United States Department of Agriculture
Natural Resources Conservation Service

Ecological Site Description

Site Stage: Provisional

Provisional: an ESD at the provisional status represents the lowest tier of documentation that is releasable to the public. It contains a grouping of soil units that respond similarly to ecological processes. The ESD contains 1) enough information to distinguish it from similar and associated ecological sites and 2) a draft state and transition model capturing the ecological processes and vegetative states and community phases as they are currently conceptualized. The provisional ESD has undergone both quality control and quality assurance protocols. It is expected that the provisional ESD will continue refinement towards an approved status.

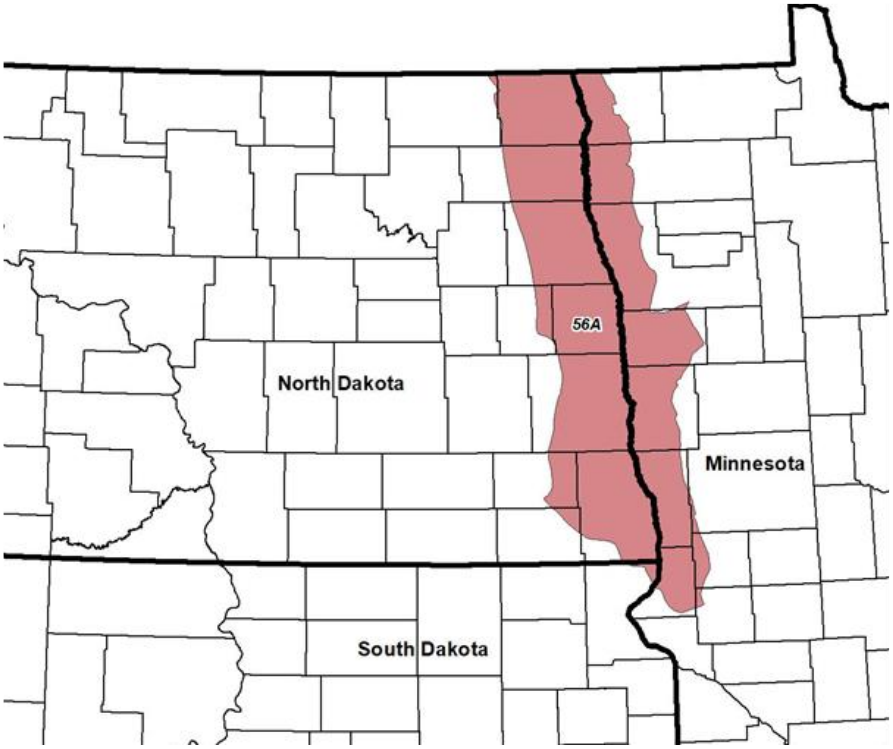
Site Name: Shallow Marsh

Site Type: Rangeland

Site ID: R056AY101ND

Major Land Resource Area: 56A – Red River Valley of the North

For more information on MLRAs, refer to the following web site:
https://www.nrcs.usda.gov/resources/data-and-reports/major-land-resource-area-mlra



Location of MLRA 56A within Minnesota, North Dakota, and South Dakota

The Red River Valley of the North MLRA is an expansive and agriculturally important region consisting of 10,400,000 acres and including a portion of 25 counties in eastern North Dakota and northwestern Minnesota along with a small portion of the northeast corner (Roberts County) of South Dakota.

Although MLRA 56A is currently called the Red River Valley of the North, the landscape does not fit the common understanding of "valley" as the transition out of the Valley is very gradual in most places. The extent of the MLRA corresponds to the area covered by Glacial Lake Agassiz including lacustrine sediments, beach ridges, and deltas where rivers flowed into the glacial lake. Also included are island areas of glacial till which were surrounded by the lake waters. Some of the lacustrine deposits are very deep and some have glacial till within a few feet of the surface. The glaciolacustrine materials range from clayey to sandy.

The primary river in the MLRA is the Red River of the North flowing northward into Canada where it empties into Lake Winnipeg. The river is formed by the confluence of the Bois de Sioux River (flowing from northeastern South Dakota) and the Ottertail River flowing from west-central Minnesota. Numerous tributaries in MLRA 56A contribute additional water to the Red River. In Minnesota these include the Two Rivers, Snake, Marsh, Middle, Red Lake, Wild Rice, and Buffalo. In North Dakota, the Pembina, Tongue, Park, Forest, Turtle, Goose, Elm, Rush, Maple, Sheyenne, and Wild Rice are tributaries to the Red River. There are also smaller streams and coulees along with many legal drains.

The relative flatness of much of the MLRA contributes to a flooding hazard for large areas of agricultural land in the spring months. Soil salinity, while variable, also impacts land management on many areas within the MLRA. Extensive surface and subsurface (tile) drainage systems have been constructed/installed to manage excess water and/or salinity on cropland. This extensive drainage has apparently reduced ground water recharge regionally, thus impacting seasonal water table level/fluctuation and its influence on plant communities. Soils that were poorly drained prior to wide-spread drainage may now function as somewhat poorly drained or even moderately well drained soils. For example, undrained Fargo soils are Wet Meadow ecological sites; with surface drainage they may function as Subirrigated sites; and with tile drainage, they commonly function as Clayey sites. Because of the extensive alteration of the hydrology, restoration to the natural conditions of the reference state dynamics would not be possible.

MLRA 56A is an ecotone between grassland dominated MLRAs 55A and 55B to the west and forest dominated MLRAs 56B and 102A to the east. This region is utilized mostly by farms; about 80 percent is non-irrigated cropland, but some irrigated fields exist on the beach areas. Cash-grain, bean, sugar beets, potatoes, and oil production crops are the principal enterprise on many farms, but other feed grains and hay are also grown. Currently about 6 percent of this area is forested, mostly in areas along rivers that are difficult to access with farm equipment. Another 6 percent is grassland used for ranching and/or wildlife habitat. Grazing lands occur primarily in the Sand Hills area of the Sheyenne River delta, on beach areas, and on other areas too wet, saline, sodic, steep, or inaccessible to be productive cropland.

Ecological Site Concept

The Shallow Marsh ecological site is commonly located in deep depressions on lake plains, till-floored lake plains, delta plains, and isolated areas of till plains. It also occurs in depressions and oxbows on flood plains. The soil is very deep. Typically, the dark-colored surface soil is more than 7 inches thick and generally more than 20 inches thick; however, some soils with thin topsoil layers (<7 inches thick) are included. The site is very poorly drained; under average climatic conditions, it is ponded for long

or very long periods during the growing season. Typically, the depth of ponding is less than 3 feet in the spring and less than 1.5 feet in late summer. Where flooding occurs, it is generally frequent and of very long duration. Soil salinity (typically with E.C. <8 dS/m) is allowable on this site. Effervescence ranges from none to violent. Hydrology (surface and sub-surface) is the primary factor used in identifying this site. All textures are included in the site. Slope is typically less than 1 percent but ranges to 2 percent. On the landscape, this site is below the Clayey, Loamy, Loamy Overflow, Limy Subirrigated, Sands, Subirrigated, Subirrigated Sands, and Wet Meadow ecological sites. The Saline Lowland site is typically slightly higher on rims of depressions and adjacent flats; it has moderate to strong soil salinity. The poorly drained Sodic Subirrigated site is associated on some sand plains.

Physiographic Features

This site typically occurs in deep depressions on lake plains, till-floored lake plains, delta plains, and isolated areas of till plain; It also occurs in depressions and oxbows on flood plains. Parent materials are alluvium (stream or local), glaciolacustrine sediments or deltaic deposits. Slope is less than 2 percent.

Landform: depression, pothole, flood plain

	Minimum	Maximum
Elevation (feet):	750	1475
Slope (percent):	0	2
Water Table Depth (inches):	0	18
Flooding:		
Frequency:	None	Frequent
Duration:	None	Very long
Ponding:		
Depth (inches):	0	36
Frequency:	None	Frequent
Duration:	None	Very long
Runoff Class:	None	Very Low
Aspect:	No influence on this site	

Climatic Features

MLRA 56A is considered to have a continental climate – cold winters and relatively hot summers, low to moderate humidity, light rainfall, and much sunshine. Extremes in temperature may also abound. The climate is the result of this MLRA's location near the geographic center of North America. There are few natural barriers on the northern Great Plains and air masses move freely across the plains and account for rapid changes in temperature.

Annual precipitation typically ranges from 18 to 23 inches per year. The average annual temperature is about 40°F. January is the coldest month with average temperatures ranging from about 1°F (Pembina, North Dakota (ND) to about 11°F (Wheaton, Minnesota (MN). July is the warmest month with temperatures averaging from about 68°F (Pembina, ND) to about 73°F (Wheaton, MN). The range of average monthly temperatures between the coldest and warmest months is about 65°F. This large annual range attests to the continental nature of this area's climate. Winds are estimated to average about 13 miles per hour annually, ranging from about 15 miles per hour during the spring to about 11 miles per hour during the summer. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 50 miles per hour.

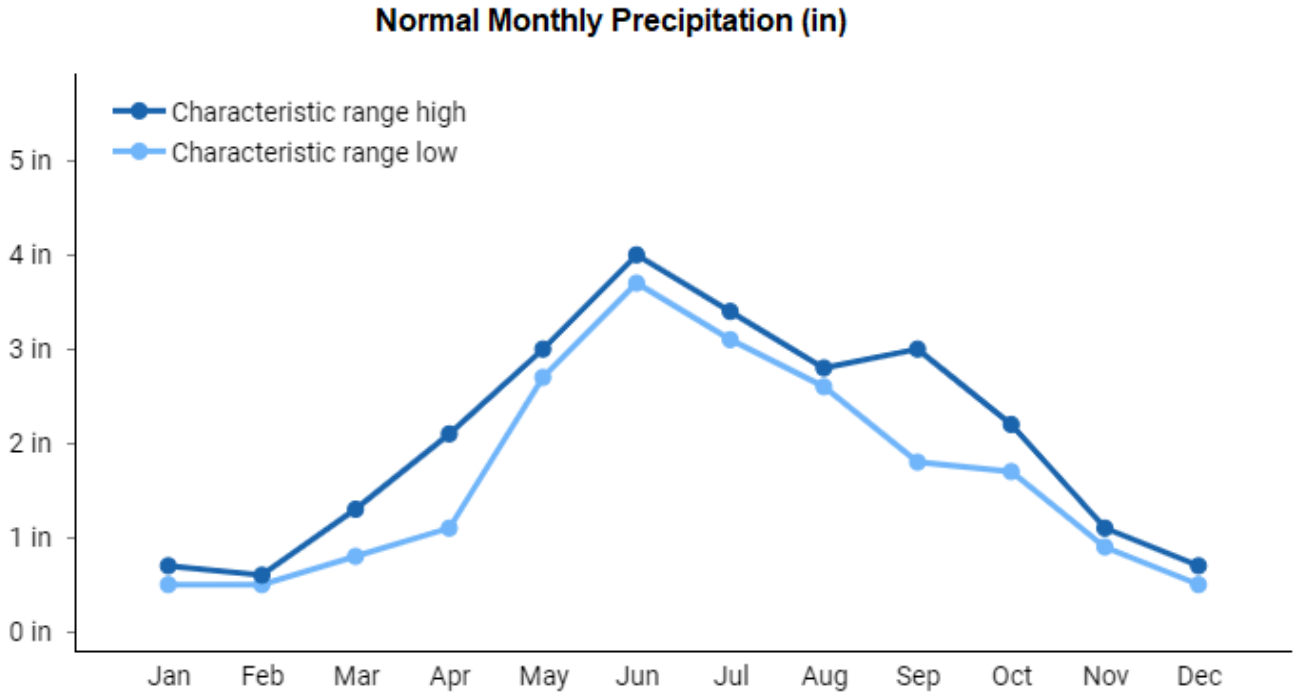
Growth of cool season plants begins in early to mid-March, slowing or ceasing in late June. Warm season plants begin growth about mid-May and continue to early or mid-September. Greening up of cool season plants may occur in September and October when adequate soil moisture is present.

Climate normals

	Representative High	Representative Low	Actual High	Actual Low	Average
Mean annual precipitation (in):	24	21	25	20	22
Frost free period (days):	126	102	131	87	112
Freeze free period (days):	145	132	150	126	138

Normal monthly precipitation (in)

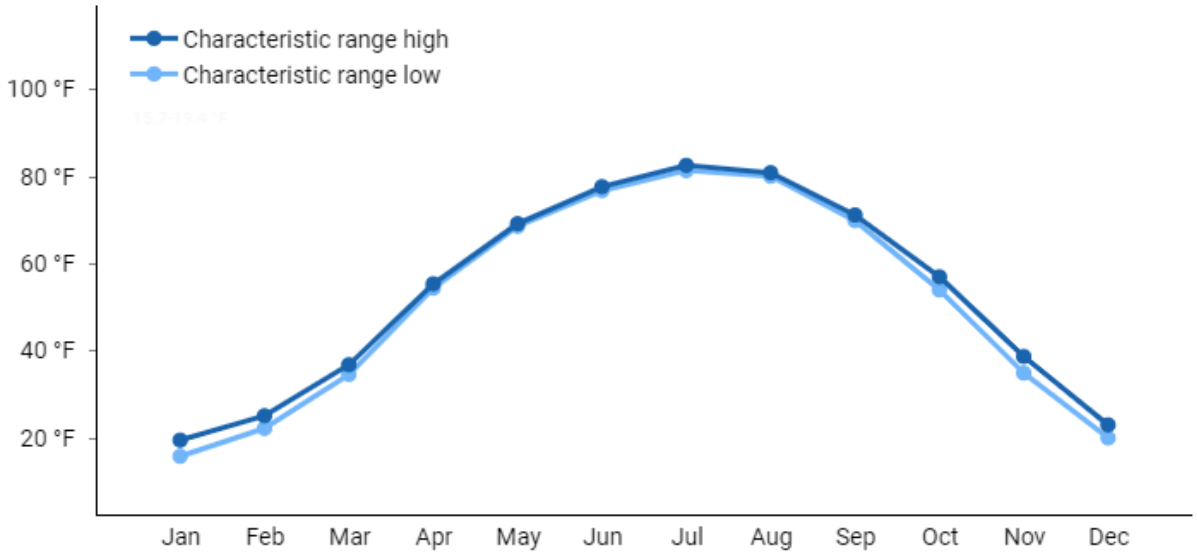
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Representative high:	0.7	0.6	1.3	2.1	3	4	3.4	2.8	3	2.2	1.1	0.7
Representative low:	0.5	0.5	0.8	1.1	2.7	3.7	3.1	2.6	1.8	1.7	0.9	0.5
Actual high:	0.8	0.7	1.5	2.2	3.2	4.1	3.4	3	3.1	2.3	1.2	0.8
Actual low:	0.5	0.4	0.8	1	2.7	3.6	3	2.5	1.8	1.6	0.8	0.5



Normal monthly maximum temperature (°F)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Representative high:	19.4	25	36.7	55.3	69.1	77.6	82.5	80.8	71.1	56.9	38.6	22.9
Representative low:	15.7	22.1	34.5	54.3	68.5	76.7	81.3	80	69.8	53.9	34.8	19.9
Actual high:	19.9	25.1	36.8	55.9	69.7	77.7	82.7	80.8	71.4	57	38.6	23.9
Actual low:	13.4	19.3	32	51.8	65.8	74.5	79.1	78.4	67.9	52.3	33.1	18.1
Average:	17	23	35.2	54.5	68.3	76.7	81.5	80.1	70.2	55.1	36.1	21.1

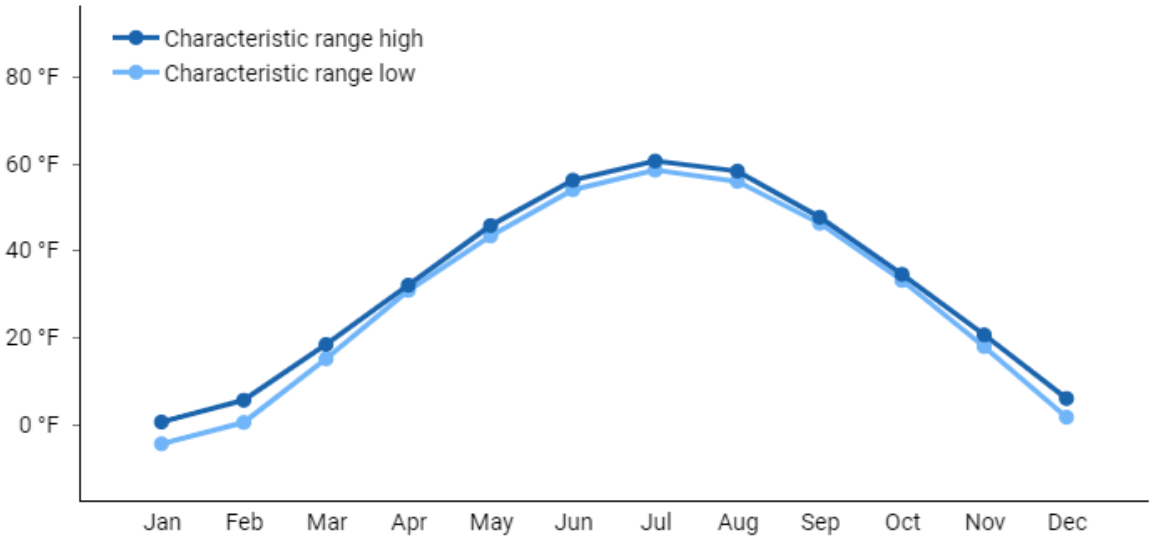
Normal Monthly Maximum Tempurature (F°)



Normal monthly minimum temperature (°F)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Representative high:	0.6	5.6	18.4	32	45.7	56.1	60.5	58.2	47.6	34.5	20.6	6
Representative low:	-4.4	0.5	15.1	30.8	43.3	53.9	58.4	55.8	46.2	33.1	17.9	1.7
Actual high:	0.6	5.7	18.9	33.3	46.1	56.2	60.7	58.4	48.4	35.6	20.7	6.3
Actual low:	-5.4	-0.5	13.9	29.7	41.9	52.4	56.6	53.8	43.8	31.5	16.9	1.2
Average:	-1.5	3.6	16.9	31.5	44.2	54.5	58.9	56.3	46.5	33.9	19.4	4.3

Normal Monthly Minimum Temperature (F°)



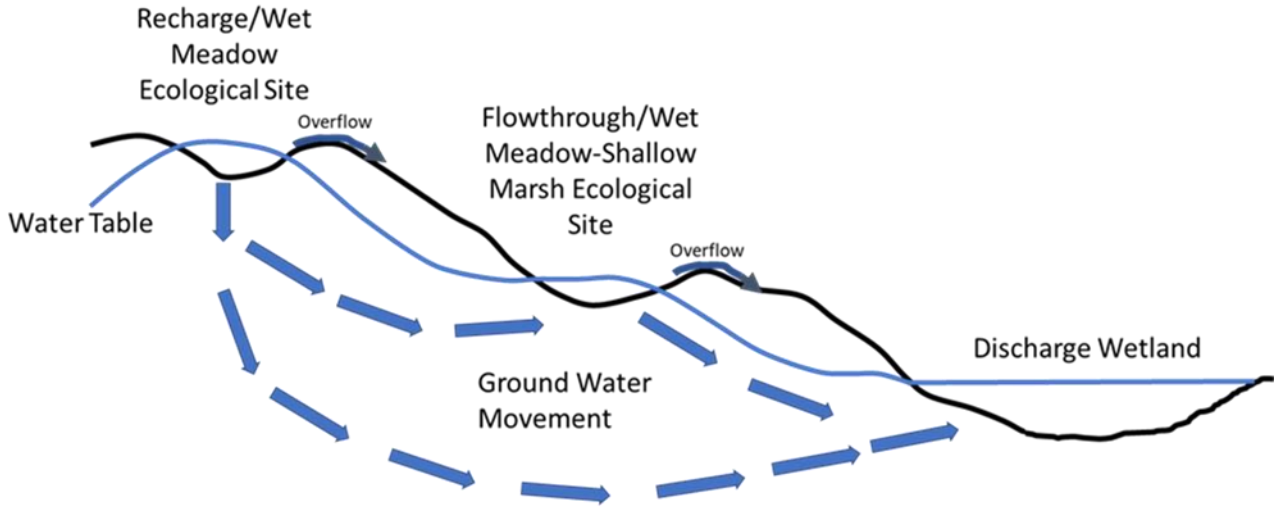
Climate stations used

(1) VICTOR 4 NNE [USC00398652], Rosholt, SD
(2) PARK RIVER [USC00326857], Park River, ND
(3) GRAFTON [USC00323594], Grafton, ND
(4) WHEATON [USC00218907], Wheaton, MN
(5) AGASSIZ REFUGE [USC00210050], Grygla, MN
(6) PEMBINA [USW00014924], Pembina, ND

Influencing Water Features

This site is very poorly drained. Under normal climatic conditions, it is inundated for very long periods (>30 days) during the growing season. Some soils in this site have endosaturation (apparent water table) and others have episaturation (perched water table above a subsoil layer with very slow or slow permeability). Water tables in endosaturated soils typically range from 1.5 feet above to 6 inches below the surface during most of the growing season. The depth of ponding on episaturated soils, typically, is less than 3 feet in the spring and less than 1.5 feet in late summer. Surface water may not be evident in late summer; but saturation is generally within a depth of 18 inches during this time.

Water on the site is typically received from upland runoff, but on flood plains it is from stream overflow. Soils occurring on flood plains have frequent, long, or very long flooding. Surface infiltration and permeability though the profile ranges from very slow to very rapid. These typically are flow-through wetlands but can also be recharge wetlands. See **Site Development and Testing Plan** for discussion of discharge wetlands.



Surface/Subsurface Water Flow Diagram (Adapted from Seelig and DeKeyser 2006)

Wetlands receive water from different sources including ground water movement. Recharge wetlands have groundwater flow predominantly away from the wetland moving toward or into a flowthrough or discharge wetland basin. Flowthrough wetlands have groundwater flowing away from the wetland basin but is balanced with water flowing into the basin.

Water loss is primarily through evapotranspiration and lateral movement into (and evaporation from) adjacent soils. During periods of drought or extreme wetness, water table fluctuations will also have an impact on depth of ponding, especially in sandy soils. During periods of drawdown (e.g., prolonged drought), soil and water chemistry may significantly impact the soil/water/vegetation dynamics of the site (see **Site Development and Testing Plan**).

Fluctuations in specific conductance are less pronounced during average or normal water conditions than during periods of excessive water depth or extreme drought. The approximate normal and extreme range in specific conductance (micromhos/cm3) of surface water in plant communities that are indicators of differences in average salinity are as follows:

Plant Community	Normal Range (micromhos/cm^3	Electroconductivity (dS/m)
Fresh	<40 - 500	< 0.5
Slightly brackish	500 - 2,000	0.5 to 2.0
Moderately brackish	2,000 - 5,000	2.1 to 5.0
Brackish	5,000 - 15,000	5.1 to 15.0
Sub-saline	15,000 - 45,000	15.1 to 45.0
Saline	45,000 -100,000	> 45.0

Soils in these depressions are considered seasonal wetlands; however, during wetter than normal climate cycles, these soils may have continuous, deep ponding throughout the growing season (or through multiple growing seasons).

Representative Soil Features

Soils associated with Shallow Marsh ES include mineral and organic soils. They are in the Mollisol, Vertisol, Entisol, and Histosol orders. The Mollisols are classified further as Cumulic Endoaquolls, Cumulic Vertic Endoaquolls, Cumulic Vertic Epiaquolls, Typic Argiaquolls, Typic Calciaquolls, Typic Endoaquolls, Typic Epiaquolls, and Vertic Argiaquolls. The Vertisols are classified further as Typic Endoaquerts and Typic Epiaquerts. The Entisols are classified further as Mollic Endoaquents, Mollic Fluvaquents, and Mollic Psammaquents. The Histosols are classified further as Typic Haplohemists. Soils on this site were developed under wetland vegetation associated with very long periods of inundation. They formed in glaciolacustrine sediments, deltaic deposits, local alluvium from till and glaciolacustrine sediments, and flood plain alluvium. A few inches of organic materials are common on the surface of mineral soils that have never been cultivated.

The common feature of soils in this site is frequent seasonal inundation (typically extends into mid-summer or longer). Some are in deep depressions and potholes that are ponded through much of the growing season, and some are on flood plains with frequent, long or very long flooding. The soils are very deep and very poorly drained. Since hydrology (surface and sub-surface) is the primary factor used in identifying this site, all textures are included. Therefore, soil physical properties associated with texture vary widely. The dark-colored surface soil typically is more than 7 inches thick and generally more than 20 inches thick; however, soils with thin topsoil layers (<7 inches thick) also occur.

Soil salinity is typically none or very slight (E.C. <4 dS/m), but soils with slight salinity (E.C. 4 – 8 dS/m) are included. Sodicity is typically none or low. In mineral soils, soil reaction typically is slightly

acid to moderately alkaline (pH 6.1 to 8.4). The calcium carbonate content typically ranges from 0 to 35 percent; some soils have a subsoil layer with CaCO3 accumulations as high as 45 percent.

In soils with a histic epipedon or that are organic throughout, soil reaction ranges from very strongly acid to slightly alkaline (pH 4.5 to 7.8) in the organic materials. The lowest pH values (bogs) occur in the eastern part of the MLRA while the highest pH values (fens) occur primarily in the western part of the MLRA.

Sub-surface soil layers are non-restrictive to root penetration, but in some soils water movement downward is slowed. These soils are not susceptible to water erosion. Inundated water conditions strongly influence the soil/water/plant relationship.

Major mineral soil series correlated to the Shallow Marsh site are Dovray, Clearwater, Espelie, Grano, Ludden, Parnell, Rauville, Roliss, Urness, and Venlo. Very poorly drained phases of the Arveson, Augsburg, Borup, Colvin, Cormant, Lowe, Percy, Rockwell, and Rosewood are also included in the site. The major organic soil included in this site is Rifle (**see Site Development and Testing Plan**). Also, currently included in the site is the Southam soil which has nearly continuous ponding (3 to >5 feet deep) – see **Site Development and Testing Plan**.

Access Web Soil Survey (https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx) for specific local soils information.

Parent Material Kind: glaciolacustrine deposits, deltaic deposits, alluvium
Parent Material Origin: lacustrine, till, outwash
Surface Texture: silty clay loam, silt loam, silty clay, clay, loam, fine sandy loam, loamy fine sand, mucky peat
Surface Texture Modifier: mucky
Subsurface Texture Group: clayey, sandy, loamy, silty
Surface Fragments <3" (% Cover): 0-1
Surface Fragments ≥3" (%Cover): 0-3
Subsurface Fragments <3" (% Volume): 0-16
Subsurface Fragments ≥3" (% Volume): 0-3

	Minimum	Maximum
Drainage Class:	very poorly	very poorly
Permeability Class*:	very slow	very rapid
Depth to first restrictive layer (inches):	80	>80
Electrical Conductivity (dS/m)*:	0	8
Sodium Absorption Ratio*:	0	7
Soil Reaction (1:1 Water)*:	6.1	8.4
Soil Reaction (0.1M CaCl2):	4.5	7.8
Available Water Capacity (inches)*:	NA	NA
Calcium Carbonate Equivalent (percent)*:	0	45

*These attributes represent from 0-40 inches. Electrical Conductivity (E.C.) values are based on Saturated Paste method; the commonly used 1:1 field method will have E.C. values <8.

Plant Communities

Ecological Dynamics of the Site:
This ecological site description is based on nonequilibrium ecology and resilience theory and utilizes a State-and-Transition Model (STM) diagram to organize and communicate information about ecosystem change as a basis for management. The ecological dynamics characterized by the STM

diagram reflect how changes in ecological drivers, feedback mechanisms, and controlling variables can maintain or induce changes in plant community composition (phases and/or states). Weather variables that dramatically change water depths and water chemistry, combined with the application of various management actions, impact the ecological processes which influence the competitive interactions, thereby maintaining or altering plant community structure. Due to these climatic and management factors, species composition within Plant Community Phases and States can be highly variable.

Drainage/Hydrological Manipulation: Hydrological manipulation (surface or tile drainage, pumping, surface water diversion, etc.) modifies this ecological site. For more detailed information on drainage/hydrological manipulation of the site, see the **Hydrology Functions** section of this document.

MLRA 56A has a wide variation of Shallow Marsh sites mainly driven by differences in water source and water chemistry. The Shallow Marsh ecological sites in the Sheyenne Delta region of the MLRA are driven by ground water fluctuations and are mainly freshwater. Shallow Marsh ecological sites in the northwestern portions of the MLRA are driven by highly saline ground water and can become very brackish dependent upon runoff from snowmelt and rainfall. Water in Shallow Marsh ecological sites in the northeast region is derived from runoff, stream flow, and groundwater sources, and has circumneutral pH (6.0–8.0) and high mineral and nutrient content. Refer to **Site Development and Testing Plan** section at end of this document.

This site developed under Northern Great Plains climatic conditions which included frequent droughts and wide fluctuations in temperature and precipitation which can result in both short-term and long-term changes in water levels and water chemistry (e.g., alkalinity/salinity). Unlike adjoining upland ecological sites, which are strongly influenced by grazing and fire, the primary ecological drivers for the Shallow Marsh ecological sites are hydrology and water chemistry. Hydrology is mainly a factor of landscape position, including the size of the contributing watershed, connectivity to other basins, ground water movement, and whether the basin has an outlet. Water chemistry is influenced by soil chemistry and whether the site is a recharge or flowthrough site.

Shallow Marsh ecological sites are highly influenced by water levels, including saturated soil, water movement, and water chemistry (i.e., recharge and flowthrough hydrology). Water levels, including soil saturation, influence fire effectiveness and livestock use. Water levels also influence exotic plant invasion. As Shallow Marsh sites drawdown (drying and losing soil moisture), they transition to functioning similarly to Wet Meadow ecological sites and can increase in salinity/alkalinity. Salt tolerant and grazing tolerant foxtail barley can dominate the site during the drawdown phase. Extended periods of drawdown accompanied by grazing may cause this site to function similarly to Saline Lowland or other, upland ecological sites. Many factors will dictate the speed of exotic plant invasion including duration of drawdown phase, management of the sites during the drawdown phase, change in soil chemistry, and availability of exotic plant seed or plant parts. Exotic plant invasion usually begins to occur on adjacent Wet Meadow ecological sites, within or between basins, and then moves into the Shallow Marsh ecological site. During extended periods of drawdown, presence of exotic plants adjacent to the site and lack of fire or heavy continuous livestock grazing can speed up the invasion of foxtail barley and exotic cool-season grasses (e.g., quackgrass, barnyard grass) or forbs (e.g., Canada thistle, sowthistle). Extended periods of drawdown will also allow upland invasive species, such as leafy spurge and Russian olive, to invade the site.

Once the site is invaded, increased water depth can inundate exotic plants to a depth above plant height, causing considerable mortality, allowing restoration from the State 2: Native/Invaded State to

the State 1: Reference State. Salt accumulation will be difficult to reverse to levels prior to extended periods of drawdown and may take extended periods of inundation. In addition, exotic grasses (e.g., quackgrass) and foxtail barley can tolerate extended periods of inundation or saturation, which may never totally drown out along the outer margins of the adjacent Wet Meadow or Saline Lowland ecological sites. The continued presence of exotic cool-season grasses will cause this site to transition from State 1: Reference State and State 2: Native/Invaded State as water levels naturally fluctuate.

During extended periods of drawdown, heavy continuous grazing without adequate recovery periods following each grazing occurrence favors foxtail barley (e.g., Community Phase 2.2). During periods of normal water level, extended periods of non-use or no fire often favor exotic species (such as reed canarygrass (e.g., Community Phase 2.1) or hybrid cattail). Annual cropping of the site or adjacent upland sites increases nutrient and sediment movement into this ecological site favoring hybrid cattail (State 3.0).

At times, particularly during periods of soil saturation with little standing water, Shallow Marsh sites may be susceptible to pugging damage or hummocking of the soil by livestock walking on the site. Pugging is a form of soil compaction due to livestock activity which damages the soil structure. It can seal the soil surface which reduces infiltration and exacerbates waterlogging of the topsoil. The micro-topography created by pugging generally supports plants of more well drained conditions (e.g., adjacent uplands) and is often associated with an increase in weedy species. This can lead to a significant reduction in herbage production and utilization.

Four vegetative states have been identified for the site (Reference, Native/Invaded, Invaded, and Go-Back). Within each state, one or more community phases have been identified. These community phases are named based on the more dominant water phases and visually conspicuous species; they have been determined by study of historical documents, relict areas, scientific studies, and ecological aspects of plant species and plant communities. However, this ecological site is quite dynamic due to wide variations in water depth, water chemistry, and other environmental factors. Management factors are also widely variable. As a result, the species composition and productivity of all states and community phases can vary considerably. Transitional pathways and thresholds have been determined through similar methods.

State 1: Reference State represents the natural range of variability that dominated the dynamics of this ecological site prior to European influence when the primary disturbance mechanisms for this site included water level fluctuations. Periodic fire and grazing by large herding ungulates were not a major disturbance mechanism. Spring snowmelt runoff and rainfall events, coupled with subsurface groundwater movement, dictated the dynamics that occurred within the natural range of variability. Due to those variations, the Reference State is thought to have shifted temporally and spatially between four plant community phases.

Water level fluctuations and water chemistry are the present-day primary disturbances. However, during drawdown phases, livestock grazing and a lack of fire impact this ecological site. Because of the changes in these and other environmental factors, the Reference State is becoming increasingly rare. Once adjacent upland ecological sites are converted to cropland, the Reference State can no longer exist due to sedimentation and increased nutrient loading to the site. The presence of exotic plants on the site precludes it from being placed in the Reference State. It must then be placed in one of the other states, commonly State 2: Native/Invaded State (T1A).

State 2: Native/Invaded State. Colonization of the site by exotic plants results in a transition from State 1: Reference State to State 2: Native/Invaded State (T1A). This transition is inevitable; it often results from colonization by exotic species or their hybrids, commonly hybrid cattail or exotic strains/hybrids of reed canarygrass.

Three community phases have been identified for this state. The exotic species/hybrids can be expected to increase. Hybrid cattail and exotic strains/hybrids of reed canarygrass tend to form virtual monocultures; as such, plants more desirable to wildlife and livestock decline.

Maintenance of communities on the periphery of the wetland (e.g., Wet Meadow ecological site, adjacent upland sites) are critical to the ecological integrity/functioning of the wetland ecosystem. If a buffer zone (50 feet minimum) is not maintained, an increase in eutrophication, sedimentation rate, and invasion by exotic species can be expected. For more information on buffer widths please refer to the Gilbert et.al. (2006) in the references section.

To slow or limit the invasion of these exotic species and their hybrids, it is imperative that managerial techniques (e.g., prescribed grazing, prescribed burning, maintaining intact buffers) be carefully constructed, monitored, and evaluated with respect to that objective. If management does not include measures to control or reduce these exotic cool-season grasses and other exotic plants/hybrids, the transition to State 3: Invaded State should be expected (T2A).

State 3: Invaded State. The threshold for this state may be reached when hybrid cattail or the exotic strains/hybrids of reed canarygrass exceed 30% of the plant community and native plants represent less than 40% of the community. One plant community phase has been identified for this state. This state is typically dominated by hybrid cattail or exotic strains/hybrids of reed canarygrass. These species typically form virtual monocultures; as a result, plant diversity is low and habitat suitability for some wildlife species is low as well (e.g., hybrid cattail dominated wetlands may not provide waterfowl habitat but may provide white-tailed deer winter habitat).

A restoration pathway to State 1: Reference State may be accomplished with the implementation of a successful wetland restoration or seeding, increased water regime, vegetative chemical treatment, and/or sediment/nutrient removal (R3A). However, it has been difficult and perhaps expensive. A failed wetland restoration or seeding will lead to State 2: Native/Invaded State (R3B).

State 4: Go-Back State often results following cropland abandonment during periods of extended below average precipitation or drought; it consists of only one plant community phase which often is composed of a variety of annual forbs, grasses, spike rushes, etc. including noxious weeds (e.g., Canada thistle) which may need control. Over time, the site will likely become dominated by exotic strains or hybrids of reed canarygrass and/or hybrid cattail. Cessation of annual cropping followed by a successful wetland restoration/planting with prescribed burning and vegetative management may lead to State 2: Native/Invaded State (R4A). A failed wetland restoration/seeding with no use and no fire will likely lead to State 3: Invaded State R4B).

The following state and transition model diagram illustrates the common states, community phases, community pathways, and transition and restoration pathways that can occur on the site. These are the most common plant community phases and states based on current knowledge and experience; changes may be made as more data are collected. Pathway narratives describing the site's ecological dynamics reference various water regimes and are influenced by management practices (e.g., prescribed grazing, prescribed burning, brush management, herbaceous weed treatment) which, if properly designed and implemented, will positively influence plant community competitive interactions. The design of these management practices will be site specific and should be developed

by knowledgeable individuals; based upon management goals and a resource inventory; and supported by an ongoing monitoring protocol.

Due to variations in management, climate, and other factors, the plant composition within plant community phases and states can be highly variable. The sites are dominantly driven by water depth and water chemistry (local and regional). When the management goal is to maintain an existing plant community phase, modification of existing management to ensure native species have the competitive advantage may be required. To restore a previous state or restore to another phase within the same state, water depth and water chemistry may need to be modified - which is rarely available to managers except under hydrological restoration applications. Whether using prescribed grazing, prescribed burning, or a combination of both (with or without additional practices), the timing and method of application needs to favor the native species over the exotic species. Adjustments to account for variations in annual growing conditions and implementing an ongoing monitoring protocol to track changes and adjust management inputs to ensure desired outcome will be necessary. The plant community phase composition table(s) has been developed from the best available knowledge including research, historical records, clipping studies, and inventory records. As more data are collected, plant community species composition and production information may be revised.

Plant Communities and Transitional Pathways

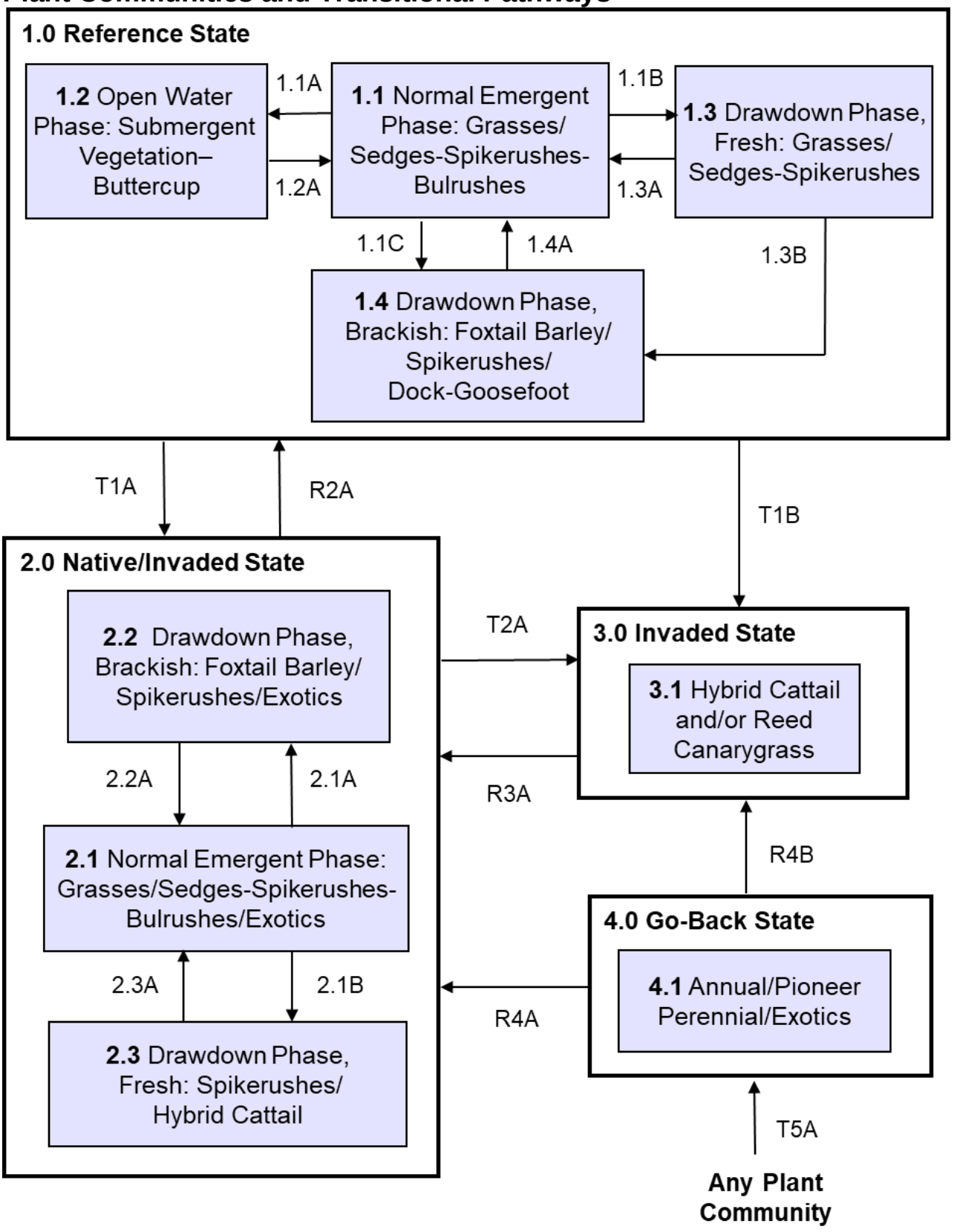


Diagram Legend - MLRA 56 Shallow Marsh

T1A	Invasion by exotic plants, no-use no fire, heavy season-long grazing, decrease in water depth
T1B	Tillage with increased eutrophication and sedimentation
T2A	Tillage with increased eutrophication and sedimentation
T5A	Cessation of annual cropping
R2A	Increased water depth
R3A	Successful wetland restoration or seeding, increased water depth, chemical treatment and/or sediment/nutrient removal, with successful upland restoration
R3B	Failed wetland restoration or seeding, increased water depth, chemical treatment and/or sediment/nutrient removal, with successful buffer or upland restoration
R4A	Cessation of annual cropping, successful wetland restoration/seeding, prescribed burning, vegetation management
R4B	Cessation of annual cropping, failed wetland restoration/seeding, no-use and no fire
CP 1.1 - 1.2 (1.1A)	Increase in water depth, above average precipitation
CP 1.1 - 1.3 (1.1B)	Drawdown phase, below average precipitation, fresh
CP 1.1 - 1.4 (1.1C)	Drawdown phase, below average precipitation, more brackish
CP 1.2 - 1.1 (1.2A)	Drawdown phase, below average to average precipitation
CP 1.3 - 1.1 (1.3A)	Average to above average precipitation, increase in water depth
CP 1.3 - 1.4 (1.3B)	Season-long grazing, no change in precipitation
CP 1.4 - 1.1 (1.4A)	Average to above average precipitation with increased water depth above plant height to cause plant mortality
CP 2.1 - 2.2 (2.1A)	Heavy season-long grazing, drawdown phase, saline soils (discharge site)
CP 2.1 - 2.3 (2.1B)	Heavy season-long grazing, drawdown phase, non-saline (recharge/flowthrough site)
CP 2.2 - 2.1 (2.2A)	Long-term prescribed grazing, increase in water depth
CP 2.3 - 2.1 (2.3A)	Long-term prescribed grazing, increase in water depth

State 1: Reference State

This state represents the natural range of variability that dominated the dynamics of this ecological site prior to European settlement. Historically, the primary disturbance mechanisms for this site in the reference condition were large fluctuations of the water table, water levels, soil saturation, and water chemistry (e.g., brackishness/salinity/alkalinity). Periodic fire and grazing by large herding ungulates were also historical disturbances that influenced this site but to a much lesser degree. Climate, weather, and drawdown events (combined with the timing of fires and grazing) dictated the dynamics that occurred within the natural range of variability.

Presently, the main disturbances are climate, weather events, water level fluctuations, lack of fire, concentrated livestock grazing, and agronomic activities on adjacent ecological sites (e.g., tillage, fertilizer and herbicide use, drainage).

The Reference State is composed of four community phases. These phases are largely due to weather and climate factors resulting in considerable fluctuations in water levels and water chemistry (e.g., brackishness). Brackishness, along with water depth, is also a major factor influencing vegetation of the site. Brackishness can be natural due to the type of hydrology and soils of the site. Exotic perennial species do not exist in this state.

Characteristics and indicators (i.e., characteristics and indicators that can be used to distinguish this state from others). Exotic species and hydrologic manipulation would not be present on this site when in State 1: Reference State.

Resilience management (i.e., management strategies that will sustain a state and prevent a transition). If intact, the reference state should be managed with current disturbance regimes which has permitted the site to remain in reference condition as well as maintaining the quality and integrity of associated ecological sites. Maintenance of the reference state is contingent upon a monitoring protocol to guide management.

Community Phase 1.1: Normal Emergent Phase – Grasses/ Sedges-Spikerushes-Bulrushes (Grasses/*Carex* spp.-*Eleocharis* spp.-*Scripus* spp.-*Schoenoplectus* spp.)

This community phase was historically the most dominant both temporally and spatially. Botanical composition can be quite variable due to variations in water chemistry and other factors. It is often dominated by tall and mid, cool-season graminoids along with sedges, spikerushes and bulrushes. The dominant grass species include common rivergrass (aka whitetop), mannagrass (i.e., American mannagrass, fowl mannagrass), slimstem reedgrass, bluejoint, and American sloughgrass. Wheat sedge is the primary sedge. Bulrushes may include common threesquare (may become dominant in brackish waters) and spikerush (includes common spikerush and needle spikerush). Common forbs include bur-reed (mostly broadfuit bur-reed), spotted water hemlock, hemlock water parsnip, water knotweed, and common bladderwort. Moss (*Drepanocladus* spp.) often covers much of the soil surface during the drawdown phase. Hardstem bulrush, river bulrush, or softstem bulrush may also be present in the transition zone to more deeply ponded, open water areas. Fowl bluegrass, northern reedgrass, and prairie cordgrass, along with various forbs and sedges, occur in the transition zone to Wet Meadow ecological sites.

Annual production can be quite variable but may range from 5800-7800 pounds per acre with graminoids and forbs contributing 95% and 5% of the production, respectively. This is the reference plant community phase and is described in the “Plant Community Composition and Group Annual Production” portion of this ecological site description.

Plant Community Composition and Group Annual Production

	1.1 Normal Emergent Phase			
COMMON/GROUP NAME	**Group**	**SYMBOL**	**lbs./acre**	**% Comp**
GRASSES & GRASS-LIKES			*4760 6460*	*70 - 95*
GRASS-LIKES	**1**		**2040 3400**	**30 - 55**
wheat sedge	1	CAAT2	1360 2720	20 - 40
woolly sedge	1	CAPE42	136 1020	2 - 15
smoothcone sedge	1	CALA12	136 1020	2 - 15
Sartwell's sedge	1	CASA8	68 340	1 - 5
softstem bulrush	1	SCTA2	68 340	1 - 5
hardstem bulrush	1	SCAC3	0 340	0 - 5
chairmaker's bulrush	1	SCAM6	0 340	0 - 5
spikerush	1	ELEOC	68 204	1 - 3
rush	1	JUNCU	0 204	0 - 3
other grass-likes	1	2GL	68 340	1 - 5
GRASSES	**2**		**1700 2720**	**25 - 40**
American mannagrass	2	GLGR	340 1020	5 - 15
fowl mannagrass	2	GLST	68 680	1 - 10
American sloughgrass	2	BESY	0 340	0 - 5
common rivergrass	2	SCFE	680 2380	10 - 35
shortawn foxtail	2	ALAE	0 340	0 - 5
prairie cordgrass	2	SPPE	0 340	0 - 5
northern reedgrass	2	CASTI3	340 1360	5 - 20
OTHER NATIVE GRASSES	**3**		**0 340**	**0 - 5**
saltgrass	3	DISP	0 340	0 - 5
scratchgrass	3	MUAS	0 340	0 - 5
other perennial grasses	3	2PG	0 340	0 - 5
FORBS	***4***		***0 340***	***0 - 5***
American water horehound	4	LYAM	68 204	1 - 3
American water plantain	4	ALPAP	68 204	1 - 3
northern water plantain	4	ALTR7	68 136	1 - 2
Indianhemp	4	APCA	68 136	1 - 2
swamp milkweed	4	ASIN	68 136	1 - 2
smooth horsetail	4	EQLA	68 136	1 - 2
curlytop knotweed	4	POLA4	68 136	1 - 2
cinquefoil	4	POTEN	68 136	1 - 2
buttercup	4	RANUN	68 136	1 - 2
arumleaf arrowhead	4	SACU	68 136	1 - 2
marsh skullcap	4	SCGA	68 136	1 - 2
marsh fleabane	4	SECO2	68 136	1 - 2
giant goldenrod	4	SOGI	68 136	1 - 2
broadfruit bur-reed	4	SPEU	68 136	1 - 2
New England aster	4	SYNO2	68 136	1 - 2
marsh arrowgrass	4	TRPA6	68 136	1 - 2
broadleaf cattail	4	TYLA	68 136	1 - 2
rough bugleweed	4	LYAS	68 136	1 - 2
knotweed	4	POLYG4	68 136	1 - 2
swamp smartweed	4	POHY2	68 136	1 - 2
western dock	4	RUAQ	68 136	1 - 2
gayfeather	4	LIATR	0 136	0 - 2
Pennsylvania smartweed	4	POPE2	0 136	0 - 2
pale dock	4	RUAL4	0 136	0 - 2
hemlock waterparsnip	4	SISU2	0 68	0 - 1
hedgenettle	4	STACH	0 68	0 - 1
panicle white aster	4	SYLA6	0 68	0 - 1
other forbs	4	2FORB	68 340	1 - 5

Annual Production lbs./acre	LOW	RV	HIGH
GRASSES & GRASS-LIKES	5510	6460	- 7410
FORBS	290	340	- 390
TOTAL	5800	6800	- 7800

This list of plants and their relative proportions are based on near normal years. Fluctuations in species composition and relative production may change from year to year dependent upon precipitation or other climatic factors. RV = Representative Value.

Community Phase Pathway 1.1A
Community Phase 1.1 to 1.2 occurs with above average precipitation or other factors causing an increase in water depth sufficient to shift the vegetation from a diverse mixture of grasses, sedges, spikerushes, and bulrushes to one with more extensive open water supporting buttercup.

Community Phase Pathway 1.1B
Community Phase 1.1 to 1.3 occurs with below average precipitation or other factors causing a drawdown phase with the fresh water, shifting the vegetation to woolly sedge, spikerush, and slimstem reedgrass.

Community Phase Pathway 1.1C
Community Phase 1.1 to 1.4 occurs during a drawdown phase with the water becoming more brackish. This shifts the dominant vegetation from a diverse mixture of grasses, sedges, spikerushes and bulrushes to foxtail barley, spikerush, dock, and goosefoot.

Community Phase 1.2: Open Water Phase – Submergent Vegetation-Buttercup (Submergent Vegetation-*Ranunculus* spp.)
This community phase occurs when increased precipitation or other factors cause the water levels to increase in depth for a sufficient for the site to become dominated by open water submergent species such as buttercup (e.g., yellow water buttercup, longbeak buttercup). With a decrease in water levels (e.g., return to average precipitation/runoff), the plant community should return to Community Phase 1.1. Annual production can be quite variable due to wide variations in water chemistry, hydrology, and other factors.

Community Phase Pathway 1.2A
Community Phase Pathway 1.2 to 1.1 occurs during times of below average precipitation or other conditions that result in a drawdown phase or drop in water levels sufficient to cause a shift in the vegetation from submergent species, such as buttercup, to a diverse mixture of grasses, sedges, spikerushes and bulrushes.

Community Phase 1.3: Drawdown Phase–Fresh - Grasses/Sedges-Spikerushes (Grasses/*Carex* spp.-*Eleocharis* spp.)
This community phase occurs during prolonged dry periods or other factors leading to decreased water depth with fresh-water conditions. Woolly sedge, spikerush (e.g., common spikerush, needle spikerush), slimstem reedgrass, and other sedges from the adjacent, drier sites encroach onto the site. With an increase in water depth (e.g., return to average precipitation) the plant community will readily return to Community Phase 1.1. Annual production can be quite variable due to wide variations in water chemistry, hydrology, and other factors.

Community Phase Pathway 1.3A
Community Phase Pathway 1.3 to 1.1 occurs during times of above average precipitation leading to an increase in water depth sufficient to cause a shift in the dominant vegetation from woolly sedge, spikerush, and slimstem reedgrass to a diverse mixture of grasses, sedges, spikerushes and bulrushes.

Community Phase Pathway 1.3B
Community Phase Pathway 1.3 to 1.4 occurs with heavy season-long grazing, leading to a change from grasses, woolly sedge, spikerush, and slimstem reedgrass to one dominated by foxtail barley, spikerush, dock, and goosefoot.

Community Phase 1.4: Drawdown Phase–Brackish - Foxtail Barely/Spikerushes/Dock-Goosefoot (*Hordeum jubatum*/*Eleocharis* spp./*Rumex* spp./*Chenopodium spp.*)

This community phase occurs on some wetland soils during a drawdown phase causing more brackish conditions, perhaps coupled with heavy season-long grazing. This leads to a marked increase in foxtail barley, spikerush (e.g., common spikerush, needle spikerush), speedwell, dock (e.g., golden dock, western dock) and goosefoot (e.g., red goosefoot). American sloughgrass, knotweeds, and cinquefoils can also be common associates of this community phase. Annual production and the extent of bare ground can be quite variable.

With continued heavy season-long grazing, increased soil compaction may result in high amounts of bare ground or in the colonization of exotic forbs and grasses. If this occurs, the site will likely begin transition to State 2: Native/Invaded State or State3: Invaded State.

Community Phase Pathway 1.4A

Community Phase Pathway 1.4 to 1.1 occurs with above average precipitation or other factors causing an increase in water depth sufficient to shift the vegetation from foxtail barley and associates to a diverse mixture of grasses, sedges, spikerushes and bulrushes.

Transition T1A

This is the transition from the State 1: Reference State to State 2: Native/Invaded State resulting from the colonization and establishment of exotic plants, often exotic strains/hybrids of reed canarygrass or hybrid cattail. Canada thistle is also known to invade the site during dry periods.

Heavy season-long grazing, prolonged periods of no use and no fire, and a decrease in the water regime of the site are often involved with this transition. Excessive litter accumulation provides conditions favorable to hybrid cattail or exotic strains/hybrids of reed canarygrass which can quickly spread to form virtual monocultures. As a result, the transition to State 3: Invaded State can be expected.

Constraints to recovery (i.e., variables or processes that preclude recovery of the former state). Restoration to State 1 is dependent upon hydrology, condition of adjacent upland ecological sites (i.e., cropland), and abundance of exotic species.

Transition T1B

This is the transition from State 1: Reference State to State 3: Invaded State. Although the State 3: Invaded State often forms via State 2: Native/Invaded State, this direct transition to State 3: Invaded State can occur with tillage of the Shallow Marsh ecological site or adjacent upland with an associated increase in eutrophication and sedimentation resulting in vegetation dominance by hybrid cattail or exotic strains/hybrids of reed canarygrass.

Constraints to recovery (i.e., variables or processes that preclude recovery of the former state). Restoration to State 1 is dependent upon hydrology, condition of adjacent upland ecological sites (i.e., cropland), and abundance of exotic species.

State 2: Native/Invaded State

This state is characterized by the colonization and establishment of minor amounts of exotic plants. Reed canarygrass is native to North America, but exotic strains (largely Eurasian) have been widely introduced and, along with their hybrids, can be quite invasive. Hybrid cattail, the hybrid between narrowleaf cattail and broadleaf cattail, is also a common exotic. Canada thistle is also known to invade the site during dry periods. Although the site is still dominated by native plants, an increase in

exotic plants can be expected. Unless a prescribed grazing and/or prescribed burning program is implemented or an increase in water depth drowns out exotic species, a transition to State 3: Invaded State can be expected.

Characteristics and indicators (i.e., characteristics that can be used to distinguish this state from others). The presence of trace amounts of exotic species/hybrids (e.g., cattail, reed canarygrass) indicates a transition from State 1 to State 2.

Resilience management (i.e., management strategies that will sustain a state and prevent a transition). Implementation of management techniques and monitoring procedures designed to limit or control exotic species/hybrids.

Community Phase 2.1: Normal Emergent Phase – Grasses/ Sedges-Spikerushes-Bulrushes/Exotics (Grasses/*Carex* spp.-*Eleocharis* spp.-*Scripus* spp.- *Schoenoplectus* spp./Exotics)

This is the wetter community phase of State 2: Native/Invaded State. This community is similar to Community Phase 1.1. However, exotic species (such as exotic strains/hybrids of reed canarygrass or hybrid cattail, curly dock, narrowleaf dock, oakleaf goosefoot, marshpepper knotweed, spotted ladysthumb, and others) are now minor components of the community. Annual production can be quite variable due to wide variations in water chemistry, hydrology, and other factors.

Community Phase Pathway 2.1A

Community Phase Pathway 2.1 to 2.2 occurs with heavy, season-long grazing coupled with a drawdown phase and saline soils (discharge site). As the pathway progresses, native plant diversity declines while foxtail barley, spikerush, sedges, and exotic forbs (e.g., knotweed, dock) increase.

Community Phase Pathway 2.1B

Community Phase Pathway 2.1 to 2.3 occurs with heavy, season-long grazing coupled with a drawdown phase and non-saline soils (recharge/flowthrough site). As the pathway progresses, the site becomes more dominated by spikerushes and hybrid cattail.

Community Phase 2.2: Drawdown Phase-Brackish - Foxtail Barely/Spikerushes/Exotics (*Hordeum jubatum*/*Eleocharis* spp./Exotics)

This is the drier, brackish community phase in State 2: Native/Invaded State. It is dominated by foxtail barley in association with spikerush, dock, and various native forbs (such as water knotweed, Mexican dock, curlytop knotweed, Pursh seepweed, goosefoot, and others). Exotic plants may include exotic strains/hybrids of reed canarygrass (as well as hybrid cattail, curly dock, narrowleaf dock, oakleaf goosefoot, marshpepper knotweed, spotted ladysthumb, and others) which are now minor components of the community. Absinthium (aka wormwood) may also become prominent if the basin dries-up. Annual production and the extent of bare ground can be quite variable.

Community Phase Pathway 2.2A

Community Phase Pathway 2.2 to 2.1 occurs with the implementation of long-term prescribed grazing with the return to near average precipitation, resulting in increased water depth. This leads to a shift from foxtail barley, spikerush, dock, and exotic forbs to one of a diverse mixture of grasses, sedges, spikerushes, and bulrushes along with exotic grasses and exotic forbs.

Community Phase 2.3 Drawdown Phase-Fresh - Spikerushes/Hybrid Cattail (*Eleocharis ssp./Typha* x *glauca*)

This is the drier, fresher community phase in State 2: Native/Invaded State. It is dominated by spikerushes and hybrid cattail. Swamp ragwort, burningbush, cocklebur, pale smartweed, and other rather weedy forbs are also common. Exotic strains/hybrids of reed canarygrass may also become minor components of the community. Absinthium (aka wormwood), Canada thistle, and sowthistle may also become prominent if the basin dries-up.

Community Phase Pathway 2.3A

Community Phase 2.3 to 2.1 occurs with the implementation of long-term prescribed grazing with the return to near average precipitation, resulting in increased water depth. This leads to increasing prevalence of emergent species (such as bulrushes, spikerushes, and sedges).

Transition T2A

The transition from State 2: Native/Invaded State to State 3: Invaded State can occur with tillage within the site or on adjacent upland sites resulting in an increase in eutrophication and sedimentation, leading to dominance of hybrid cattail or exotic strains/hybrids of reed canarygrass. Studies indicate that a threshold may exist in the transition to this Native/Invaded State on some upland ecological sites when Kentucky bluegrass exceeds 30% of the plant community and native grasses represent less than 40% of the plant community composition. Similar thresholds may exist for exotic strains of reed canarygrass and hybrid cattail on this site.

Constraints to recovery (i.e., variables or processes that preclude recovery of the former state). Restoration to State 2 is dependent upon hydrology and abundance of exotic species/hybrids.

Restoration R2A

This restoration pathway from State 2: Native/Invaded State to State 1: Refence State is initiated by an increase in water depth sufficient to drown out invasive exotic species. Success of this pathway is dependent upon the invasive species present in State 2 Native/Invaded State. Hybrid cattail and reed canary grass will likely persist with increased water levels, whereas foxtail barley, dock, or Canada and sowthistle will drown out.

Context dependence (i.e., factors that cause variations in plant community shifts, restoration likelihood, and contribute to uncertainty). Hydrological restoration/management to remove exotic species/hybrids which may necessitate chemical control. Adjacent upland ecological sites will need to remain intact or reseeded to native species to prevent sedimentation and nutrient loading to Shallow Marsh ecological site. Prescribed grazing techniques may provide a short-term reduction in reed canarygrass density; however, a combination of mowing and prescribed burning may be more effective than prescribed grazing alone.

State 3: Invaded State

This state occurs when the site becomes dominated by exotic plants. Common exotics of the site include exotic strains/hybrids of reed canarygrass or hybrid cattail. Canada thistle may also invade the site during dry periods. Once the state is established, restoration efforts have proven difficult (see Restoration R3A).

Characteristics and indicators (i.e., characteristics that can be used to distinguish this state from others). This site is characterized by exotic species/hybrids dominating the site and controlling the ecological processes (i.e., approximately 30 to 40%).

Resilience management (i.e., management strategies that will sustain a state and prevent a transition). Once established, reed canarygrass and hybrid cattail are very resilient and will withstand grazing, haying pressure, and non-use.

Community Phase 3.1 Hybrid Cattail or Reed Canarygrass (*Typha* x *glauca* or *Phalaris arundinacea*)

Hybrid cattail or exotic strains/hybrids of reed canarygrass often dominate State 3: Invaded State. Whether hybrid cattail or reed canarygrass dominate the site is largely determined by which species propagules are present on the site. Diversity plummets with dominance by either of these species, as both hybrid cattail and reed canarygrass form monotypic stands.

Hybrid cattail is the hybrid of narrowleaf cattail and broadleaf cattail. The hybrid is also known to backcross with the broadleaf cattail. It is widely regarded as aggressive or invasive and typically forms monotypic stands. It is particularly adapted to nutrient enriched habitats with high sedimentation (i.e., associated with tillage, siltation, and/or drainage).

Reed canarygrass is native to North America, but exotic strains have repeatedly been introduced over the years. These exotic strains and their hybrids are regarded as aggressive or invasive, often forming monotypic stands.

Reed canarygrass and hybrid cattail are highly adaptive and managerial efforts to control them has been difficult (see Restoration R3A). Annual production can be quite variable due to wide variations in water chemistry, hydrology, and other factors.

Restoration R3A

This restoration pathway from State 3: Invaded State to State 1: Reference State can rarely be accomplished. The likelihood of a successful wetland restoration through hydrological restoration, seeding, increased water regime, chemical treatment, and/or sediment/nutrient removal is limited due the persistence of exotic invasive species, such as hybrid cattail or reed canarygrass. A successful upland restoration is also needed to reduce the likelihood of exotic species invasion or continued sedimentation or nutrient loading. It is more likely that a wetland restoration effort considered to be successful will eventually end up in State 2 Native/Invaded State.

Context dependence (i.e., factors that cause variations in plant community shifts, restoration likelihood, and contribute to uncertainty). Reed canarygrass and hybrid cattail are difficult to control, largely due to vigorous spreading rhizomes, high seed production, and a large seed bank. Various control techniques may show signs of success but are often short-term with vegetation reverting within a few years. Adjacent upland ecological sites will need to remain intact or reseeded to native species to prevent sedimentation and nutrient loading to the Shallow Marsh ecological site.

Prescribed grazing (e.g., heavy seasonal), high-intensity burns, and herbicides have shown some success in reducing the dominance by reed canarygrass. However, within several years the vegetation often reverts.

Herbicides can be effective in reducing or eliminating hybrid cattail and can be followed by reseeding (or plugging) desirable species. Prescribed burning has also been effective during dry periods where fire temperatures may kill rhizomes and seeds. Although expensive, mechanical removal of the substrate has also been an effective technique.

Restoration R3B

This restoration pathway from State 3: Invaded State to State 2: Native/Invaded State results from a failed restoration or seeding, increased water regime, chemical treatment, and/or sediment/nutrient removal with failed buffer or upland restoration.

Context dependence (i.e., factors that cause variations in plant community shifts, restoration likelihood, and contribute to uncertainty). Reed canarygrass and hybrid cattail are difficult to control, largely due to vigorous spreading rhizomes, high seed production, and a large seed bank. Various control techniques may show signs of success but are often short-term with vegetation reverting within a few years.

Prescribed grazing (e.g., heavy seasonal), high-intensity burns, and herbicides have shown some success in reducing the dominance by reed canarygrass. However, within several years the vegetation often reverts.

Herbicides can be effective in reducing or eliminating hybrid cattail and can be followed by reseeding (or plugging) desirable species. Prescribed burning has also been effective during dry periods where fire temperatures may kill rhizomes and seeds. Although expensive, mechanical removal of the substrate has also been an effective technique.

State 4: Go-Back State

This state is highly variable depending on the level and duration of disturbance related to the T5A pathway. In this MLRA, the most probable origin of this state is plant succession following crop abandonment. This plant community will initially include a variety of annual forbs and grasses, some of which maybe noxious weeds.

Characteristics and indicators (i.e., characteristics that can be used to distinguish this state from others). Tillage has destroyed the native plant community, altered soil structure and biology, increased eutrophication, reduced soil organic matter, and results in the formation of a tillage induced compacted layer which is restrictive to root growth. Noxious weeds, if present, will need to be managed.

Resilience management (i.e., management strategies that will sustain a state and prevent a transition). Continued tillage will maintain the state. Control of noxious weeds will be required.

Community Phase 4.1 Annual/Pioneer Perennial/Exotics

This community phase may be quite variable in composition. Vegetation is generally a mix of pioneer species, both native and exotic, as well as some native and exotic perennials such as foxtail barley, reed canarygrass, slough grass, spikerush, speedwell, dock, goosefoot, knotweeds, hybrid cattail, water horehound, sowthistle, and others. Absinthium and Canada thistle are known to be present during extended drawdown periods. Annual production can be quite variable due to wide variations in water chemistry, hydrology, and other factors.

Restoration R4A

This restoration pathway from State 4: Go-Back State to State 2: Native/Invaded State results from cessation of annual cropping, successful wetland restoration/seeding/plugging, prescribed burning, and vegetation management.

Context dependence (i.e., factors that cause variations in plant community shifts, restoration likelihood, and contribute to uncertainty). If manipulated, hydrology needs to be restored. Elevated

soil nitrogen levels and sedimentation have been shown to benefit reed canarygrass and hybrid cattail. Sedimentation may need to be removed to preexisting conditions. A successful range planting will include proper seedbed preparation, weed control (both prior to and after the planting), selection of adapted native species representing functional/structural groups inherent to the State 1, and proper seeding technique. Management (e.g., prescribed grazing, prescribed burning) during and after establishment must be applied in a manner that maintains the competitive advantage for the seeded native species.

Restoration R4B

This restoration pathway from State 4: Go-Back State to State 3: Invaded State results from cessation of annual cropping followed by a failed wetland restoration/seeding with no use and no fire.

Context dependence (i.e., factors that cause variations in plant community shifts, restoration likelihood, and contribute to uncertainty). Failure to restore hydrology and failed range plantings can result from many causes (both singularly and in combination) including drought, poor seedbed preparation, improper seeding methods, seeded species not adapted to the site, insufficient weed control, herbicide carryover, poor seed quality (purity & germination), and/or improper management.

Transition T5A

This transition from any plant community to State 4: Go-Back State. Most commonly, it is associated with the cessation of cropping without the benefit of restoration efforts, resulting in a “go-back” situation. Soil conditions can be quite variable on the site, in part due to variations in the management/cropping history, such as development of a tillage induced compacted layer, erosion, fertility (degree of eutrophication), sedimentation and/or herbicide/pesticide carryover. Thus, soil conditions should be assessed when considering restoration techniques.

Ecological Site Interpretations

Animal Community – Wildlife Interpretations

Landscape

The MLRA 56A landscape is characterized by a nearly level glacial lake plain bordered on the east and west by outwash plains, till plains, gravelly beaches, and dunes. MLRA 56A is considered to have a continental climate with cold winters and hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature are common and characteristic of the MLRA. This area supports natural tall-grass prairie vegetation with bur oak, green ash, and willow growing in drainageways. This area is formed in silty and clayey lacustrine sediments from the former Glacial Lake Agassiz. Complex intermingled ecological sites create diverse grass/shrub land habitats interspersed with varying densities of linear, slope, depressional, and in-stream wetlands associated with headwater streams and tributaries to the Red River of the North. MLRA 56A is located within the boundaries of the Prairie Pothole Region and is an ecotone between the humid east and the sub-humid west regions. The primary land use is annual cropland (~80%). The Red River Valley is known for its exceptional fertility with major crops including corn, soybeans, small grains, and sugar beets.

By the mid-19th century, the majority of the Red River Valley had been converted from tall-grass prairie to annual crop production. To alleviate crop production loss from wetlands and overland flow, a system of shallow surface ditches, judicial ditches, and road ditches removes surface water in spring and during high rainfall events. The major soils are poorly drained with extensive areas of saline soils. Tile drainage systems have been or are being extensively

installed throughout MLRA 56A for sub-surface field drainage to enhance annual crop production.

The east and west side of the Red River Valley formed in a complex pattern of sandy beach material, stratified inter-beach material, lacustrine silts, and lake washed glacial till. The soils vary from excessively drained on ridges to very poorly drained organic basins. Surface ditches serve to drain some of the area, although much of the area lacks adequate drainage for maximum crop production. Calcareous fens and saline seeps can occur at the base of beach ridges and result in rare plant communities. Native vegetation was mixed- and tall-grass prairie with scattered woodland and brush.

Historic Communities/Conditions within MLRA 56A:

The northern tall- and mixed-grass prairie was a disturbance-driven ecosystem with fire, herbivory, and climate functioning as the primary ecological drivers (either singly or often in combination). Frequent and expansive flooding along the Red River and its tributaries provided abundant opportunities for Native Americans to harvest wild rice. American bison roamed MLRA 56A wintering along the Red River and migrating west into MLRA 55A and 55B for parts of the season. Many species of grassland birds, small mammals, insects, reptiles, amphibians, and large herds of roaming American bison, elk, and pronghorn were historically among the inhabitants adapted to this region. Roaming herbivores, as well as several small mammal and insect species, were the primary consumers linking the grassland resources to large predators (such as the wolf and American black bear) and smaller carnivores (such as the coyote, bobcat, red fox, and raptors). Extirpated species include free-ranging American bison and gray wolf (breeding). Extinct from the region is the Rocky Mountain locust.

Present Communities/Conditions within MLRA 56A:

MLRA 56A has the most conversion to cropland of any MLRA within Region F-Northern Great Plains. European influence has impacted remaining grassland and shrubland by domestic livestock grazing, elimination of fire, removal of surface and subsurface hydrology via artificial drainage, and other anthropogenic factors influencing plant community composition and abundance.

Extensive drainage has taken place. Streams have been straightened (removing sinuosity) and riparian zones have been converted to annual crop production. These anthropogenic impacts have reduced flood water detention and retention on the landscape, increasing storm water runoff, sediment, and nutrient loading to the Red River and its tributaries. The installation of instream structures has reduced aquatic species movement within the MLRA.

Annual cropping is the main factor contributing to habitat fragmentation, reducing habitat quality for area-sensitive species. These influences fragmented the landscape, reduced, or eliminated ecological drivers (fire), and introduced exotic species including smooth brome, Kentucky bluegrass, and leafy spurge which further impacted plant and animal communities. The loss of the bison and fire as primary ecological drivers greatly influenced the character of the remaining native plant communities and the associated wildlife, moving towards a less diverse and more homogeneous landscape.

Included in this MLRA are approximately 70,000 acres of the United States Forest Service, Sheyenne National Grassland (southern portion of MLRA) with an additional 65,000 acres of

intermingled privately owned land of sandy soils providing a large tract of intact tall grass prairie within the MLRA. United Fish and Wildlife Service refuges and waterfowl production areas, along with and state wildlife management areas cover approximately 67,000 acres within the MLRA. Two of three largest cities in North Dakota are located within the MLRA.

USDA conservation programs have seeded thousands of cropland acres in riparian zones to native herbaceous vegetation. Natural succession is replacing the planted native herbaceous vegetation to native woody vegetation re-establishing native wooded riparian areas on previously cropland. Most of the plantings have been along the Red River and its tributaries in the northern portions of the MLRA within the United States. These areas are privately owned and protected from annual agricultural production with perpetual conservation easements.

Some characteristic wildlife species in this area are:

Birds: Mallard, blue-winged teal, red-tailed hawk, American kestrel, ring-necked pheasant, western meadowlark, killdeer, eastern and western kingbird, American crow, common yellowthroat, downy and hairy woodpecker, clay-colored sparrow, vesper sparrow, Savannah sparrow, and brown-headed cowbird.

Mammals: Northern short-tailed shrew, white-tailed jackrabbit, snowshoe hare, Franklin's ground squirrel, thirteen-lined ground squirrel, northern pocket gopher, plains pocket gopher, western harvest mouse, deer mouse, meadow vole, meadow jumping mouse, western jumping mouse, coyote, red fox, raccoon, American badger, striped skunk, white-tailed deer, North American beaver, and moose.

Reptiles/Amphibians: American toad, Great Plains toad, northern leopard frog, chorus frog, tree frog, tiger salamander, plains garter snake, and common garter snake.

Presence of wildlife species is often determined by ecological site characteristics including grass and forb species, hydrology, aspect, and other associated ecological sites. The home ranges of most species are usually larger than one ecological site or are dependent upon more than one ecological site for annual life requisites. Ecological sites offer different habitat elements as the annual life requisites change. Habitat improvement and creation must be conducted within the mobility limits of a known population for the species.

Insects play an important role providing ecological services for plant community development. Insects that are scavengers or aid in decomposition provide the food chain baseline sustaining the carnivorous insects feeding upon them. Many insects provide the ecological services necessary for pollination, keeping plant communities healthy and productive. Insects provide a protein food source for numerous species including grassland-nesting birds and their young. Extensive use of insecticides for specialty crops (such as potatoes, sugar beets, and other crops) has greatly reduced insects within this MLRA.

Species of Concern within MLRA 56A:

The following is a list of species considered "species of conservation priority" in the North Dakota State Wildlife Action Plan (2015); "species of greatest conservation need" in the Minnesota State Wildlife Action Plan, Conservation Focus Areas, Target Species (2015) and the South Dakota State Wildlife Action Plan (2014); and "species listed as threatened, endangered, or petitioned" under the Endangered Species Act within MLRA 56A at the time this section was developed:

Invertebrates: Arogos skipper, Assiniboia skipper, Dakota skipper, dusted skipper, Leonard's skipper, monarch butterfly, Poweshiek skippering, red-tailed leafhopper, regal fritillary, and Uhler's Arctic.

Birds: American kestrel, American bittern, bobolink, American white pelican, bald eagle, black-billed cuckoo, chestnut-collared longspur, Dickcissel, grasshopper sparrow, greater prairie-chicken, Henslow's sparrow, LeConte's sparrow, loggerhead shrike, marbled godwit, Nelson's sparrow, northern harrier, northern pintail, red-headed woodpecker, sharp-tailed grouse, short-eared owl, Swainson's hawk, upland sandpiper, western meadowlark, willet, Wilson's phalarope, and yellow rail.

Mammals: Arctic shrew, big brown bat, eastern spotted skunk, gray fox, little brown bat, northern grasshopper mouse, plains pocket mouse, prairie vole, pygmy shrew, Richardson's ground squirrel, and river otter.

Amphibians/Reptiles: Canadian toad, common snapping turtle, northern prairie skink, and plains hognose snake.

Fish: Blacknose shiner, blue sucker, burbot, chestnut lamprey, finescale dace, hornyhead chub, largescale stoneroller, logperch, northern pearl dace, northern redbelly dace, pearl dace, shortnose gar, sickle-fin chub, sliver chub, silver lamprey, trout-perch, and yellow bullhead.

Mussels: Black sandshell, creek heelsplitter, creeper, mapleleaf, pink heelsplitter, pink papershell, threeridge, and Wabash pigtoe.

Grassland Management for Wildlife in MLRA 56A:

Management activities within the community phase pathways have both short and long term positive and negative impacts on wildlife. Community phase, transitional, and restoration pathways are keys to long-term management within each State and between States. Significant inputs must occur to cross the threshold between States (e.g., State 3.0 to 2.0) requiring substantial economic inputs and management (grazing intensity, reseeding, prescribed fire, woody vegetation removal, etc.). Timing, intensity, and frequency of these inputs can have dramatic positive or negative effects on vegetative structure impacting local wildlife species' habitats. Ranchers and other land managers must always consider the long-term beneficial effects of management on the habitat in comparison to potential short-term negative effects to individual species.

Ecological sites occur as intermingled complexes on the landscape with gradual or sometimes abrupt transitions. Rarely do ecological sites exist in large enough acreage to manage independently. Ecological sites supporting a dominance of herbaceous vegetation (Wet Meadow, Subirrigated Sands) can be located adjacent to ecological sites that support trees (Choppy Sands and Loamy Overflow).

Management of these complex ecological sites can provide a heterogeneous or a homogenous landscape. Grassland bird use reduces as the plant community transitions to a homogenous state or increases in woody vegetation. Managers need to recognize ecological sites and the complexes they occur in to properly manage the landscape. A management regime for one

ecological site may negatively impact an adjacent site (e.g., alteration of a grazing regime within a Choppy Sands ecological site to encourage understory growth may encourage exotic cool-season grasses to increase or dominate an adjacent ecological site).

Life requisites and habitat deficiencies are determined for targeted species. Deficiencies need to be addressed along community phase, transitional, and restoration pathways as presented in specific state-and-transition models. Ecological sites should be managed and restored within the site's capabilities to provide sustainable habitat. Managers also must consider habitat provided by adjacent/intermingled ecological sites for species with home ranges or life requisites that cannot be provided by one ecological site.

With populations of many grassland-nesting birds in decline, it is important to maintain these ecological sites in a 1.0 Reference State or the 2.0 Native/Invaded State. Plant communities optimal for a guild of grassland species serve as a population source where the birth rate exceeds mortality. Species may use marginal plant communities; however, these sites may function as a population sink where mortality exceeds the birth rate.

Understanding preferred vegetative stature and sensitivity to woody encroachment is necessary to manage for the specific grassland species. Various grass heights may be used for breeding, nesting, or foraging habitat. While most species use varying heights, many have a preferred vegetative stature height. The following chart provides preferred vegetative stature heights and sensitivity to woody vegetation encroachment.

Grassland-nesting Bird Species	Preferred Vegetative Stature			Avoids woody vegetation*
	Short < 6 inches	Medium 6 - 12 inches	Tall >12 inches	
Baird's sparrow	x	x		x
Bobolink		x	x	x
Brewer's sparrow	x	x		
Burrowing owl	x			x
Chestnut-collared longspur	x	x		x
Common yellowthroat			x	
Dickcissel		x	x	
Ferruginous hawk	x	x		
Grasshopper sparrow	x	x		x
Horned lark	x			x
Killdeer	x			x
Lark bunting	x	x		
Lark sparrow	x			
Le Conte's sparrow			x	x
Long-bill curlew	x			x
Marbled godwit	x	x		x
McCown's longspur	x	x		x
Mountain plover	x			x
Nelson's sparrow			x	x

Nesting waterfowl		x	x	
Northern harrier		x	x	x
Savannah sparrow		x	x	x
Short-eared owl		x	x	x
Sprague's pipit	x	x		x
Upland sandpiper	x	x		x
Western meadowlark	x	x		
Willet	x	x		x
*Many of the listed species avoid nesting in grassland areas with large amounts of woody vegetation within a grassland or avoid nesting near woody vegetation in adjacent habitats. Although these species avoid areas with woody vegetation, most can tolerate a small amount of woody vegetation within areas dominated by grassland habitat, including short-statured shrubs (e.g., western snowberry) in this MLRA.				

Shallow Marsh Wildlife Habitat Interpretation:

Shallow Marsh ecological sites are very poorly drained soils located in depressions and on floodplains. Associated ecological sites include Clayey, Limy Subirrigated, Loamy Overflow, Loamy, Saline Lowland, Sands, Sodic Subirrigated, Subirrigated, Subirrigated Sands, and Wet Meadow. Shallow Marsh habitat features and components commonly support grassland-nesting birds, notably birds utilizing wetland vegetation habitats (such as Nelson's and LeConte's sparrow, sedge wren, and water and wading birds using uplands for nesting). Insects rely on associated forbs and grasses for survival and serve as food sources for birds and their young and as forage for small and large herbivores. Shallow Marsh ecological sites support a diversity of invertebrates important in the diet of water birds.

Shallow Marsh ecological sites may be found in four plant community states within a local landscape. Multiple plant community phases exist within this ecological site dependent upon water levels, saturation, water and soil chemistry, and management. Today, these states occur primarily in response to precipitation (extended periods of above average precipitation or drought), water chemistry, fire, grazing, non-use, and other anthropogenic disturbances.

Restoration pathways from State 2.0 and 3.0 back to State 1.0 may occur. Restoration Pathway R2A's and R3A's main ecological driver is increased water levels above plant height causing plant mortality, drowning out exotic forbs and grasses. Restoration Pathway R3A is dependent upon a combination of a successful wetland restoration or seeding, increased water regime, chemical treatment, and/or sediment/nutrient removal. However, maintenance and/or restoration of adjacent upland ecological sites is critical for full restoration of the Shallow Marsh ecological site to Reference.

Non-anthropogenic Community Phase, Transition, and Restoration Pathways rely predominantly on water regime, either increasing or decreasing water depth with associated saturation. While tillage and drainage are the main anthropogenic impacts to Shallow Marsh ecological sites within MLRA 56A, heavy grazing during a drawdown phase can cause saline soils, especially on discharge or flow-through sites. Degree of tillage and the length of time the site is cultivated will have a significant impact on the ability of the site to follow Restoration Pathways R3A, R4A, and R4B. The longer the wetland is tilled or drained, the

fewer native wetland plant propagules are available to recolonize the wetland. Increased salinity due to tillage will also negatively impact restoration.

Native wildlife, dependent upon shallow wetlands found in the Shallow Marsh ecological site, generally benefit from the heterogeneous grasslands/graminoids found in Community Phases in States 1.0 and 2.0. Plant communities within States 1.0 and 2.0 are dependent upon long-term changes in precipitation and impacted by grazing intensity and frequency.

Management along community phase, transition, or restoration pathways should focus upon attainable changes. Short- and long-term monetary costs must be evaluated against short- and long-term ecological services in creating and maintaining habitat of sufficient quality to support a sustainable population density.

Hydrological manipulation (surface or tile drainage, pumping, surface water diversion, etc.) modifies this ecological site's functions, having a significant negative impact to wetland dependent wildlife (such as invertebrates, amphibians, and water birds). Without restoring hydrologic function (which may include range seeding), managers need to reference state and transition models within those sites. Hydrology will need to be fully restored in Wet Meadow and Shallow Marsh ecological sites for these sites to properly function. It is recommended that managers review the appropriate State and Transition Models prior to wetland restoration.

1.0 Reference State

Community Phase 1.1 Normal Emergent Phase – Grasses/Sedges/Spikerushes-Bulrushes: This plant community offers vegetative cover for wetland associated wildlife; every effort should be made to maintain this ecological site within this community phase in State 1.0. Water level is the main ecological driver maintaining this plant community. However, this phase retains high functionality through continued maintenance including prescribed grazing with adequate recovery period as well as prescribed burning.

Invertebrates: Shallow Marsh ecological sites provide habitat for a diverse suite of aquatic invertebrates providing an important trophic link between macrophytes and vertebrates that depend upon them as food. The structure provided by vegetated wetlands increases the abundance of aquatic invertebrates compared to less vegetated sites. Maximum invertebrate production occurs when emergent and submergent vegetation are interspersed.

Insects play a role in maintaining the forb community and provide a forage base for grassland birds, wetland birds, and rodents. Early season pollinator plants are limited; however, a variety of forbs provide mid- to late-season pollen and nectar. Wet soil does not provide habitat for ground nesting pollinator species. This site does not provide habitat for Dakota skippers, regal fritillaries, or monarch butterflies. Depending on forb species composition, this site may be visited for nectar.

Birds: This plant community provides quality nesting, foraging, and escape habitats favored by mid- to tallgrass-nesting birds, especially those species preferring wetter (hydric) habitats (such as Nelson's sparrow, black tern, northern harrier, sedge wren, waterfowl and other water birds). This site provides waterfowl pair bonding sites, quality invertebrate food source for egg-laying water bird hens, and water bird brood habitat. This plant community provides winter cover and escape for many upland birds. This site provides good hunting opportunities for grassland raptors, especially northern harrier.

Mammals: The diversity of grasses and forbs provide high nutrition levels for small and large herbivores. In addition, it provides foraging opportunities for raccoon, skunks, coyotes, and other mammals that use wetlands and wetland edges for food resources. Tall- to mid-statured vegetation provides suitable food, thermal, protective, and escape cover for small and large herbivores.

Amphibians and Reptiles: This ecological site can provide habitat for the northern leopard frog, Canadian toad, and tiger salamander. Duration of surface water provides for successful egg laying and tadpole development.

Fish and Mussels: This ecological site is often directly associated with streams, rivers, or water bodies. As a seasonal wetland, it ponds water into mid-summer or longer. This site receives run-on hydrology from adjacent ecological sites and provides hydrology to shallow ground water and other surface waterbodies. Management on Shallow Marsh sites, in conjunction with neighboring run-off sites, will have a direct effect on aquatic species within the site and in streams and/or tributaries receiving water from Shallow Marsh sites. Optimum hydrological function and nutrient cycling limit potential for sediment yield and nutrient loading to the adjacent aquatic ecosystems from State 1.0.

Community Phase 1.2 Open Water – Submergent Vegetation-Buttercup: This plant community phase occurs during periods of increased water depth, usually associated with prolonged periods of above average precipitation. The increased ponded water depth favors submerged vegetation and may create a mosaic of vegetation in conjunction with Plant Community Phases 1.1 and 1.3. The forb community is limited to submerged vegetation with flowers borne just above the water surface.

Invertebrates: Invertebrate abundance and diversity will increase with submerged vegetation, while pollen and nectar sources for bees and butterflies is limited to mid- to late-season when flowers are borne on submerged vegetation above the water surface.

Birds: Dominated by submerged vegetation, this site provides high protein source for egg-laying waterfowl hens. Dependent upon the duration of ponding into the growing season, the site will provide a quality protein source for waterfowl broods with escape cover when associated with Plant Community Phase 1.1. This site provides good hunting opportunities for grassland raptors, especially northern harrier.

Mammals: Provides similar life requisites as Community Phase 1.1; however, this Plant Community Phase no longer provides thermal, protective, escape, and winter habitat for a big game animals and other small herbivores.

Amphibians and Reptiles: Provides similar life requisites as Community Phase 1.1.

Fish and Mussels: Provides similar life requisites as Community Phase 1.1.

Community Phase 1.3 Drawdown Phase–Fresh-Grasses/Sedges-Spikerushes: This plant community occurs during the drawdown phase associated with prolonged periods of below average precipitation. The plant community is dominated by short- to mid-statured vegetation. This phase retains high functionality and, with average or above average precipitation (via Community Phase Pathway 1.3A), will revert to Plant Community Phase 1.1.

Invertebrates: Insects play a role in maintaining the forb community and provide a forage base for grassland birds, wetland birds, and rodents. This plant community contains a variety of forbs providing season-long pollen and nectar. However, due to wet soils, ground nesting pollinator species do not prefer this site. Dakota skippers, regal fritillaries, or monarch butterflies will use this site when swamp milkweed, New England aster, or goldenrods occupy this site.

A diverse suite of aquatic invertebrates still occurs in this plant community phase; however, abundance is reduced due to loss of emergent vegetation. Rapid warming during spring snowmelt allows the invertebrate population to flourish.

Birds: Provides similar life requisites as Community Phase 1.1; however, a shorter statured plant community favors bird species that prefer short- to mid-statured vegetation.

Mammals: Provides similar life requisites as Community Phase 1.1; however, the shorter-statured vegetation limits thermal, protective, and escape cover for small and large herbivores.

Amphibians and Reptiles: Provides similar life requisites as Community Phase 1.1; however, the lack of surface water does not provide the opportunity for successful egg-laying and tadpole development habitat.

Fish and Mussels: Provides similar life requisites as Community Phase 1.1.

Community Phase 1.4 Drawdown Phase-Brackish-Foxtail Barley/Spikerushes/Dock-Goosefoot: This plant community phase occurs during the drawdown phase caused by long-term, below average precipitation coupled with season-long grazing. Increased salinity occurs allowing grazing tolerant foxtail barley to become one of the dominant species in this plant community. Grazing tolerant spikerush species increase along with weedy native forbs (goosefoot/dock).

Invertebrates: Pollinator friendly forbs decrease as salinity and foxtail barley increase which limits pollen and nectar availability. Bare ground increases but few ground nesting species, if any within MLRA 56A, use saline soils for nesting sites. This shift to drier soil conditions reduces or eliminates aquatic invertebrates.

Birds: This plant community phase does not provide waterfowl brood habitat. Depending on spring moisture conditions, waterfowl may find abundant invertebrate populations during the breeding season. As the site draws down, wading bird habitat increases as shallow water increases and as taller vegetation is replaced with increasing amounts of bare ground. Invertebrates remain abundant early in the growing season unless prolonged below average precipitation persists drying of the soil, reducing invertebrate abundance and diversity.

Mammals: A shift to short-grass species, drier soil conditions, and increased salinity reduces habitat for large mammals, such as white-tailed deer, while still providing vegetative cover for small mammals. Thermal, escape, and winter cover is no longer provided for larger ungulates. Foraging opportunities for raccoon, skunks, coyotes, and other mammals becomes limited.

Amphibians and Reptiles: Loss of surface water and increased salinity reduces habitat for amphibians and reptiles. Tiger salamander habitat is lost while saline soils are not favored by frogs and toad species.

Fish and Mussels: Provides similar life requisites as Community Phase 1.1.

2.0 Native/Invaded State

Community Phase 2.1 Normal Emergent Phase Grasses/Sedges-Spikerushes-Bulrushes/Exotics: This transition from the State 1: Reference State to State 2: Native/Invaded State results from the colonization and establishment of exotic plants, often exotic strains of reed canarygrass. Exotic forbs that may occur include the hybrid cattail (cross between narrowleaf and broadleaf cattail), Canada thistle, and purple loosestrife.

Heavy grazing, prolonged periods of non-use and no fire, and a decrease in the water regime of the site are often involved with this transition. Excessive litter accumulation provides conditions favorable to exotic strains and/or hybrids of reed canarygrass and/or cattails which can quickly spread to form virtual monocultures. As a result, the transition to State 3: Invaded State can be expected. This plant community phase has a very similar appearance and function to the Plant Community 1.1. Managers should consider management within the State 2.0 Community Phase Pathways to avoid transitioning to State 3.0.

Invertebrates: Provides similar life requisites as Community Phase 1.1.

Birds: Provides similar life requisites as Community Phase 1.1.

Mammals: Provides similar life requisites as Community Phase 1.1.

Amphibians and Reptiles: Provides similar life requisites as Community Phase 1.1.

Fish and Mussels: Provides similar life requisites as Community Phase 1.1.

Community Phase 2.2 Drawdown Phase-Brackish/Foxtail Barley/Spikerushes/Exotics: This plant community phase occurs with heavy season-long grazing combined with a drawdown phase and increased salinity. Grazing and salt tolerant foxtail barley and assorted forbs dominate the site while wheat sedge and other native grasses decline.

Invertebrates: Provides similar life requisites as Community Phase 1.4. Heavy season-long grazing and saline soils do not allow flowering plants to recover, limiting pollen and nectar resources for bees and other pollinating insects. In addition, a shift from perennial to annual forbs reduces season-long pollen and nectar sources for pollinating insect species. These annual forbs do not provide pollen and nectar resources at the same high level as native forbs provide. Prolonged periods of reduced precipitation favor ground nesting pollinators; however, increased compaction from mechanical impacts or increased livestock presence negatively impacts ground nesting pollinator opportunities. This shift to drier soil conditions reduces or eliminates aquatic invertebrates.

Birds: Provides similar life requisites as Community Phase 1.4.

Mammals: Provides similar life requisites as Community Phase 1.4.

Amphibians and Reptiles: Provides similar life requisites as Community Phase 1.4**.**

Fish and Mussels: Provides similar life requisites as Community Phase 1.1.

Community Phase 2.3 Drawdown Phase–Fresh-Spikerushes/Hybrid Cattail: This plant community phase occurs with heavy season-long grazing combined with a drawdown phase. This combination favors spike rushes and annual forbs.

Invertebrates: Heavy season-long grazing coupled with reduced to no ponding favors annual forbs and spikerushes limiting pollen and nectar resources for bees and other pollinating insects. These annual forbs do not provide pollen and nectar resources at the same high level as native forbs provide. Prolonged periods of reduced precipitation favor ground nesting pollinators; however, increased compaction from mechanical impacts or increased livestock presence negatively impacts ground nesting pollinator opportunities. This shift to drier soil conditions reduces or eliminates aquatic invertebrates until the site is inundated again.

Birds: This shorter, drier plant community reduces or eliminates nesting, brooding, or feeding opportunities for waterfowl and other water birds.

Mammals: Short spikerushes and annual forbs provide limited resources for mammals of all sizes.

Amphibians and Reptiles: Provides similar life requisites as Community Phase 1.3**.**

Fish and Mussels: Provides similar life requisites as Community Phase 1.1.

3.0 Invaded State

Community Phase 3.1 Hybrid Cattail and/or Reed Canarygrass: Eutrophication and sedimentation of the site, often due to tillage on or adjacent to the site, transitions this plant community to one dominated hybrid cattails or exotic strains/hybrids of reed canarygrass. Monotypic stands of hybrid cattail generally develop and out-compete other grasses, graminoids or forbs. Mechanical treatment, sediment removal, prescribed burning, reseeding, and buffer reestablishment may all be needed to restore this site to State 1.0 (via Restoration Pathway R3A) or State 2.0 (via Restoration Pathway R3B). Extended periods of above average precipitation along with mechanical treatment, sediment removal, prescribed burning, and reseeding (via Restoration Pathway R3A or R3B) can move this plant community back to State 1.0 or 2.0.

Invertebrates: Saturated to ponded soils favor aquatic invertebrates. Monotypic stands of hybrid cattail or reed canarygrass limit forb species, providing a decrease in pollen and nectar sources for insects. Restoration efforts, including prescribed grazing, can reduce hybrid cattail and reed canarygrass while increasing forb diversity. The initial flush of forbs may be Canada thistle and field sowthistle resulting from restoration efforts, especially prescribed grazing.

Birds: Monotypic stands of hybrid cattail or reed canarygrass reduce water bird use. LeConte's and Nelson's sparrow, marsh wren, and yellow rail favor this plant community. American bittern may use this site. Yellow-headed and red-winged black birds use cattail

dominated wetlands for roosting, especially in late summer and early fall prior to migration. This plant community can provide winter cover for ring-necked pheasants when located near a winter food source. Restoration efforts, including prescribed grazing, can reduce hybrid cattail and reed canary grass, increasing open water providing foraging and breeding habitat for dabbling ducks and shore birds including an quality food source of aquatic invertebrates.

Mammals: Monotypic stands of hybrid cattail or reed canarygrass provide winter cover for large herbivores including white-tailed deer and moose. Depending on degree of ponding or saturation, this plant community may provide season-long escape cover for white-tailed deer. Tall- to mid-statured vegetation provides suitable food and thermal, protective, and escape cover for small and large herbivores.

Amphibians and Reptiles: Provides similar life requisites as Community Phase 1.1.

Fish and Mussels: Provides similar life requisites as Community Phase 1.1.

4.0 Go-Back State

Community Phase 4.1 Annual/Pioneer Perennial/Exotics: Following cropland abandonment, these plant communities are dominated by early pioneer annual and perennial plant species. Plant species composition and production are highly variable and dependent upon water depth and length of time the wetland has been in crop production contributing to eutrophication and sedimentation of wetland basin. Hybrid cattail, Canada thistle, field sowthistle, other annual weeds (dock, smartweed, barnyard grass, etc.), quackgrass, foxtail barley, slough grass, and pioneering spikerush species are typical pioneer species. Weedy plants can provide pollinator habitat along with spring and summer cover for many mammals and birds and their young. Dense weed cover can keep soils moist, increasing insect presence. Tall stature provided by some weeds offers thermal cover and seeds throughout winter. The response by wildlife species will be dependent upon ponded water depth, plant community composition, vegetative stature, patch size, and management activities (such as wetland restoration, sediment removal, prescribed grazing, burning, inter-seeding, haying, or noxious weed control).

Successful restoration of native species along Transition Pathway R4A can result in a native grass and forb community in State 2.0. Management activities within State 2.0 are needed to avoid a transition out of State 2.0. Unsuccessful wetland restoration or unsuccessful native forb and grass seeding along Transition Pathway R4B will result in State 3.0.

Animal Community – Grazing Interpretations

Note: When interpreting plant production regarding stocking rate, several things must be taken into consideration. Annual production is highly variable and subject to wide fluctuations; palatability is generally low and seasonally quite variable; and access to the forage can be limited due to water levels. As a result, caution must be exercised so that the stocking rate is based on a realistic inventory or a reasonable estimate of usable forage. More accurate stocking rate estimates should eventually be calculated using actual stocking rate information and monitoring data.

NRCS defines prescribed grazing as “managing the harvest of vegetation with grazing and/or browsing animals with the intent to achieve specific ecological, economic, and management objectives”. As used in this site description, the term ‘prescribed grazing’ is intended to include multiple grazing management systems (e.g., rotational grazing, twice-over grazing, conservation

grazing, targeted grazing, etc.) provided that, whatever management system is implemented, it meets the intent of prescribed grazing definition.

The basic grazing prescription addresses balancing forage demand (quality and quantity) with available forage, varying grazing and deferment periods from year-to-year, matching recovery/deferment periods to growing conditions when pastures are grazed more than once in a growing season, implementation of a contingency (e.g., drought) plan, and a monitoring plan. When the management goal is to facilitate change from one plant community phase or state to another, then the prescription needs to be designed to shift the competitive advantage to favor the native grass and forb species.

Grazing levels are noted within the plant community narratives and pathways in reference to prescribed grazing management. "Degree of utilization" is defined as the proportion of the current year's forage production that is consumed and/or destroyed by grazing animals (may refer to a single plant species or a portion or all the vegetation). "Grazing utilization" is classified as slight, moderate, full, close, and severe (see the following table for description of each grazing use category). The following utilization levels are also described in the Ranchers Guide to Grassland Management IV. Utilization levels are determined by using the landscape appearance method as outlined in the Interagency Technical Reference "Utilization Studies and Residual Measurements" 1734-3.

Utilization Level	%	Use Description
Slight (Light)	0-20	Appears practically undisturbed when viewed obliquely. Only choice areas and forage utilized.
Moderate	20-40	Almost all of accessable range shows grazing. Little or no use of poor forage. Little evidence of trailing to grazing.
Full	40-60	All fully accessable areas are grazed. The major sites have key forage species properly utilized (about half taken, half left). Points of concentration with overuse limited to 5 to 10 percent of accessible area.
Close (Heavy)	60-80	All accessible range plainly shows use and major sections closely cropped. Livestock forced to use less desirable forage, considering seasonal preference.
Severe	> 80	Key forage species completely used. Low-value forages are dominant.

Hydrology Functions

Under unaltered hydrologic conditions, the site is dominated by soils in hydrologic group D; where significantly impacted by drainage practices, these soils are in hydrologic group A/D, B/D, or C/D depending upon soil texture. Infiltration varies from very slow to very rapid; runoff potential for this site is none to very low.

Hydrological manipulation (surface or tile drainage, pumping, surface water diversion, etc.) modifies this ecological site. Under natural conditions, this ecological site includes a wide range of soil textures; after hydrologic manipulation, soil texture often becomes a more significant factor in vegetative response. If the degree of manipulation allows soil texture to influence the plant community or if altered soil properties (i.e., salinization or the addition of fill material) results in vegetation change, a transition to a completely different ecological site may have occurred. The transition to an altogether different ecological site will depend upon severity of altered hydrology, soil properties, and corresponding vegetation. Due to the many variables (e.g., hydrology, type and success of drainage, etc.), impacts to the ecological site will be site specific. As a result, each situation will require field investigation to determine what, if any, change in ecological site designation is necessary and proceed accordingly.

Without restoring hydrologic function (which may include range seeding), managers need to reference state and transition models within those sites. Hydrology will need to be fully restored in Wet Meadow and Shallow Marsh ecological sites for these sites to properly function. It is recommended that managers review the appropriate State and Transition Models prior to wetland restoration.

Recreational Uses

Hunting and Bird Watching: The United States Fish and Wildlife Service manages approximately 4,000 acres of National Wildlife Refuges for hiking and bird watching and approximately 24,000 acres of Waterfowl Production Areas for public hunting, hiking, and bird watching. States within MLRA 56A manage approximately 39,000 acres of wildlife management areas for multiple use including hunting, fishing, hiking, birdwatching, berry picking, and other non-motorized uses. Of the 39,000 acres, approximately 21,400 are in Minnesota with approximately 16,000 acres in North Dakota and approximately 1,700 acres in South Dakota.

In North Dakota, the United States Forest Service manages 70,000 acres on the Sheyenne National Grassland for multiple uses including camping, hunting, photography, backpacking birdwatching, biking, horseback riding, and other non-motorized recreation. The Sheyenne National Grassland is also managed for livestock grazing. The Choppy Sands and Sands ecological sites dominate the Grassland. It is the only National Grassland in the tallgrass prairie region of the United States. The grassland provides habitat for greater prairie chickens as well as several other sensitive species, such as the Dakota skipper and regal fritillary. It also contains one of largest populations of the western prairie fringed orchid which is listed as a threatened species by the U.S. Fish and Wildlife Service.

Fishing: Approximately 20 lakes are managed for public fishing MLRA 56A. Most of these lakes offer boat docks and ramps. These lakes contain various sport fish including walleye, northern pike, yellow perch, crappie, and bluegill. The Red River runs from south to north through the center of the MLRA. The Red River is best known for channel catfish but also has walleye, sauger, northern pike, and smallmouth bass. The Red River is 550 miles long from its source in the southern end of the MLRA

near Breckenridge, Minnesota to Lake Winnipeg in Manitoba, Canada. Between North Dakota and Minnesota, there are 32 public access points along the Red River with 18 having boat ramps.

Camping: Four state parks or recreation areas provide of modern and primitive camping facilities. Minnesota hosts the Buffalo River State Park and Red River State Park. North Dakota hosts the Icelandic State Park and Turtle River State Park. These Parks provide hiking, biking, birding, canoeing, and wildlife viewing opportunities. Many local parks and private parks provide modern and primitive camping opportunities. Limited primitive camping is also available on North Dakota Game and Fish Department Wildlife Management Areas.

Hiking/Biking/Horseback Riding: Hiking is permitted on most state and federally owned lands. Developed hiking and biking trails can be found the four state parks. The Grand Forks Greenway has over 22 miles of trails while municipalities along the Red River have extensive walking and hiking trails. A 30-mile segment of the North Country National Scenic Trail leads hikers through the Sheyenne National Grassland's unique landforms and plant communities. This trail has three trailheads along its route; it is a graveled, marked trail. The entire North Country National Scenic Trail stretches from Crown Point, New York to Lake Sakakawea near Garrison, North Dakota.

Canoeing/Kayaking: The Red River has six designated canoe/kayaking trails. Public access, with limited rentals, is available at these segments. Sheyenne River Water Trail has a segment within the MLRA Sheyenne National Grasslands. Canoe/kayak rentals are available at Icelandic State Park.

Wood Products

No appreciable wood products are present on the site.

Other Products

Seed harvest of native plant species can provide additional income on this site. In addition, cattails can provide a variety of other uses including edible pollen and roots, paper, and ethanol.

Site Development and Testing Plan

- Further investigation is recommended on organic soils (fens and bogs) included in this site. The hydrology and plant communities may warrant a separate ecological site and STM. The primary organic soil to investigate is Rifle. Many other organic components are currently linked to MLRA 56B ESDs (where the soils are of much greater extent).
- Further investigation is needed on the influence of water chemistry on the soil/water/plant dynamics of this site. Currently wetlands with fresh water and those with brackish water are both included in the Shallow Marsh site. During the drawdown phase, in particular, the chemistry of both water and soil will likely significantly impact the plant community. Soils with some accumulation of carbonates and/or salts are included in this site; however, these accumulations are more typical of discharge wetlands which are not considered the central concept of Shallow Marsh. Calciaquolls form where soil water movement is more upward than downward, creating the layer of carbonate accumulation near the surface. It is believed the duration of ponding on the Typic Calciaquolls included in this site is significantly longer now than when these soils were forming. Extensive cultivation of the surrounding uplands contributes to more runoff into these wetlands now than under prairie conditions. In addition, periodic cultivation of the wetland soils likely has altered soil structure significantly – slowing infiltration. A separate ecological site may be needed to adequately address the brackish water/discharge wetland areas included in this site.

- Further investigation is needed on soils with nearly continuous, deep ponding (Southam series). The hydrology and plant community on this site is likely not well-represented by the Shallow Marsh site. A Deep Marsh ecological site may need to be developed.
- Further investigation is needed on areas of this site associated with flood plains. Rauville (major and minor components) and minor components of Ludden soils occur in on flood plains and in oxbows of streams and rivers. A separate ecological site for these soils may be useful. The impact of occasional or frequent flooding on these areas needs evaluation.
- Further investigation is needed on the wide range of landforms and soil textures (and associated properties) and their relationship to hydrology/plant dynamics.
- Further evaluation and refinement of the State-and-Transition model may be needed to identify disturbance driven dynamics. Additional states and/or phases may be required to address grazing response.
- Further documentation may be needed for plant communities in all states. Plant data has been collected in previous range-site investigations, including clipping data; however, this data needs review. If geo-referenced sites meeting Tier 3 standards for either vegetative or soil data are not available, representative sites will be selected for further investigation.
- Site concepts will be refined as the above noted investigations are completed.
- The long-term goal is to complete an approved, correlated Ecological Site Description as defined by the National Ecological Site Handbook.
- NASIS revisions needed:
    - Nineteen components (1 major) of Dovray, very poorly drained are currently linked to Wet Meadow; these need to be relinked to Shallow Marsh.
    - One major component of Colvin moderately saline, one major Grano, moderately saline, one minor component of Grano, slightly saline, and one minor component of Augsburg, moderately saline are very poorly drained and currently linked to Saline Lowland. Very poorly drained soils should be linked to Shallow Marsh regardless of soil salinity level.
    - Three components (2 major) of Roliss, very poorly drained are linked to Wet Meadow; these need to be relinked to Shallow Marsh.
    - Two components (1 major) of Flom, very poorly drained are currently linked to Wet Meadow; these need to be relinked to Shallow Marsh.
    - Two components (1 major) of Kratka, very poorly drained are currently linked to Wet Meadow; these should be relinked to Shallow Marsh. Both components occur in the Minnesota part of MLRA 56A.
    - Three components (1 major) of Lallie, very poorly drained are currently linked to Wet Meadow; these should be relinked to Shallow Marsh.

This ESD is the best available knowledge. The site concept and species composition table have been used in the field and tested for more than five years. It is expected that as additional information becomes available revisions may be required.

Supporting Information

Associated Sites

Ecological Site Name	Site ID	Narrative
Clayey	R056AY084ND	This site occurs on nearby uplands. The subsoil layers form a ribbon >2 inches long. It is >30 inches to redoximorphic features.
Limy Subirrigated	R056AY087ND	This site is somewhat poorly drained and occurs on flats adjacent to Shallow Marsh sites. The soils are highly calcareous in the upper part of the subsoil; redoximorphic features at a depth of 18 to 30 inches. All textures are included in the site.
Loamy Overflow	R056AY088ND	This site occurs on floodplain terraces. The surface and subsoil layers form a ribbon 1 to 2 inches long. It is deeper than 30 inches to redoximorphic features.
Saline Lowland	R056AY089ND	This site occurs on rims of depressions and adjacent flats. It has an accumulation of salts in the surface and subsoil layer (E.C. >8 dS/m). Typically, this site does not have a claypan layer, but one is allowed if the soil is poorly drained. All textures are included in this site.
Sands	R056AY090ND	This site occurs on nearby uplands. Between a depth of 10 and 20 inches, the soil does not form a ribbon. It is >40 inches to redoximorphic features.
Loamy	R056AY094ND	This site occurs on nearby uplands. The surface layer and subsoil layers form a ribbon 1 to 2 inches long. It is >30 inches to redoximorphic features.
Subirrigated	R056AY095ND	This site is somewhat poorly drained and occurs on flats adjacent to Shallow Marsh sites. The soils are non-effervescent to a depth $\geq$16 inches; redoximorphic features at a depth of 18 to 30 inches. All textures are included in the site.
Subirrigated Sands	R056AY096ND	This site occurs on nearby uplands. The upper 20 inches does not form a ribbon. Redoximorphic features occur between 30 and 40 inches.
Wet Meadow	R056AY102ND	This poorly drained site is in shallow depressions, on low-lying flats, and on floodplains. A seasonal high-water table is typically within a depth of 1.5 feet during the months of April through June; in depressions, it is frequently ponded (typically $\leq$1.5 feet) from April into July. It typically has redoximorphic features within a depth of 18 inches. Some soils are highly calcareous. It is non-saline to slightly saline (E.C. <8 dS/m). All textures are included in this site.
Sodic Subirrigated	R056AY104ND	This site occurs on poorly drained landscape positions on some sand plains. Redoximorphic features occur within a depth of 18 inches. The soil has a dense, sodic claypan. The surface layer and upper part of subsoil do not have significant salt accumulations (E.C. <8 dS/m).

Similar Sites

Ecological Site Name	Site ID	Narrative
Wet Meadow	R056AY102ND	This poorly drained site is in shallow depressions, on low-lying flats, and on floodplains. A seasonal high-water table is typically within a depth of 1.5 feet during the months of April through June; in depressions, it is frequently ponded (typically $\leq$1.5 feet) from April into

		July. It typically has redoximorphic features within a depth of 18 inches. Some soils are highly calcareous. It is non-saline to slightly saline (E.C. <8 dS/m). All textures are included in this site.

Acknowledgements

Developers

ND NRCS: Keith Anderson, Fred Aziz, Stan Boltz, David Dewald, Jonathan Fettig, Alan Gulsvig, Mark Hayek, Chuck Lura, Jeff Printz, Steve Sieler, Lee Voigt, and Hal Weiser.

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Inventory Data References

Information presented here has been derived from NRCS and other federal/state agency clipping and inventory data. Also, field knowledge of range-trained personnel was used. All descriptions were peer reviewed and/or field-tested by various private, state and federal agency specialists.

State Correlation

This site has been correlated with Minnesota, North Dakota, and South Dakota in MLRA 56A.

Relationship to Other Established Classifications

Level IV Ecoregions of the Conterminous United States: 48a Glacial Lake Agassiz Basin; 48b Beach Ridges and Sand Deltas; 48c Saline Area; and 48d Lake Agassiz Plains.

Wetland Description:	**System**	**Subsystem**	**Class**	**Sub-class**	**Water Regime**
Cowardin, et. al., 1979	Palustrine	N/A	Emergent	Persistent	Seasonal

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Site Description Approval

ND, State Range Management Specialist	Date	MN, State Range Management Specialist	Date
SD, State Range Management Specialist	Date		

INTERPRETING INDICATORS OF RANGELAND HEALTH, Version 5, REFERENCE SHEET

Ecological site name: _Shallow Marsh___ **Ecological site code: _RO56AY101ND____**
Author(s)/participant(s): _USDA-NRCS North Dakota_____
Contact for lead author: _NRCS State Rangeland Management Specialist_____
Date: __Dec. 2021___ **MLRA:** __56_____ **LRU:** _____
Composition based on (check one): ☐ Cover ☒ Annual Production

Indicators. For each indicator, describe the potential for the site using the reference sheet checklist. Where possible, (1) use quantitative measurements; (2) include expected range of values for above- and below-average years and natural disturbance regimes for each community phase within the reference state, when appropriate; and (3) cite data sources used. Continue descriptions on separate sheet.
1. Rills: Rills are not expected for this site.
2. Water flow patterns: Water flow patterns not visible.
3. Pedestals and/or terracettes: Neither pedestals nor terracettes are expected.
4. Bare ground: Bare ground is 5% or less. Amount of bare ground may increase for a short time following periods of inundation.
5. Gullies: Active gullies are not expected on this site.
6. Wind-scoured and/or depositional areas: No wind-scoured or depositional areas expected on this site.
7. Litter movement: Plant litter movement not expected on this site.
8. Soil surface resistance to erosion: Stability class averages 6.
9. Soil surface loss and degradation: Use soil series description for depth, color, and structure of A-horizon.
10. Effects of plant community composition and distribution on infiltration: Tall-statured rhizomatous grasses and grass-likes are dominant. Mid- and short-statured rhizomatous grasses, mid- and short-statured bunch grasses are subdominant.
11. Compaction layer: No compaction layer occurs naturally on this site.
12. Functional/structural groups: Due to differences in phenology, root morphology, soil biology relationships, and nutrient cycling Kentucky bluegrass, smooth brome, and crested wheatgrass are included in a new Functional/structural group, mid- and short-statured early cool-season grasses (MSeC3), **not expected for this site**.

Dominance Category[1]	**Relative dominance of F/S groups for community phases in the *Reference State*** *Minimum expected number of species for dominant and subdominant groups is included in parentheses.*
	Dominance based on[1]: Annual Production _X_ or Foliar Cover __

	Phase 1.1_	Phase 1. __	Phase 1. __
Dominant	Tall C3 rhizomatous grasses (3); Grass-likes (6)		
Subdominant	Mid & short C3 rhizomatous grasses (1); Mid & short C4 rhizomatous grasses (2)		
Minor	Mid & short C3 bunch grasses; Forbs; Tall C4 rhizomatous grasses		
Trace			

[1]Biological soil crust dominance is determined based on cover, rather than production. If biological soil crusts are an expected dominant or subdominant group, the number of expected life forms (e.g., lichen, moss) is listed, rather than number of individual species.

13. Dead or dying plants or plant parts: Rare to not occurring on this site.

14. Litter cover and depth: Plant litter cover is 85 to 90% with a depth of 1.0 to 1.5 inches. Plant litter is in contact with the soil surface.

15. Annual production: Annual air-dry production is 6800 lbs./ac (reference value) with normal precipitation and temperatures. Low and high production years should yield 5800 lbs./ac to 7800 lbs./ac, respectively.

16. Invasive plants: State and local noxious species, Kentucky bluegrass, smooth bromegrass, reed canarygrass, hybrid cattail, and redtop.

17. Vigor with an emphasis on reproductive capability of perennial plants: Noninvasive species in all functional/structural groups are vigorous and capable of reproducing annually under normal weather conditions.

October 2024

Functional/Structural Groups Sheet

State ND **Office** _____ **Ecological site** Shallow Marsh **Ecol. site code** RO56AY101ND

Observers _____ **Date** _____

Evaluation site ID and/or name: _____
Dominance in ESD based on: Foliar Cover Annual Production Biomass

Species list of functional/structural groups in the **Reference State**	
Functional/Structural Group	Species List
Tall C3 rhizomatous grasses	American mannagrass, fowl mannagrass, common rivergrass
Grass-likes	wheat sedge, woolly sedge, smoothcome sedge, Sartwell's sedge, softstem bulrush,
.	hardstem bulrush*, chairmaker's bulrush*, spikerush,
Mid & short C3 rhizomatous grasses	northern reedgrass
Mid & short C3 bunch grasses	American sloughgrass*, shortawn foxtail*
Mid & short C4 rhizomatous grasses	saltgrass, scratchgrass
Forbs	please see plant community table 1.1
Tall C4 rhizomatous grasses	prairie cordgrass*
.	
.	
Biological soil crust[1]	

Reference State - Relative dominance of functional/structural groups for each community phase

Relative dominance annotations: *Use the following annotations in the narrow columns to describe the relative dominance of the listed functional/structural groups: = "equal"; > "greater than"; >> "much greater than"*

Phase	Dominant **	>> > =	Subdominant **	>> > =	Minor **	>> > =	Trace **
1.1	Tall C3 rhizomatous grasses > Grass-likes	>>	Mid & short C3 rhizomatous grasses > Mid & short C3 bunch grasses =	>	Mid & short C4 rhizomatous grasses > Forbs = Tall C4 rhizomatous grasses	.	
		.		.		.	
		.		.		.	

* Indicates species that may or may not be present on the site. Absence of these species may not constitute a departure.
** See IIRH Version 5 page 70.

Circle the community phase that most closely matches the evaluation area. *Revise functional/structural groups relative dominance for the community phase circled to represent changes in dominance given the time since disturbance(s) (see page 1 of site evaluation sheet).

Species list of functional/structural groups in the **Evaluation Area**	
Functional/Structural Group	Species List
Tall C3 rhizomatous grasses	
Grass-likes	
Mid & short C3 rhizomatous grasses	
Mid & short C4 rhizomatous grasses	
Mid & short C3 bunch grasses	
Forbs	
Tall C4 rhizomatous grasses	
Groups not expected:	
Mid & short early C3 grasses	
Biological soil crust[1]	

Evaluation Area - Relative dominance of functional/structural groups						
Dominant **	>> > =	Subdominant **	>> > =	Minor **	>> > =	Trace **

Biological soil crust [1] - dominance is evaluated solely on cover, not composition by weight

** See IIRH Version 5 page 70.

Notes: