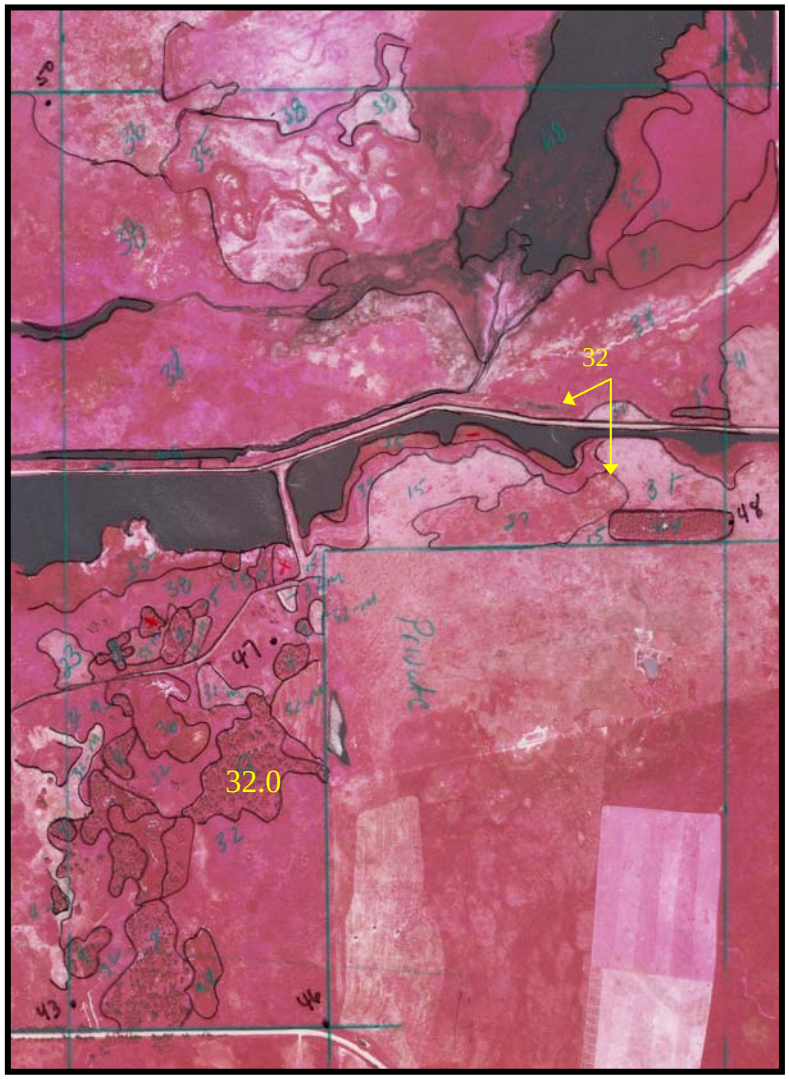


Photograph 9-7 with mylar
Horizons, Inc

Peachleaf Willow Woodland (Map Code 32.0)

Location: Scattered small to large stands occur throughout the northern portion of the Refuge adjacent to pools, ponds, and streams.

Photo Signature: This type appeared as large crowned trees and brushy, thick stands of young trees. Both had a dark red and pebbly appearance.



Photograph 8-13 with mylar
Horizons, Inc

Plains Cottonwood Stands (Map Code 33.0)

(No Ground Photo)

Location: Small stands occur throughout the northern portion of the Refuge adjacent to pools, ponds, and streams.

Photo signature: This type has a dark red signature typical of deciduous trees. It closely resembles other tree types such as peachleaf willow and green ash. Due to its rarity, this type was mapped based on field verification.

Photograph 3-5 with mylar
Horizons, Inc

Green Ash Stands (Map Code 34.0)

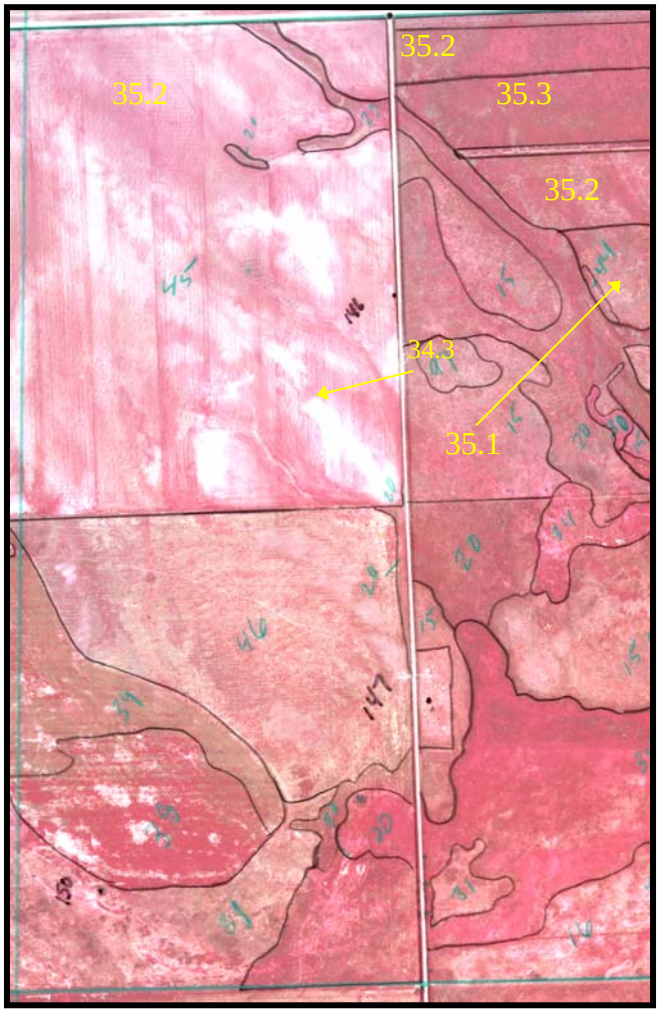
Location: One small stand occurs in the northern portion of the Refuge.

(No Ground Photo)

Photo signature: This type has a dark red signature typical of deciduous trees. It closely resembles other tree types such as peachleaf willow and green ash. Due to its rarity, this type was mapped based on field verification.

Photograph 6-17 with mylar
Horizons, Inc

Native Species Plantings (Sideouts Grama) (Map Code 35.1)
Native Species Plantings (Mixed Grasses) (Map Code 35.2)
Native Species Plantings (Switchgrass) (Map Code 35.3)



Location: Widely scattered throughout the northern portion of the Refuge.

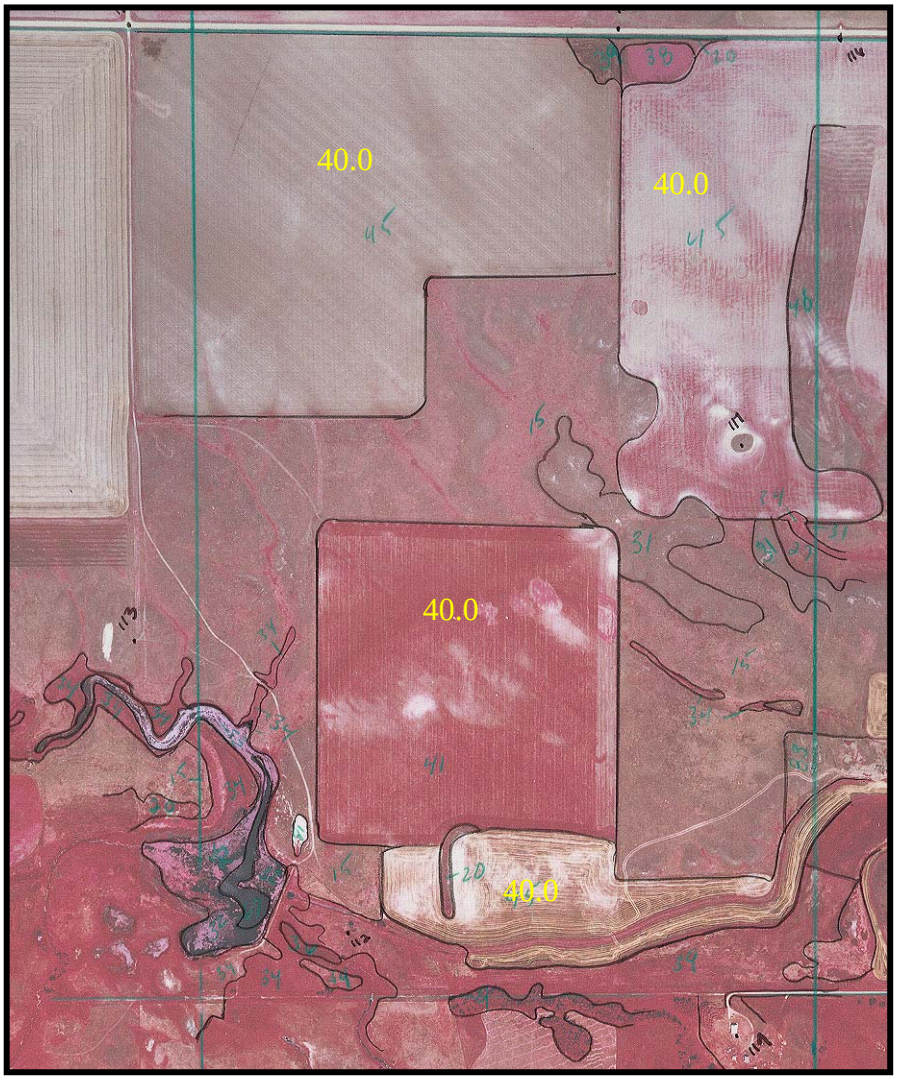
Photo Signature: Reddish brown with brownish spots. Can often see cultivation lines within the stand.

Photograph 7-8 with mylar
Horizons Inc.

Agricultural Lands (Map Code 40.0)

Location: These types are found adjacent to county roads in the northern portion of the Refuge.

Photo Signature: Brown, red, to dark red, often with white spots indicating bare soil, especially in soybean fields. Substantial evidence of agricultural activity (lines indicating cultivating, haying, etc.).



Photograph 3-3
with mylar
Horizons, Inc

Shelterbelts (Map Code 41.0)

Location: Adjacent to county roads and residential areas throughout the Refuge.

Photo Signature: Large crowned trees in straight rows that are dark red and pebbly in appearance.

Photograph 3-5 with mylar
Horizons, Inc