Natural Resources Conservation Service
U.S. DEPARTMENT OF AGRICULTURE

Draft Watershed Plan for the Box Butte Watershed Project

Box Butte, Dawes, and Sheridan Counties, Nebraska

September 2025

Prepared by

U.S. Department of Agriculture

Natural Resources Conservation Service

In cooperation with

Upper Niobrara White Natural Resources District, Chadron, Nebraska

U.S. Army Corps of Engineers

DRAFT
WATERSHED PLAN
For
Box Butte Watershed
Box Butte, Dawes, and Sheridan Counties, Nebraska

AUTHORITY

This watershed work plan has been prepared under the authority of the Watershed Protection and Flood Prevention Act of 1954 (Public Law 83-566) as amended. The construction of this Project is authorized under Public Law 83-566 (as amended) and in accordance with Section 102(2) of the National Environmental Policy Act of 1969, Public Law 91-190, as amended (42 U.S.C. 4321 et seq.).

ABSTRACT

The purpose of the proposed action is to improve agricultural water management and flood prevention in the Box Butte Creek Watershed. The project is needed due to significant groundwater declines in static aquifer levels in the Box Butte Creek Watershed over the past 25 years and flooding along Box Butte Creek and its tributaries in the last 10 years that has resulted in damages to agricultural land use and rural roadway. The recommended plan consists of 3 on-channel dam diversion structures and 3 roadbed improvement areas at locations identified to promote groundwater recharge and prevent flood damage. Incidental benefits of the Plan are reducing erosion and sedimentation and reducing threats to public health and safety and social and economic conditions. Total project costs are $2,661,303 of which $1,659,516 (62 percent) will be paid by Public Law 566 funds and $1,001,787 (38 percent) will be paid by the Sponsor. This document is intended to fulfill requirements of the National Environmental Policy Act of 1969 and to be considered for authorization of Public Law 566 funding.

Prepared by:	U.S. Dept. of Agriculture, Natural Resources Conservation Service
Lead Agency:	U.S. Dept. of Agriculture, Natural Resources Conservation Service
Sponsor:	Upper Niobrara White Natural Resources District
Cooperating Agency:	United States Army Corps of Engineers

ADDITIONAL INFORMATION

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Summary (OMB Fact Sheet)

Summary Watershed Plan for Box Butte Creek
Box Butte and Sheridan Counties, Nebraska
3rd Congressional District

Prepared by: United States (US) Department of Agriculture (USDA), Natural Resources Conservation Services (NRCS).

Authorization: Public Law 83-566 Stat. 666 as amended (16 USC Section 1001 et. seq.) 1954

Sponsor: Upper Niobrara White Natural Resources District (UNWNRD)

Proposed Action: The proposed action for Box Butte Creek would promote groundwater recharge and provide flood damage relief in the Box Butte Creek Watershed.

Purpose and Need for Action: The purpose of the project is to address agricultural water management to reduce damages to agricultural land due to untimely access to groundwater resources. The project is needed due to significant declines in aquifer levels within the Box Butte Creek Watershed over the past 25 years, which have reduced the reliability of groundwater for irrigation.

The purpose of the project is also to address flood prevention in the Box Butte Creek Watershed. The Box Butte Creek Watershed has experienced four major flooding events with watershed-wide impacts in the last 10 years, including two major flood events in both 2018 and 2019, as well as several intense rainfall events resulting in flooding along Box Butte Creek and its tributaries that caused damage agricultural land and rural roads. The project is needed to address the historical decline in groundwater levels and reduce flood damages to private and public infrastructure.

Preferred Alternative: The Proposed Action includes constructing three on-channel dam diversion structures to off-channel storages (or catchment) to promote ponding, infiltration, and passive groundwater recharge and road improvements at three locations to provide flood damage reduction in the Box Butte Creek Watershed.

As required by PL 83-566, the Proposed Action (Preferred Alternative) contains benefits directly related to agriculture, including rural communities, as the nearest municipality has a population less than 50,000; hence, all benefits of the project are considered agricultural.

The preferred alternative involves constructing three on-channel dam diversion structures to off-channel storages (or catchment) (Site 1, 5, and 7) to promote ponding, infiltration, and passive groundwater recharge. Each dam diversion to off-channel storage (passive recharge) sites would include the construction of a low earthen dam diversion structure, which would be designed to divert portions of run-off event flows to an off-channel storage basin (or catchment) and to have all other flows generated from runoff events overtop the structure at a controlled

location. A culvert pipe would be placed in the dam diversion structure to allow for normal flows to pass. These dam diversion structures would be designed to meet NeDNR criteria (NeDNR 2008) for either Minimal Hazard potential (a dam failure or misoperation would likely result in no economic loss beyond the cost of the structure itself and limited to the property owner) or Low Hazard potential (a dam failure or misoperation would result in no probable loss of human life and low economic loss). In addition, these dam diversion structures would meet NRCS Conservation Practice Standard 348 (Dam, Diversion). The dam diversion structure would effectively convey water to an off-channel storage basin (catchment). These basins would be excavated in the floodplain adjacent to the diverted water source. The off-channel storage basin depth would be no deeper than the bottom elevation of the diverted water source. Side slopes would be a minimum of 3:1. Extension of the dam diversion structure would be placed around the off-channel storage basins, as site topography dictates, to contain the desired storage volume. The dam diversion extension elevation would be set at the elevation of the in-channel dam diversion structure. Borrow material for the dam diversion extension would obtained from the excavated material for the off-channel storage basins.

The preferred alternative would also include road improvements at three locations (Site 11, 12b, and 16). Road improvements for each site would consist of raising the roadbed by a maximum of 2 feet and increasing the capacity of flow conveyance by adding and/or enlarging the culverts under the roadway.

Resource Information:

Hydrologic Unit Code (HUC): The Project is in the Box Butte Creek HUC 10 (1015000309), situated in the larger Upper Niobrara HUC 8 (10150003).

Watershed size: Box Butte Creek HUC 10 – 162,194 acres

Latitude and Longitude: 42.326586, -102.869849

Climate and topography: The climate within the region is semi-arid with distinct seasons and large temperature variations. Summers are hot and humid with average July temperatures of 76°F (24°C) but often reaching over 90°F (32°C). Winters are cold and snowy with average January temperatures of 23°F (-5°C). Precipitation varies from year to year, averaging 17 inches per year.

This project is in the Plains Topographic Region. The Plains are flat-lying land which lies above the valley. The materials of the Plains region are sandstone or stream-deposited silt, clay, sand, and gravel overlain by wind-deposited silt (loess).

Land uses (acres): Land use is primarily agricultural, including grassland and shrubland used for grazing and cultivated cropland. Landcover in the drainage is characterized in Table S-1.

Table S-1. Land Use

Land Use Type	Acres
Barren	95
Dry Cropland	29,507
Irrigated Cropland	18,964
Open Water	32
Other Agricultural Land	72
Rangeland	88,679
Riparian Forest	42
Developed Land	272
Summer Fallow	22,431
Wetlands	2,025
Total	**162,119**

Source: National Land Cover Dataset (2019)

Land ownership: Land ownership is largely private with state-local lands concentrated around the city of Hemingford. There are no federal or Tribal lands present. Private >90%, State-Local <10%, Federal 0%.

Population and Demographics: The population and demographic data are presented in Tables S-2 through S-5.

Table S-2. Population of Counties and Places in the Study Area

Place	2019 Population
Box Butte County	10,970
Dawes County	8,810
Sheridan County	5,231
Village of Hemingford	909

Source: U.S. Census Bureau 2020a

Table S-3. Median Family Income for Counties and Places in the Study Area

Place	2019 (in dollars)
Box Butte County	72,721
Dawes County	71,750
Sheridan County	59,671
Village of Hemingford	73,000

Source: U.S. Census Bureau 2020b

Table S-4. Number of People Employed for Counties and Places in the Study Area

Place	People Employed	Unemployment Rate (%)
Box Butte County	5,363	5.0
Dawes County	4,772	2.2
Sheridan County	19,254	1.7
Village of Hemingford	476	0.6

Source: U.S. Census Bureau 2020c

Table S-5. Percentages of Minority and Low-Income Persons in the Study Area and Box Butte, Dawes, and Sheridan Counties

	Box Butte County Census Tract 9511, Block Group 1	Box Butte County Census Tract 9511, Block Group 2	Dawes County Census Tract 9506, Block Group 3	Sheridan County Census Tract 9517, Block Group 2	Box Butte County	Dawes County	Sheridan County	Box Butte, Dawes, and Sheridan Counties
Total Population	1,418	488	710	756	10,778	8,279	5,102	24,159
White, Not Hispanic	1,285	446	699	711	8,629	7,060	4,068	19,757
Black	0	0	0	13	365	194	44	603
American Indian, Alaska Native	6	0	0	5	217	188	422	827
Asian	11	0	0	1	76	77	63	216
Native Hawaiian, Pacific Islander	0	0	0	0	0	0	0	0
Hispanic[1]	106	39	5	0	1,429	478	313	2,220
Total Minority	123	39	5	19	2,087	937	842	3,866
Percent Minority[2]	8.7	8.0	0.7	2.5	19.4	11.3	16.5	16.0 [3]
Low income	131	41	22	80	1,271	964	539	2,774
Percent low income	9.4	8.5	3.1	11.1	12.0	13.0	10.8	12.1 [3]

Sources: U.S. Census Bureau 2022a, 2022b, and 2022c
Notes:
[1] Includes all Hispanic, regardless of race.
[2] Based on the Federal Highway Administration's definition of minority; does not include "Not Hispanic, Two or more races."
[3] Based on identifying a minority or low-income population as 130 percent of the Box Butte, Dawes, and Sheridan Counties average; thresholds for identifying minority or low-income populations were determined at 20.0 and 19.4 percent, respectively

Table S-6. Relevant Resource Concerns and Impacts of the Preferred Alternative

Resource Concern	Diversion to Off-Channel Storage Impacts	Channel/Infrastructure Improvements Impacts
Geology	No impact.	No impact.
Erosion and Sedimentation	Negligible, short-term, direct, adverse impact associated with construction. Negligible, permanent, direct, adverse impacts due to minor amounts of sedimentation.	Negligible, short-term, direct, adverse impact associated with construction. Minor, permanent, beneficial impacts due to less erosion and sedimentation during future flood events.
Prime and Unique Farmland	Minor, permanent, direct, adverse impacts on 33.2 acres and minor, short-term, direct, adverse impacts on 37.4 acres of agriculturally important lands.	No impact.
Wetlands and Waters of the United States	Minor, permanent, direct, adverse impacts on 0.83 acre and minor, short-term, adverse impacts on 54.56 acres of aquatic resources.	Minor, permanent, direct, adverse impacts on 0.36 acre.
Surface Water Hydrology	Negligible, permanent, direct, adverse impact.	No impact on surface water quantity. Negligible, permanent, direct, adverse impact on the timing of small, frequent runoff events.
Water Quality	Negligible, permanent, direct, beneficial impact.	No impact.
Groundwater	Minor, permanent, direct, beneficial impact due to increased passive recharge.	No impact.
Surface and Groundwater Management	Minor, permanent, direct, beneficial impact.	No impact.
Regional Water Management Plans and Agency Programs	Minor, permanent, direct, beneficial impact. Compliant with regional water management plans and agency programs.	No impact. Compliant with regional water management plans and agency programs.
Wild and Scenic Rivers	Negligible, permanent, indirect, adverse impact.	No impact.
Floodplains	Moderate, permanent impact.	Moderate, permanent impact.
Air Quality	Minor, short-term, direct adverse during construction.	Minor, short-term, direct adverse during construction.
Ecologically Critical Areas	No impact.	No impact.
Noxious Weeds and Invasive Species	Negligible, permanent, direct, adverse impacts on native vegetation.	Negligible, permanent, direct, adverse impacts on native vegetation.
Fish & Aquatic Resources & Terrestrial Wildlife	Negligible, permanent, direct, beneficial impacts on aquatic species. Negligible, permanent, direct, adverse impacts on upland species. Negligible, permanent, direct, adverse impacts on unobstructed channel habitat.	Negligible, permanent, direct, beneficial impacts on aquatic species. Negligible, permanent, direct, adverse impacts on upland species. Negligible, permanent, direct, adverse impacts on unobstructed channel habitat.
Migratory Birds and Eagles	No impact with the implementation of conservation conditions.	No impact with the implementation of conservation conditions.
Endangered and Threatened Species	May affect, not likely to adversely affect with the implementation of conservation conditions.	May affect, not likely to adversely affect with the implementation of conservation conditions.
Riparian Areas	Minor, permanent, direct, adverse impact due to tree clearing. Minor, permanent, direct, beneficial impact due to increased ponding.	Minor, permanent, direct, adverse impact due to tree clearing.

Resource Concern	Diversion to Off-Channel Storage Impacts	Channel/Infrastructure Improvements Impacts
Cultural Resources and Historic Properties	In consultation with the Nebraska State Historic Preservation Office and other consulting parties, NRCS has determined that this alternative would not affect any historic properties.	In consultation with the Nebraska State Historic Preservation Office and other consulting parties, NRCS has determined that this alternative would not affect any historic properties.
Parklands & Recreation	No impact.	No impact.
Public Health and Safety	No impact.	Minor, permanent, direct, beneficial impact due to reduced flooding.
Population	No impact.	No impact.
Local and Regional Economy	Short-term, minor, direct, beneficial impacts due to construction. Minor, permanent, direct, beneficial impact by supporting local producers.	Short-term, minor, direct, beneficial impact due to construction. Minor, permanent, direct, beneficial impact by reducing flood damages.
Scenic Beauty	Minor, short-term, direct, adverse impacts due to construction.	Minor, short-term, direct, adverse impacts due to construction.
Land Use	Minor, permanent, direct, adverse impact for cultivated crops.	No impact.
Provisioning Services	Increased groundwater levels will support continued irrigation in the watershed, which will support crop growth.	Transportation of crops and access to cropland will be facilitated by reduced flooding of roads and reduced flood damage to roadways.
Cultural Services	Bequest values would also be improved by preserving the rural infrastructure and improving groundwater levels.	Stress and the financial hardship caused by displacement and disruption from flooding would be alleviated with implementation of the project.
Regulating Services	No impact.	This alternative would have a moderate, long-term benefit on flood damage reduction with infrastructure improvements (roadways) and a minor, long-term benefit to water quality with the reduction of sediment and erosion from roadways.

Alternatives

Alternatives Considered:

Several alternatives were considered to address the agricultural water management and flood damage reduction purposes and corresponding needs. Those alternatives were evaluated to determine whether they should be carried forward for a more detailed analysis based on the screening criteria requirements of NEPA; CWA Section 404(b)(1) guidelines; and PR&G for federal investments in water resources. Table S-7 and Table S-8 summarize the alternatives and screening process results and identify the alternative(s) carried forward for detailed study.

Table S-7. Summary of Alternatives – Agricultural Water Management

Alternative	Meets Purpose and Need	Reasonable/ Practicable[1]	PR&G (Completeness, Effectiveness, Efficiency, Acceptability)	Carried Forward for Detailed Study
No Action/Future Without Federal Project	No	N/A	N/A	Yes
Off-Channel Storage (passive)	No	N/A	N/A	No
Diversion to Off-Channel Storage (passive)	Yes	Yes	Yes	Yes
On-Channel Storage (passive recharge)	Yes	No	No	No
Injection Recharge	Yes	Yes	No	No
Agricultural Best Management Practices (conservation measures) – Nonstructural	No	N/A	N/A	No

[1] Addresses both reasonableness under NEPA and practicability under Section 404(b)(1) guidelines.

Table S-8. Summary of Alternatives – Flood Damage Reduction

Alternative	Meets Purpose	Reasonable/ Practicable[1]	PR&G (Completeness, Effectiveness, Efficiency, Acceptability)	Carried Forward for Detailed Study
No Action/Future Without Federal Project	No	N/A	N/A	Yes
On-Channel Storage	Yes	No	No	No
Off-Channel Storage	No	No	No	No
Channel/Infrastructure Improvements	Yes	Yes	Yes	Yes
Flood Protection Dikes/Levees	Yes	No	No	No
Diversions	Yes	No	No	No
Floodplain Connectivity	Yes	No	No	No
Physical Nonstructural Measures	Yes	No	No	No
Nonphysical Nonstructural Measures	No	N/A	N/A	No
Agricultural Best Management Practices (conservation measures)	No	N/A	N/A	No

[1] Addresses both reasonableness under NEPA and practicability under Section 404(b)(1) guidelines

Three alternatives were carried forward, including Alternative 1 (No Action/Future Without Federal Investment), Alternative 2 (Dam Diversion to Off-Channel Storage [Future with Federal Investment]), and Alternative 3 (Channel/Infrastructure Improvements [Future with Federal Investment]). The No-Action alternative would result in no construction and continued maintenance. alternative 2 would include constructing three on-channel dam diversion structures to off-channel storages (or catchment) (Site 1, 5, and 7) to promote ponding, infiltration, and passive groundwater recharge. alternative 3 would include conducting road improvements at three locations (Site 11, 12b, and 16).

Mitigation, Minimization, and Avoidance Measures

- Historic Properties and Cultural Resources: No mitigation measures required. In consultation with the State Historic Preservation Office and other consulting parties, NRCS determined that no historic properties would be affected.
- Wetlands/Streams: Coordinate with USACE once final design is completed and Clean Water Act Section 404 permitting is initiated.
- Woodlands: No mitigation measures required.
- Conservation conditions include construction timing and surveys to avoid adverse impacts to threatened and endangered species.
- Obtain a National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges Associated with Construction Activity from Nebraska Department of Environment and Energy.
- Reseeding of grasses would occur in disturbed areas.

Table S-9. Costs and Funds

Works of Improvement	NRCS	Sponsor	Total
Cost-Sharable Items[1]			
Agricultural Water Management			
Dam Diversion to Off-Channel Storage (Sites 1, 5, 7)	$1,349,490	$449,830	$1,799,320
Relocation, beyond required decent, safe, sanitary[2]	$0	$0	$0
Subtotal	$1,349,490	$449,830	$1,799,320
Flood Prevention			
Channel/Infrastructure Improvements (Sites 11, 12b, 16)	$0	$216,370	$216,370
Relocation, beyond required decent, safe, sanitary[2]	$0	$0	$0
Subtotal	$0	$216,370	$216,370
Subtotal: Cost-Sharable Costs	$1,349,490	$666,200	$2,015,690
Cost-Share Percentages	75%	25%	100%
Non-Cost-Sharable Items[3]			
NRCS Technical Assistance/Engineering[4]	$229,248	$0	$229,248
Project Administration[5]	$77,013	$47,491	$124,503

Works of Improvement	NRCS	Sponsor	Total
Federal, State, and Local Permits	$0	$100,796	$100,796
Real Property Rights	$0	$182,820	$182,820
Subtotal: Non-Cost-Share Costs	$306,250	$331,107	$637,367
Total:	$1,655,750	$997,307	$2,653,057

Notes:
[1] The cost-share rate is the percentage of the average cost of installing the practice in the selected plan for the evaluation unit. During project implementation, the actual cost-share rate must not exceed the rate of assistance for similar practices and measures under existing national programs.
[2] Investigation of the watershed project area indicates that no displacements will be involved under present conditions. However, in the event that displacement becomes necessary at a later date, the cost of relocation assistance and payments will be cost-shared in accordance with the associated authorized purpose of 100% for flood damage reduction and 75% for agricultural water management.
[3] If actual non-cost-sharable item expenditures vary from these figures, the responsible party will bear the change.
[4] Technical Assistance assumes that an A/E contract would be used for project design and construction.
[5] The Sponsor and NRCS will each bear the costs of project administration that each incurs.

Project Benefits:

Number of Direct Beneficiaries: The 162,119-acre watershed includes 18,964 acres of irrigated cropland within the Niobrara River water division with 300 active registered wells, including five wells that serve 810 people within the village of Hemingford. Those within the watershed and users of those wells would benefit from the increased groundwater recharge. Box Butte County and the traveling public would benefit from the flood damage reduction.

Other Beneficial Effects – Physical Terms: The project would provide improved groundwater recharge rates and have a permanent benefit by reducing flash flooding risks.

Damage Reduction Benefits:

- Ground Water Recharge: $105,818/104 years
- Flood Damage Reduction: $22,272/104 years
- Benefit to Cost Ratio: 1.43

Period of Analysis: 104 years (4-year installation period and 100-year project life)

Table S-10. Funding Schedule

Year	PL 83-566	Other Funds	Total
Agricultural Water Management			
Year 1–2: Design, Permitting, Real Estate	$227,029[1]	$278,206[2]	$505,235
Year 3–4: Construction	$1,414,490[3]	$480,541[4]	$1,895,032
Subtotal	$1,641,520	$758,747	$2,400,266
Flood Prevention			
Year 1–2: Design, Permitting, Real Estate	$14,231[5]	$12,534[6]	$26,765
Year 3–4: Construction	$0	$226,026[7]	$252,791

Year	PL 83-566	Other Funds	Total
Subtotal	$14,231	238,560	$252,791
Total	$1,655,750	$997,307	$2,653,057

Notes:
[1] Includes design, technical assistance, and 15% of NRCS administrative costs
[2] Includes permitting, real estate, and 15% of Sponsor administrative costs
[3] Includes NRCS cost share of construction and 85% of administrative costs
[4] Includes Sponsor cost share of construction and 85% of administrative costs
[5] Includes design, technical assistance, and technical assistance
[6] Includes permitting and 15% of Sponsor administrative costs
[7] Includes construction costs and 85% of Sponsor administrative costs

Environmental Effects

The Preferred alternative was developed based on its ability to best address the Federal Objective and Guiding Principles and provide the most beneficial effects on environmental, social, and economic resources. The Preferred alternative would be planned, designed, and installed to have long-term net beneficial effects on flood damage reduction.

Implementation of the Preferred alternative may result in minor, unavoidable adverse effects, such as impacts to land use, farmland, floodplains, water resources (including wetlands), endangered and threatened species, and cultural resources (see Table S-6). The Sponsor would work closely with partners, contractors, and affected landowners to incorporate measures to avoid and minimize adverse effects.

Major Conclusions: Implementation of this Plan would result in minimal negative impacts to the environment. The Preferred alternative has the greatest benefit to cost ratio and would provide groundwater recharge and flood damage reduction within the watershed.

Areas of Controversy/Controversial Issues: There have been no areas of controversy identified.

Issues to be Resolved: None

Evidence of Unusual Congressional or Local Interest: None

Compliance: This report is in compliance with executive orders, public laws, and other statues governing the formulation of water resource projects.

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Appendices

1 Purpose and Need for Action

This section provides a project background, description of the purpose and need for action, outlines the federal objectives, and identifies project objectives and constraints.

1.1 Project Background

In July 2019, the Upper Niobrara White Natural Resources District (UNWNRD) requested assistance from the U.S. Department of Agriculture (USDA) – Natural Resources Conservation Service (NRCS) to develop a watershed work plan under the Watershed and Flood Prevention Operations (WFPO) program. This plan would promote groundwater recharge and provide flood damage relief in the Box Butte Creek Watershed. UNWNRD is one of 23 Natural Resource Districts (NRD) in Nebraska organized under state law to conserve and protect the state's natural resources. The NRDs are locally controlled, tax-funded, and watershed-based entities that were created to solve flood control, soil erosion, irrigation run-off, and groundwater quantity and quality issues. State law provides the NRDs with authority to carry out, operate, and maintain works of improvement related to flood control and soil erosion, making the UNWNRD an eligible sponsor as defined in Section 2 of P.L. 83-566.

The Box Butte Creek Watershed study area comprises the area drained by Box Butte Creek from its headwaters in north-central Box Butte County as it proceeds easterly to the confluence with the Niobrara River in west-central Sheridan County (Figure 1-1). The total study area is approximately 162,000 acres (253 square miles). For this plan, the project area is the same as the study area.

The Box Butte Creek Watershed Plan (Plan) is prepared under the authority of the Watershed Protection and Flood Prevention Act of 1954 (Public Law 83-566). The Plan has been prepared in accordance with the National Environmental Policy Act of 1969, as amended (42 United States Code [U.S.C.] 4321 et seq.). This Plan will address two of the eight purposes listed in Title 390, National Watershed Program Manual, Part 500, Subpart A, 500.3, Agricultural Water Management and Flood Prevention (Flood Damage Reduction).

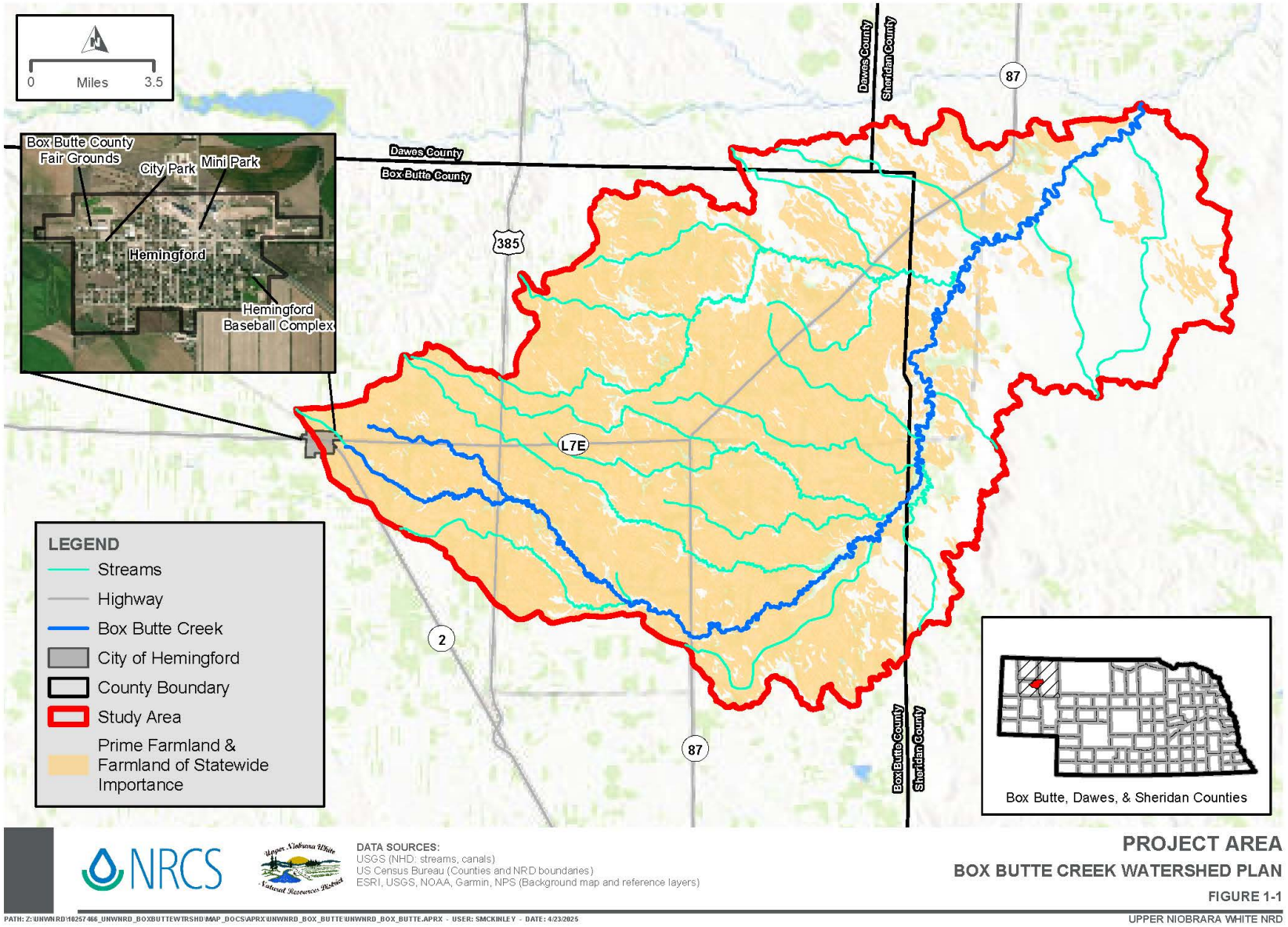

Figure 1-1. Project Area

1.2 Purpose and Need

This project has two purposes: (1) address agricultural water management to reduce damages to agricultural land due to untimely access to groundwater resources and (2) address flood damage reduction to public infrastructure in Box Butte Creek Watershed. The P.L. 83-566 authorized purposes are agriculture water management and flood prevention (flood damage reduction).

In addition, the Box Butte Creek Watershed has experienced four major flooding events with watershed-wide impacts in the last 10 years, including major flood events in both 2018 and 2019, as well as several intense rainfall events resulting in substantial flooding along Box Butte Creek and its tributaries. The project is needed to address the declining groundwater levels and reduce flood damages to public infrastructure

1.2.1 Need for Agricultural Management

Since agricultural irrigation using groundwater accessed with pumps has been predominately used in conjunction with center pivot irrigation, there have been significant declines in aquifer levels in the Box Butte Creek Watershed over the past 25 years, which has reduced the reliability of groundwater for irrigation.

Documentation of groundwater well registration in the Study Area (NeDNR 2025) shows that the number of groundwater wells increased from 44 during the period of 1947 to 1969 to 101 from 1970 to 1979, a 130 percent increase. From 1980 to 2002, well installation slowed to less than 2 wells per year. The years 2003 and 2004 saw an increase in installation (approximately 6.5 per year). From 2005 until 2025, well installation averaged less than 1 per year.

Since the 1970s, groundwater levels have declined in excess of 45 feet in the study area (U.S. Geological Survey [USGS] 2021a). In addition, recharge deficits of 1 to 3 inches are prevalent within the study area (University of Nebraska – Lincoln [UNL] 2021). Figure 1-2 represents groundwater level changes over 10 years, from 2007 to 2017, showing a decline of approximately 2 to 17 feet over the area (HDR 2019).

Net groundwater recharge is calculated as the difference between deep drainage of water (percolating below the plant root zone) and the rate of groundwater pumping by high-capacity irrigation wells (NRCS 2001). Net groundwater recharge is a function of crop type, production practices, soils, and climate. Mapping of the net groundwater recharge (2007–2015 average) from the Upper Niobrara White Groundwater Model (UNWGM) are illustrated in Figure 1-3 (HDR 2019).

Figure 1-4 shows the net groundwater recharge values grouped into three classes and assigned relative ranking index scores. The ranked index values provide the baseline recharge rate for determining the areas with the highest potential for enhanced or induced recharge rates. The higher the net groundwater recharge, the higher the ranking index score.

The percent of silt and clay in the unsaturated zone (UZ)—the soil surface above the water table where both oxygen and water fill the spaces between sediments—and the depth to groundwater influence the net groundwater recharge rates. The higher the percentage of silt and clay in the UZ, the lower the net groundwater recharge rate. The percentage of silt and clay in the UZ is appreciably high in several parts of the study area (Figure 1-5). Similarly, the greater the depth to groundwater, the lower the net groundwater recharge rate. The depth to groundwater is highest within the interfluves (uplands between streams/drainages), particularly in the western part of the study area (Figure 1-6). See Sections 2.3 and 2.4 within Appendix D, Attachment 4 for a deeper discussion on groundwater recharge analysis.

The UNWNRD recognized the challenge of managing groundwater resources for irrigation in 1984 when a Ground Water Management Plan was approved and in 1988 when rules and regulations were adopted. The following summarizes the UNWNRD's actions to manage groundwater quantity and quality:

- 1998 – Groundwater management areas established for entire UNWNRD boundaries.
- 2003 – Temporary suspension on the issuance of new well permits in the entire district. The UNWNRD appointed a Citizen's Advisory Committee to assist with revisions to the NRD's Ground Water Management Plan and the development of a Joint Action Plan.
- 2007 – Groundwater use (volume) restrictions implemented (meters and a 4-year allocation of an average of 16 acre-inch per year).
- 2009 – Integrated Management Plan adopted that addresses integrated management of surface and ground water.
- 2010 – Groundwater use allocations reduced (4-year allocation of an average of 13.5 acre-inch per year).
- 2014 – Groundwater use allocations reduced (5-year allocation of an average of 13.0 acre-inch per year).

Currently, the study area has 174 registered irrigation wells (NeDNR 2025) and accounts for approximately 20,680 irrigated acres (UNWNRD 2025). Since 2007, existing registered well users have been metered and under use allocations. The use allocations effectively limit the way producers may have traditionally irrigated. In any given year, combined with prior and current year weather and soil moisture conditions, the 5-year allocations influence cropping patterns and the timing and quantity of irrigation water applied. Based on these factors, the producer's decision has an effect on the overall farming and ranching operation and annual income.

1.2.2 Need for Flood Prevention

Box Butte Creek typically has base flow in the early spring and summer, but that flow may be intermittent in late summer to early fall based on precipitation and corresponding irrigation. However, substantial flooding along the creek and its tributaries has occurred with increasing frequency. This flooding has resulted from four major flooding events with watershed-wide

impacts in the last 10 years, including two major flood events in both 2018 and 2019, and from several other events with isolated damages and intense rainfall.

The March 2019 flood event provides an example of flood-related damages that can be expected from flood events in the study area. Box Butte County experienced snow events on March 7, 9, and 13 combined with wind gusts of 25 miles per hour (mph), 33 mph, and 47 mph, respectively. These conditions caused drifting along roads upwards of 10 feet in some areas. When warmer temperatures arrived, the snow melt caused usually dry creek beds to swell, sending water flooding over nearly every county road. The photographs below highlight the flooding near Hemingford (Star Herald 2019).

In early July 2019, several intense, short-duration thunderstorms occurred. Between July 3 and July 8, a total of approximately 2 inches of rain fell in the study area. The cumulative effect of these events resulted in damage to multiple county roads (see the photographs on subsequent pages). Road damage primarily included roadway erosion due to overtopping.

Figure 1-7 shows the locations of road damage reported by Box Butte County because of both 2019 events. Costs to repair flood-related damages ranged from $2,000 to match pre-event conditions to $22,500 for roadway elevations to reduce future flood damages (Keagan 2022).

Hydraulic modeling was performed to estimate the performance of culverts and frequency of overtopping at county roadway crossings. Modeling results indicate that for the road crossing analyzed, overtopping of the roadway occurs for the 1-year event, with overtopping depths ranging from approximately 2 to 10 inches. The length of roadway overtopped ranges from approximately 70 to 500 feet. See Appendix D1 for detailed information.

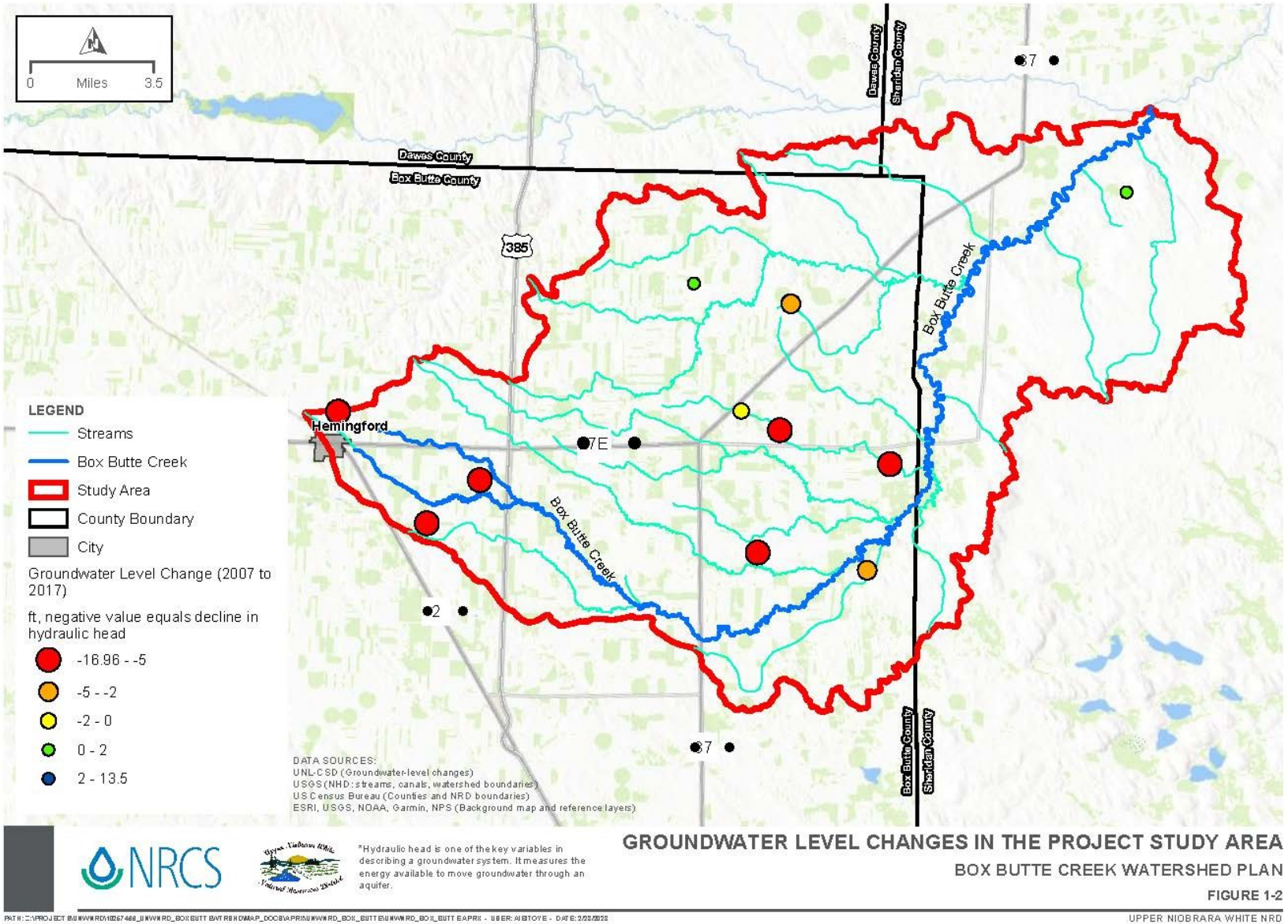

Figure 1-2. Groundwater Level Changes in the Project Study Area

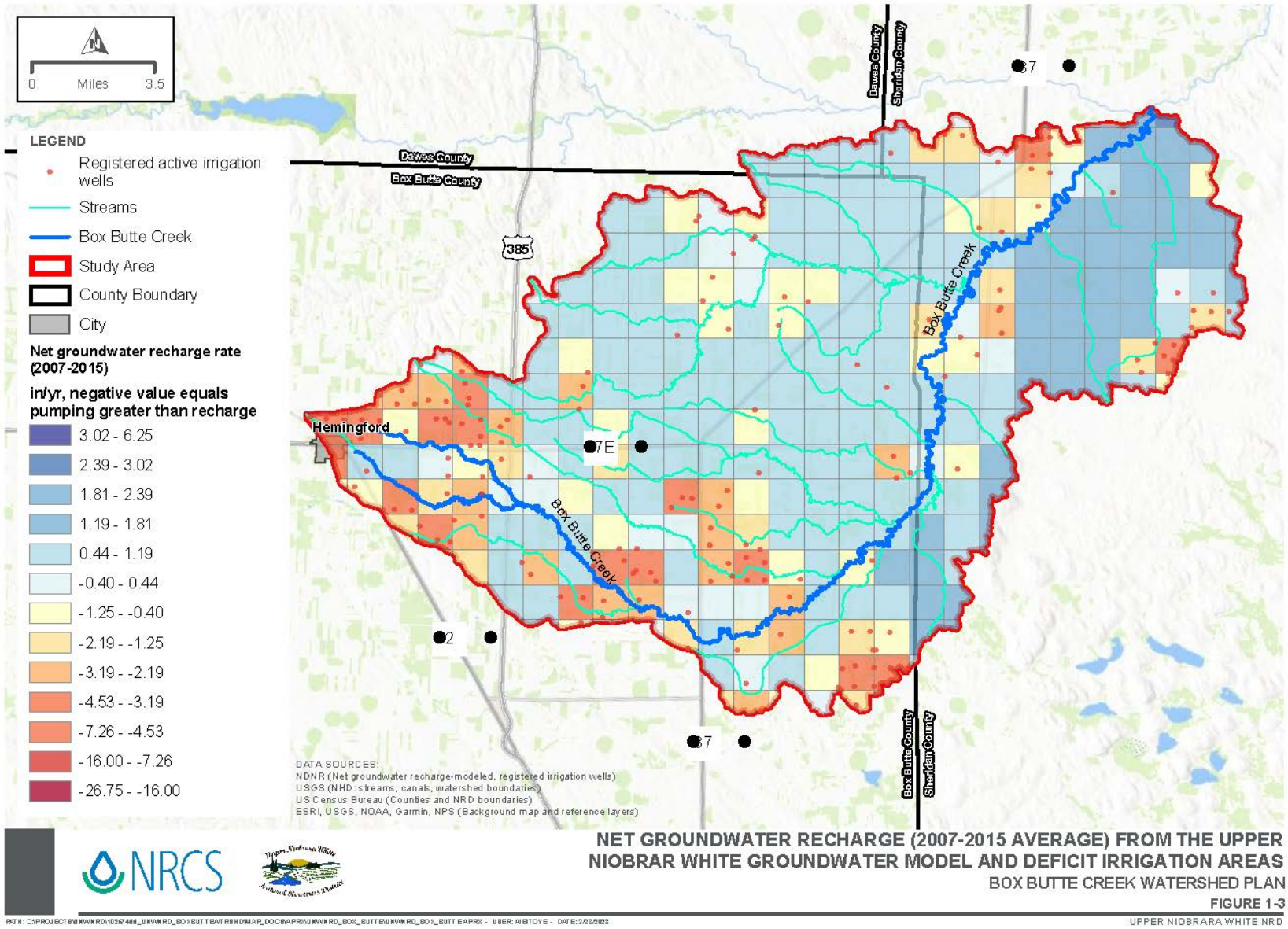

Figure 1-3. Net Groundwater Recharge of the Box Butte Watershed

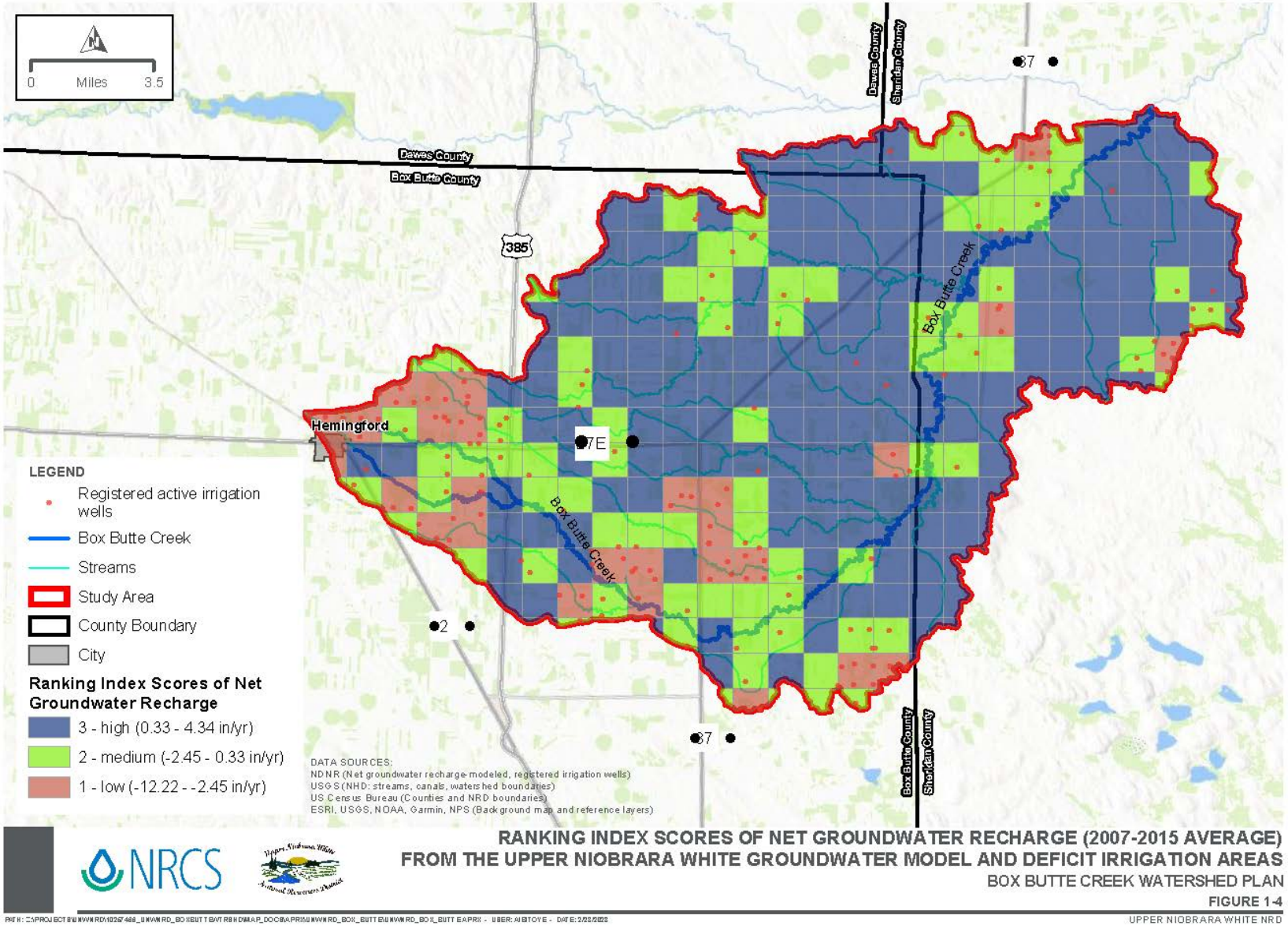

Figure 1-4. Ranking Index Scores of Net Groundwater Recharge

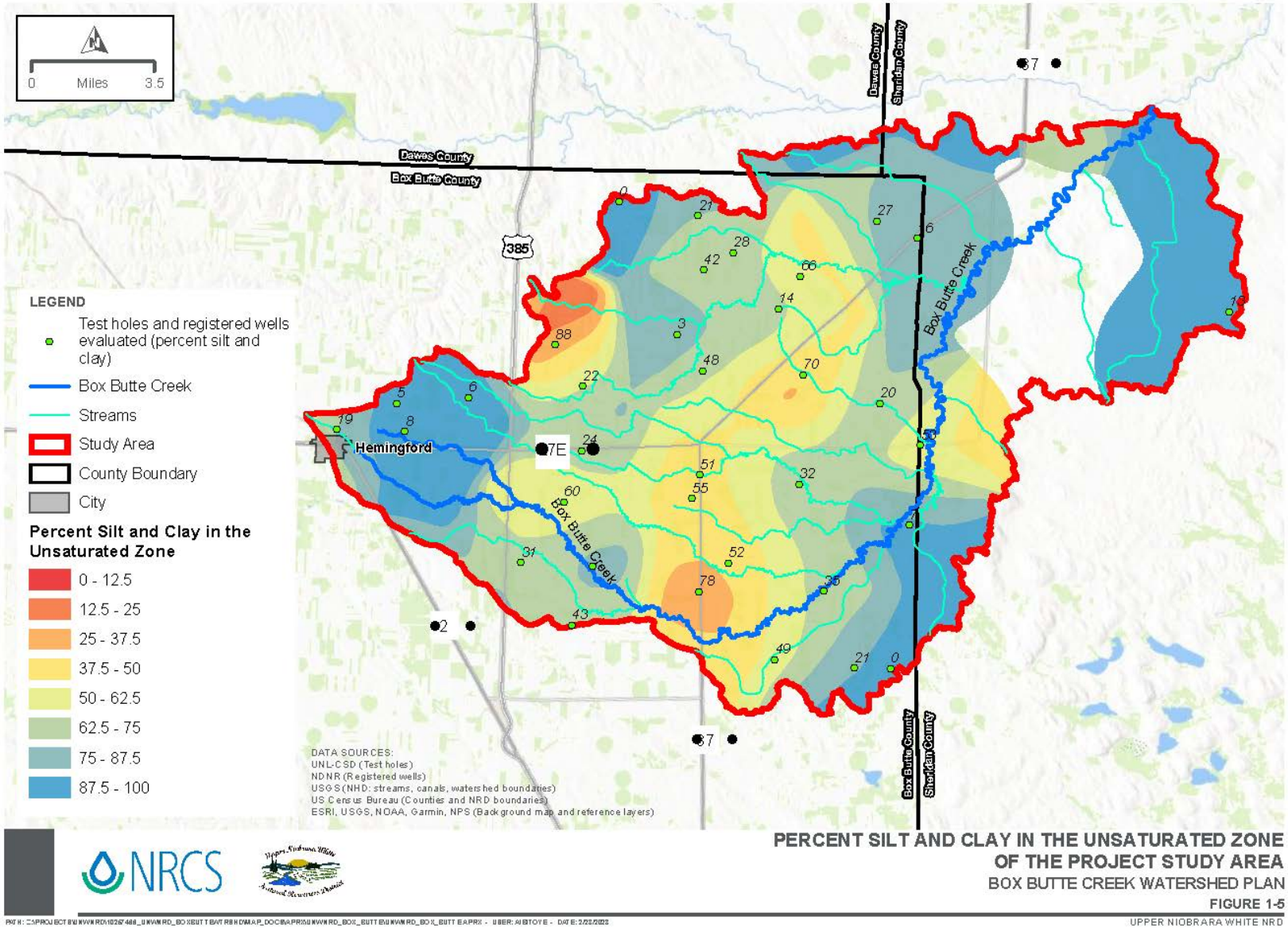

Figure 1-5. Percent Silt and Clay in the Unsaturated Zone

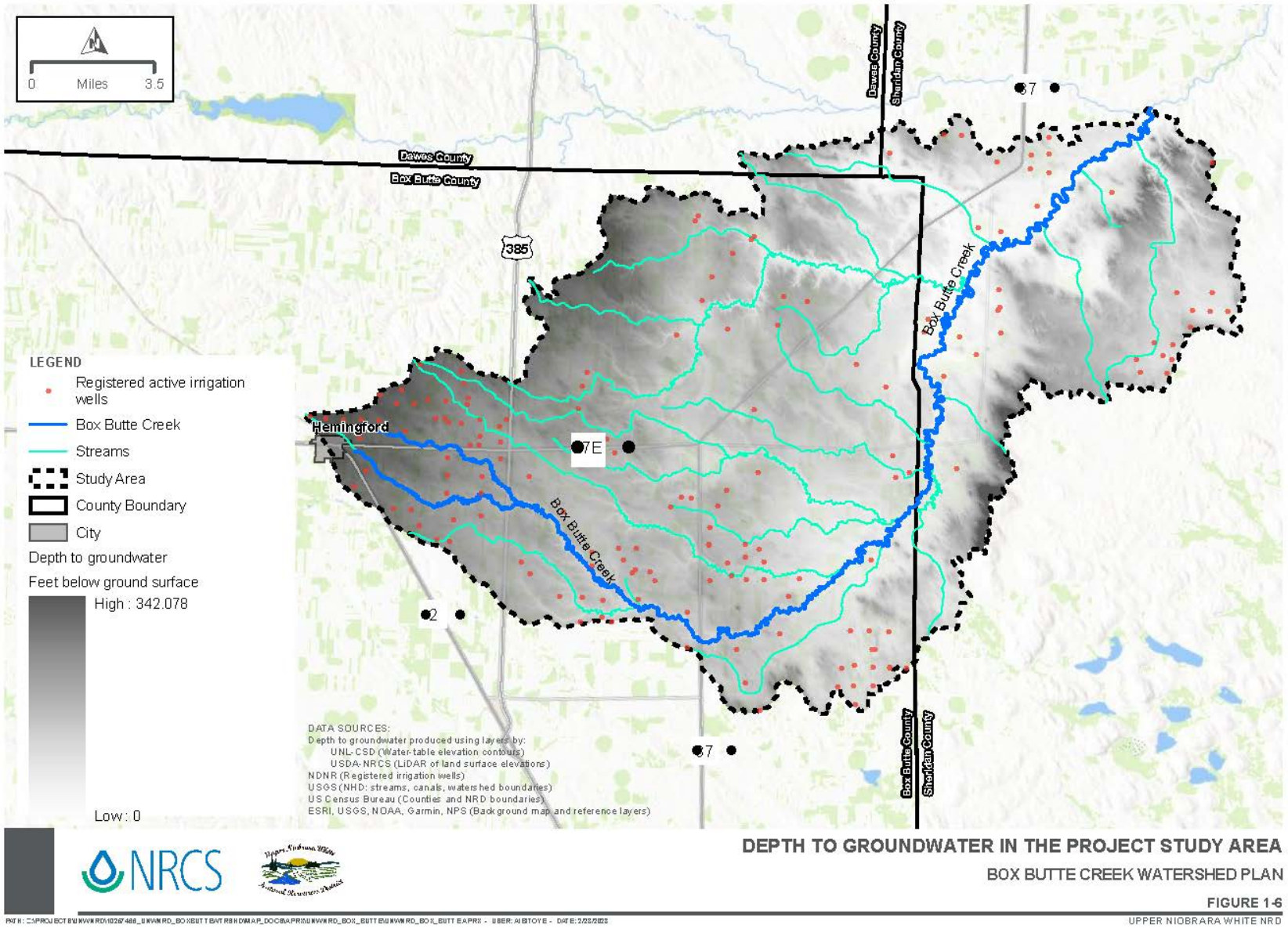

Figure 1-6. Depth to Groundwater in the Project Study Area

Photograph 1-1. Inundated Crop Fields Near Hemingford

Photograph 1-2. Flooded Crop Fields Overflowing into County Road Culverts

Photograph 1-3. County Roads Near Hemingford Showing Significant Flood Damage

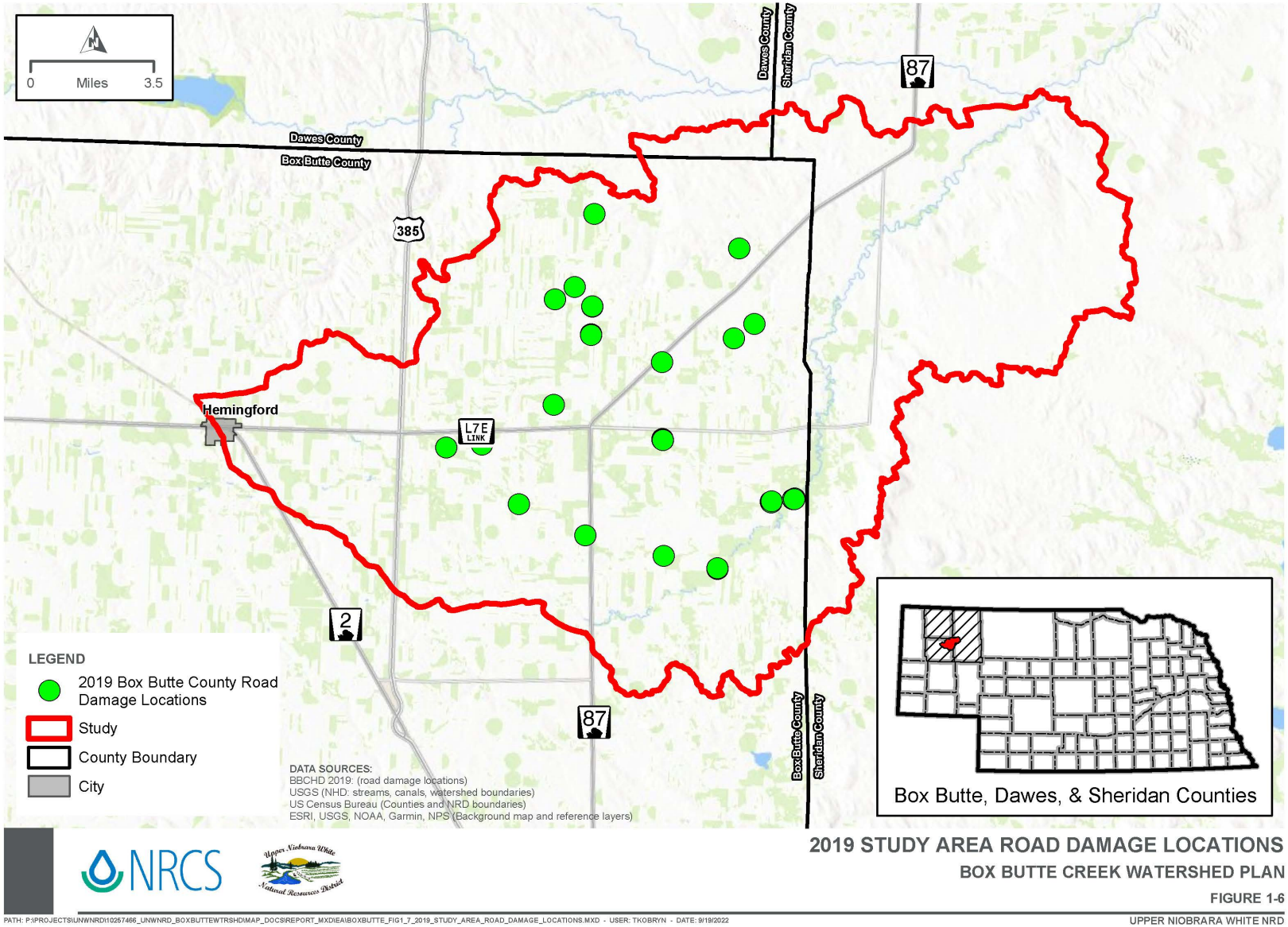

Figure 1-7. 2019 Study Area Road Damage Locations

1.3 Federal Objectives

The federal objective is to maximize sustainable economic development, avoid the unwise use of flood-prone areas, and protect and restore natural systems and mitigate any unavoidable impacts. With the federal law passage of the 2007 Water Resources Development Act, Congress directed the federal government to update and consolidate its past guidance to ensure investments meet the federal objective. The original Principles and Guidelines was replaced by Principles, Requirements, and Guidelines (PR&G) as of April 2019. The PR&G allow for:

"… maximizing public benefits (of all types) relative to costs, the use of quantified and unquantified information in the tradeoff analysis, flexibility in decision making to promote localized solutions, ability to rely on the best available science and objectivity, and advance transparency for Federal investments in water resources."

The PR&G further states:

"Federal investments in water resources as a whole should strive to maximize public benefits, with appropriate consideration of costs. Public benefits encompass environmental, economic, and social goals; include monetary and non-monetary effects; and allow for the consideration of both quantified and unquantified measures."

The PR&G also requires benefits and costs to be evaluated in an ecosystem service framework that includes economic, social, and environmental values. The framework classifies ecosystem services into four broad categories: provisioning, regulating, cultural, and supporting services. Flood mitigation projects primarily impact the regulating and cultural services categories. Projects designed to provide additional irrigation water may primarily impact provisioning services. Supporting services, such as nutrient cycling, underlie most regulating and provisioning services.

Information from previous work in the watershed and new alternatives were considered to determine the best approach to reduce flood damage in the Box Butte Creek Watershed. This section provides a description of the purpose and need for the proposed action, corresponding problems identified in the study area, and identified opportunities associated with the project.

1.4 Objectives and Constraints

1.4.1 Objectives

There are several objectives to consider within the study area associated with the development and implementation of this project:

- Address agricultural water management to reduce damages to agricultural land due to untimely access to groundwater resources
- Address flood damage reduction to public infrastructure in Box Butte Creek Watershed

- Identify measures to address agricultural water management related to the problems associated with historic groundwater decline
- Assess the study area for physical parameters that are associated with the potential for groundwater recharge
- Evaluate alternatives for effective agricultural water management
- Identify measures to address flood damage reduction related to flood damages associated with agricultural land use and public roadways
- Evaluate alternatives for effective flood damage reduction

1.4.2 Constraints

Constraints in addressing agricultural water management in the study area include the following:

- Lack of surface water supply at locations that are conducive to groundwater recharge and are in areas of current groundwater declines
- Insufficient subsurface geology in areas that have experienced groundwater declines

Constraints in addressing flood damage reduction in the study area include the following:

- Identification of measures that are appropriate in scale relative to the magnitude of public roadway damages
- Availability of data related to location and extent of flood damages on agricultural land

2 Scope of the Watershed Plan

The Plan's scope is based on identified resources and a resources re-evaluation and potential concerns found during studies by NRCS, the sponsor, and interested agencies and individuals. The following section identifies the relevant resources of concern and resources that were considered but not studied in detail.

A coordination meeting was held with the sponsor and NRCS in October 2020 to discuss problems and opportunities within the watershed and identify potential resource concerns. An agency scoping meeting was held November 13, 2020, where project information and a map showing the project area was distributed to agencies and tribes with potential interest in the project. Additional project information was posted on the project website, and public comments were accepted from December 15, 2020, to January 14, 2021. Further information about public participation is included in Chapter 6.

As discussed in Chapter 1, the PR&G requires alternatives to be evaluated through an ecosystem services framework, which looks at the benefits (both tangible and intangible) that natural ecosystem services provide to humans. There are four broad categories of ecosystem services:

- **Provisioning** – Benefits to people that can be extracted from nature, such as food, drinking water, timber, gas, oils, and medicine
- **Regulating** – Benefits provided by ecosystem processes that moderate natural phenomena, such as air quality, water quality, erosion prevention, flood control, pollination, and climate regulation
- **Cultural** – Nonmaterial benefits that contribute to the development and cultural advancement of people, helping to create a world where people want to live and addressing people's basic needs for a fulfilling life, such as aesthetics, recreation, tourism, and spirituality
- **Supporting** – Benefits provided by underlying natural processes, such as photosynthesis, nutrient cycling, soil formation, and water cycling

An ecosystem services framework provides an integrated approach allowing consideration and transparent evaluation of the benefits and trade-offs of potential alternatives. Ecosystem service flows can be expressed in both monetary and nonmonetary metrics, which are then used to describe the magnitude of changes from each alternative. These metrics are developed based on each service evaluated in terms that are unique and appropriate to the watershed area and alternatives analysis. Appropriate metrics should be based on current methodology to quantify impacted services over time and project- and regional-specific information and values. The primary services impacted by flood mitigation projects are regulating and cultural services. Supporting services, such as nutrient cycling, underlies all regulating and provisioning services.

A summary of scoping is provided in Table 2-1, which identifies resources that are relevant to the project and those that are not studied further within this Plan.

Table 2-1. Summary of Scoping

Item/Concern	Relevant to Proposed Action? (Yes or No)	Rationale
Soil-Related Concerns	**Relevant to Proposed Action? (Yes or No)**	**Rationale**
Geology	Yes	Geological conditions may impact design alternatives.
Erosion	Yes	The watershed has continued streambank erosion from heavy-flow events.
Sedimentation	Yes	The watershed has continued sedimentation from heavy-flow events.
Prime and Unique Farmland and Farmland of Statewide or Local Importance	Yes	The watershed contains prime farmland.
Water-Related Concerns	**Relevant to Proposed Action? (Yes or No)**	**Rationale**
Waters of the United States, Wetlands, and Special Aquatic Sites	Yes	Addresses NRCS policy and Executive Order 11990, Protection of Wetlands. Historically, wetlands and other waters were filled to create additional farmland and for development. Waters of the United States are likely to be impacted in the project area. Screening will be required for Section 404, 401, 402, and 303(d) of the Clean Water Act and Nebraska State Title 117 compliance.
Surface Water Hydrology	Yes	The watershed contains multiple streams that may be impacted by a change in surface water hydrology.
Water Quality	Yes	There are impaired waters in the watershed. Agricultural runoff, pollutants, and sedimentation affect the watershed.
Groundwater	Yes	Groundwater quantities and elevations in the watershed are declining.
Surface and Groundwater Management	Yes	NRDs and NeDNR manage surface and groundwater in the watershed.
Regional Water Resource Plans	Yes	NeDNR operates agency programs in the watershed, which is located in areas addressed through the 2011 UNWNRD Integrated Water Management Plan (2011).

Item/Concern	Relevant to Proposed Action? (Yes or No)	Rationale
Wild and Scenic Rivers	Yes	The watershed does not include any portion of a river designated as such (National Park Service 2025). However, the wild and scenic portion of the Niobrara River is located 100 miles downstream of the watershed.
Floodplains	Yes	Portions of the watershed are in the 100-year floodplain.
Sole Source Aquifers	No	No sole source aquifers are in the watershed (U.S. Environmental Protection Agency 2025).
Coastal Zone Management Areas	No	No coastal zone management areas in the watershed (National Oceanic and Atmospheric Administration 2025a).
Coral Reefs	No	No coral reefs occur in the watershed (U.S. Coral Reef Task Force Restoration Working Group 2024).
Air-Related Concerns	**Relevant to Proposed Action? (Yes or No)**	**Rationale**
Air Quality	Yes	Construction activities may affect local air quality.
Plant and Animal-Related Concerns	**Relevant to Proposed Action? (Yes or No)**	**Rationale**
Ecologically Critical Areas	Yes	The Upper Niobrara River Biologically Unique Landscape falls in the northern portion of the watershed.
Vegetation	Yes	The watershed contains vegetated land cover.
Noxious Weeds and Invasive Species	Yes	Invasive species occur in the watershed, and the proposed alternatives have the potential to introduce invasive species.
Fish and Aquatic Resources	Yes	The watershed contains fish and aquatic resources.
Terrestrial Wildlife	Yes	The watershed contains terrestrial wildlife.
Migratory Birds and Eagles	Yes	Given the size of the watershed, many species of migratory birds could be present. Bald or golden eagles can be found in the watershed near large bodies of water, including rivers.
Endangered and Threatened Species	Yes	The watershed contains endangered and threatened species and their habitats.
Riparian Areas	Yes	The watershed contains surface water and associated riparian areas.
Essential Fish Habitat	No	No essential fish habitat occurs in the watershed (National Oceanic and Atmospheric Administration 2025b).

Item/Concern	Relevant to Proposed Action? (Yes or No)	Rationale
Natural Areas	No	No natural areas would be negatively affected in the watershed.
Forest Resources	No	The watershed does not contain forest resources.
Human Use-Related Concerns	**Relevant to Proposed Action? (Yes or No)**	**Rationale**
Cultural Resources and Historic Properties	Yes	There is potential for archaeological and historic resources to be present in the watershed. Historic properties may be affected.
NGPC Open Field and Waters Program Lands	Yes	There are open fields and waters lands in the watershed.
City Parks and County Fairgrounds	Yes	There are city parks and county fairgrounds the watershed.
Public Health and Safety	Yes	The flooding conditions have the potential to affect public health and safety.
Population	Yes	The watershed includes urban and rural populations.
Local and Regional Economy	Yes	The watershed affects the local and regional economies. Flood damages are known to affect public infrastructure and private property in the study area.
Scenic Beauty	Yes	There are viewsheds in the watershed that are representative of rural agricultural landscapes.
Significant Scientific Resources	No	There are no significant scientific resources in the watershed (see Appendix C, Figure 2-1).
Land Use	Yes	Land use impacts flooding characteristics and damages in the watershed.
Social Issues	No	There would be no change to land use or community cohesion.
Ecosystem Services	**Relevant to Proposed Action? (Yes or No)**	**Rationale**
Provisioning Services	Yes	The project area is agricultural, and food production activities may be affected by flooding and the proposed action.
Regulating Services	Yes	Flooding and the proposed action may have an impact on regulating services.
Supporting Services	Yes	Supporting services may be affected by flooding and the proposed action.
Cultural Services	Yes	Cultural services may be affected by flooding and the proposed action.

3 Affected Environment

This section describes existing conditions in the study area, which were identified during scoping.

3.1 Soils

The study area falls within the Flat to Rolling Plains and the Sand Hills Level 4 Ecoregions as defined by the U.S. Environmental Protection Agency (EPA). The western two-thirds of the study area are within the Flat to Rolling Plains ecoregion, where dryland farming with areas of irrigated cropland agriculture is extensive. Winter wheat is the main dryland cash crop, with smaller acreages of forest crops. In addition, there is a diverse mix of irrigated crops, including corn, wheat, sugar beets, and edible beans. In this region, the flat to rolling plains are smoother, are more level, and generally have thicker loess-mantled uplands than other Western High Plains regions. Loess deposits are thickest in southwestern Nebraska and northwestern Kansas and are thinnest in the north and south. The northernmost extent of this region, just west of the Sand Hills, has a very thin loess layer with more silty and sandy soils than in the southern portion of the region. In the eastern third of the study area, expansive areas of sand sheets and undulating fields of grass-stabilized sand dunes cover the Sand Hills. Dune size, pattern, and alignment generally follow a west-to-east trending axis, with the larger dune hills in the west having local relief as great as 400 feet. Few lakes and streams are found in this area; however, groundwater is accessible and used for livestock and irrigation (Chapman et al. 2001).

The study area is split into two major land resource areas (MLRA), as defined by NRCS, with the western two-thirds located in the Mixed Sandy and Silty Tableland and Badlands resource area and the eastern third located within the Nebraska Sand Hills. The dominant soil orders in the Mixed Sandy and Silty Tableland and Badlands MLRA “are Entisols, Inceptisols, and Mollisols. The soils in the area dominantly have a mesic soil temperature regime, an ustic or aridic soil moisture regime, and mixed mineralogy. They are shallow to very deep, generally well drained or somewhat excessively drained, and loamy or sandy” (USDA NRCS 2006). The dominant soil orders in the Nebraska Sand Hills MLRA “are Entisols and Mollisols. The soils in the area dominantly have a mesic soil temperature regime, an ustic or aridic soil moisture regime, and mixed mineralogy. They generally are very deep, excessively drained to somewhat poorly drained, and sandy” (USDA NRCS 2006).

3.1.1 Geology

This region’s geologic setting consists of unconsolidated alluvial, colluvial, and eolian sediments from the Quaternary period and primarily includes silts, sands, and gravels. These surficial geologic deposits overlie the bedrock of the region, which consists of the Ogallala Group, deposited primarily within the Miocene epoch (University of Nebraska – Lincoln Conservation and Survey Division [CSD] STATEMAP 2024; CSD Testhole Database 2024; Burchett 1992). (The Ogallala Group is composed of deposits originating from eroded Rocky Mountains sediment, so the materials can be complex and varied. However, most sediments of the

Ogallala Group generally include sands, gravels, sandstones, siltstones, and claystones (Aboushanab 2024). Lithology in the formation varies both laterally and vertically within short distances; therefore, the Ogallala Group is subdivided into formations within most of western Nebraska. When undivided, the Ogallala Group is simply referred to as the "Ogallala Formation." When divided, the Ogallala Group can include, from oldest to youngest, the Runningwater, Sheep Creek, Valentine, and Ash Hollow Formations, as well as other members within these divisions (Aboushanab 2024).

While published surficial geologic maps do not exist in the project area, geologic shapefiles and test hole data pertaining to the USGS Box Butte NE and NW and Skunk Lake NE and NW quadrangles are available from CSD. This data includes information regarding bedrock top formations and surficial geologic deposits. Within these quadrangles, mapped formations and members of the Ogallala Group include the Ash Hollow, Runningwater, Rushville, Sand Canyon, and Starvation Gulch (CSD STATEMAP 2024; CSD Testhole Database 2024). Below the Quaternary surficial deposits, depth to bedrock is mapped in CSD test holes and is noted to range from 4 to 20 feet; however, depth can extend to up to 100 feet closer to the Sandhills (CSD STATEMAP 2024; CSD Testhole Database 2024).

The area rests on the Ogallala aquifer, also known as the High Plains aquifer. The alluvial sands and gravels that make up the Ogallala aquifer range from 0 to 430 feet thick and are generally divided into two layers based on the texture of the sediments. The upper layer has a higher percentage of coarse sands and gravels, while the lower layer has a higher predominance of sands, fine sands, silts, and clays.

3.1.2 Erosion

The study area is dominated by rangeland and row crop agriculture. Sediment loads vary depending on the type of crops planted. Therefore, erosion rates vary slightly every year depending on the types and diversity of crops planted within the study area. Wind erosion is the primary type of erosion experienced within the watershed, with little observed water erosion. In addition, NRCS defines highly erodible land (HEL) as land that can erode at an excessive rate from either water or wind because of soil properties, leading to long-term decreased productivity. Approximately 95,078 acres of HEL and potential HEL are within the study area. HEL is designated by field and based on the proportion of the total acreage that contains highly erodible soils (USDA NRCS 2021a). As shown in Figure 3-1A and Figure 3-2B, the study area contains a diverse mix of both HEL and non-HEL lands with HEL lands predominately located in the northern and eastern portions of the study area in Sheridan and Dawes Counties, in areas associated with the Nebraska Sandhills. Slope for the HEL soils generally ranges from 6 to 60 percent. For HEL lands, nationwide conservation measures require less than 3-5 tons of erosion per year per acre.

3.1.3 Sedimentation

Sedimentation within the study area predominantly occurs in the portions of the Nebraska Sand Hills in Sheridan and Dawes Counties. As discussed in Section 3.1.1, soils located in the study area are highly susceptible to erosion. Eroded soils enter the upper watershed and make their

way into the floodplain. Sediment deposition in normal conditions would occur within the waterways or would continue down the watershed to Box Butte Creek. During flood events, waters overtop stream banks and deposit sediment into the floodplain. Approximately 65 percent of the watershed consists of Class C Hydric Soils, soils that have a slow infiltration rate when wet. Those soils would have a higher likelihood of runoff and may result in increased sedimentation. Overall, sedimentation within the study area is minor because the vegetative layer over HEL soils reduces erosion and sedimentation in the watershed.

3.2 Prime and Unique Farmlands

The federal Farmland Protection Policy Act (FPPA) was enacted to minimize unnecessary conversion of farmland to other uses because of federal decisions. In addition, the FPPA states that federal programs should be compatible with state and local policies or programs that protect farmland. Soils that exhibit the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops when treated and managed (including water management) according to acceptable farming methods are designated as prime or unique farmland. “For the purpose of FPPA, farmland includes prime farmland, unique farmland, and land of statewide or local importance. Farmland subject to FPPA requirements does not have to be currently used for cropland. It can be forest land, pastureland, cropland, or other land, but not water or urban built-up land” (USDA NRCS 2021b).

Prime farmland is land that has the best combination of physical and chemical characteristics for producing agricultural crops and livestock with minimum uses of fuel, chemicals, labor, and tolerable rates of soil erosion. Unique farmland is non-prime farmland that is used for production of specific high-value crops. Farmland that is of statewide or local importance other than prime or unique farmland is used for the production of food, feed, fiber, forage, or oilseed crops, as determined by the appropriate state or unit of local government agency, with the approval of the Secretary of Agriculture (USDA NRCS 2021c). Note that not all areas that have been classified as prime or unique farmland are necessarily actively in use as cropland at any given time (USDA NRCS 2021c).

Approximately 98,530 acres of soils are identified within the study area as prime farmland if irrigated or farmland of statewide importance are listed in Table 3-1 and shown in Figure 3-1A and Figure 3-2B. No unique farmland is present in the study area.

Table 3-1. Prime and Unique Farmland

Map Unit Symbol	Map Unit Name	Rating	Area (acre)
1182	Las Animas loam, occasionally flooded	Farmland of statewide importance	36.2
1361	Bridget very fine sandy loam, 0 to 1 percent slope	Prime farmland if irrigated	23.6
1362	Bridget very fine sandy loam, 1 to 3 percent slope	Prime farmland if irrigated	156.7

Map Unit Symbol	Map Unit Name	Rating	Area (acre)
1363	Bridget very fine sandy loam, 3 to 6 percent slope	Prime farmland if irrigated	113.6
1617	Keith loam, 0 to 1 percent slope	Prime farmland if irrigated	3,375.6
1618	Keith loam, 1 to 3 percent slope	Prime farmland if irrigated	2,306.97
1621	Keith loam, 3 to 6 percent slope	Prime farmland if irrigated	184.5
1683	Manter-Satanta fine sandy loam, 0 to 3 percent slope	Prime farmland if irrigated	2,946.2
1684	Manter-Satanta fine sandy loam, 3 to 6 percent slope	Prime farmland if irrigated	4,278.2
1725	Rosebud loam, 0 to 1 percent slope	Prime farmland if irrigated	746.1
1726	Rosebud loam, 1 to 3 percent slope	Prime farmland if irrigated	1,765.9
1809	Satanta fine sandy loam, 1 to 3 percent slope	Prime farmland if irrigated	7,135.2
1812	Satanta fine sandy loam, 3 to 6 percent slope	Prime farmland if irrigated	2,795.4
5070	Vetal and Bayard soils, 1 to 6 percent slope	Prime farmland if irrigated	63.4
5100	Alliance loam, 0 to 1 percent slope	Prime farmland if irrigated	8,074.6
5101	Alliance loam, 1 to 3 percent slope	Prime farmland if irrigated	17,468.5
5102	Alliance loam, 3 to 6 percent slope	Prime farmland if irrigated	1,545.1
5108	Alliance-Rosebud loam, 1 to 3 percent slope	Prime farmland if irrigated	3,678.8
5109	Alliance-Rosebud loam, 3 to 6 percent slope	Prime farmland if irrigated	3,772.3
5119	Busher fine sandy loam, 0 to 3 percent slope	Prime farmland if irrigated	621.0
5120	Busher fine sandy loam, 3 to 6 percent slope	Prime farmland if irrigated	1,606.3
5123	Busher loamy very fine sand, 1 to 6 percent slope	Farmland of statewide importance	28.2
5124	Busher loamy very fine sand, 1 to 6 percent slope, eroded	Farmland of statewide importance	35.2
5133	Busher-Jayem loamy very fine sand, 0 to 3 percent slope	Farmland of statewide importance	3,906.9

Map Unit Symbol	Map Unit Name	Rating	Area (acre)
5179	Hemingford loam, 0 to 1 percent slope	Prime farmland if irrigated	3,963.2
5180	Hemingford loam, 1 to 3 percent slope	Prime farmland if irrigated	3,685.3
5181	Hemingford loam, 3 to 6 percent slope	Prime farmland if irrigated	2,070.4
5188	Keya loam, 0 to 2 percent slope	Prime farmland if irrigated	1,352.0
5265	Tuthill fine sandy loam, 0 to 3 percent slope	Prime farmland if irrigated	48.1
5266	Tuthill fine sandy loam, 3 to 6 percent slope	Prime farmland if irrigated	390.9
5281	Vetal fine sandy loam, 0 to 3 percent slope	Prime farmland if irrigated	4,036.3
5282	Vetal fine sandy loam, 3 to 6 percent slope	Prime farmland if irrigated	132.2
5288	Vetal loamy fine sand, 0 to 3 percent slope	Farmland of statewide importance	532.2
5616	Craft very fine sandy loam, occasionally flooded	Prime farmland if irrigated	638.3
5625	Duroc loam, occasionally flooded	Prime farmland if irrigated	5,115.9
5815	Creighton very fine sandy loam, 0 to 1 percent slope	Prime farmland if irrigated	402.8
5934	Creighton very fine sandy loam, 1 to 3 percent slope	Prime farmland if irrigated	2,689.6
5935	Creighton very fine sandy loam, 3 to 6 percent slope	Prime farmland if irrigated	968.3
5943	Duroc loam, 1 to 3 percent slope	Prime farmland if irrigated	4,113.1
5947	Duroc very fine sandy loam, 1 to 3 percent slope	Prime farmland if irrigated	104.2
5965	Jayem fine sandy loam, 0 to 3 percent slope	Prime farmland if irrigated	1,477.3
5966	Jayem fine sandy loam, 3 to 6 percent slope	Prime farmland if irrigated	145.0
		Total	**98,529.6**

Source: USDA NRCS 2021c

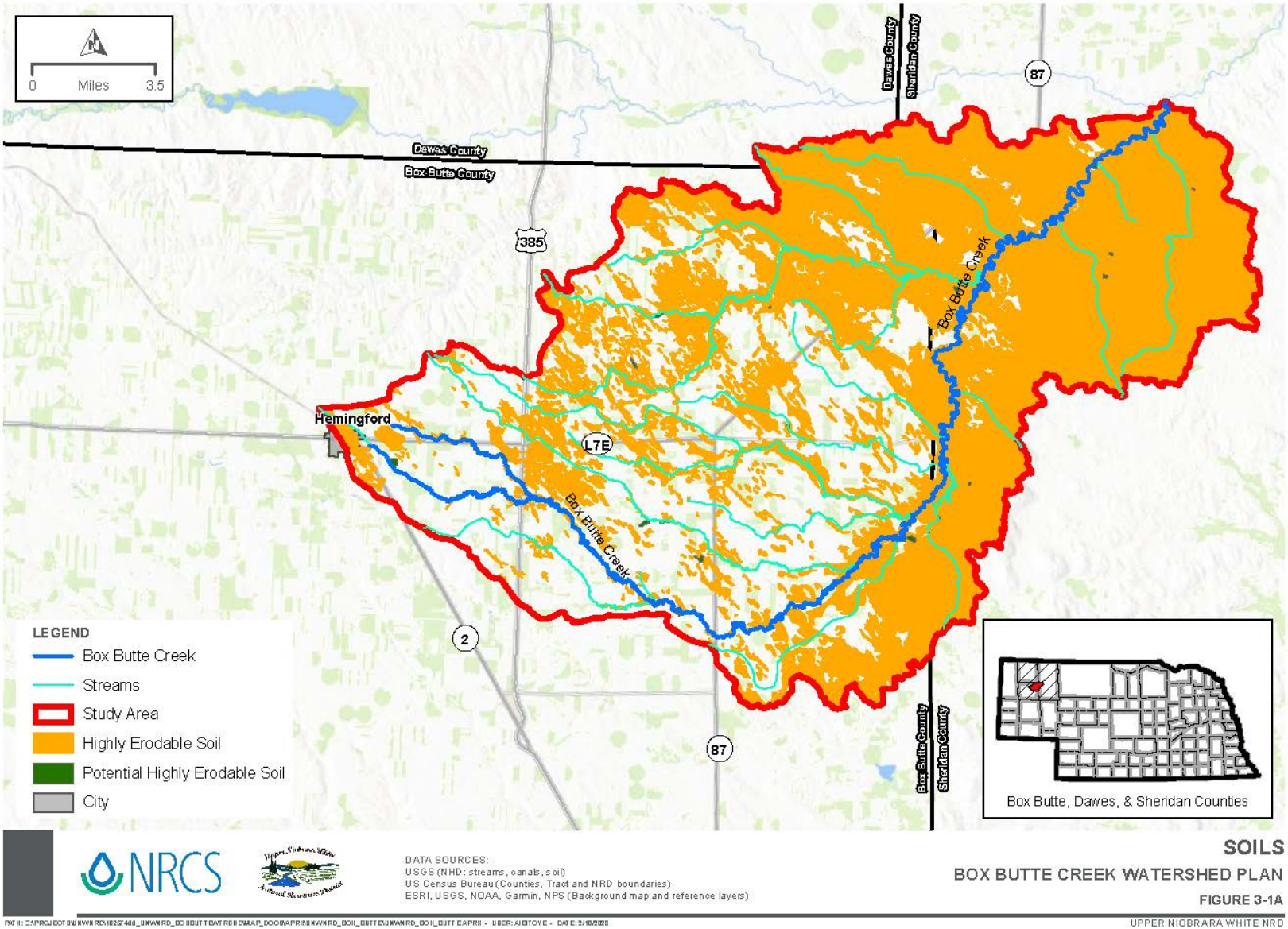

Figure 3-1A. Soils

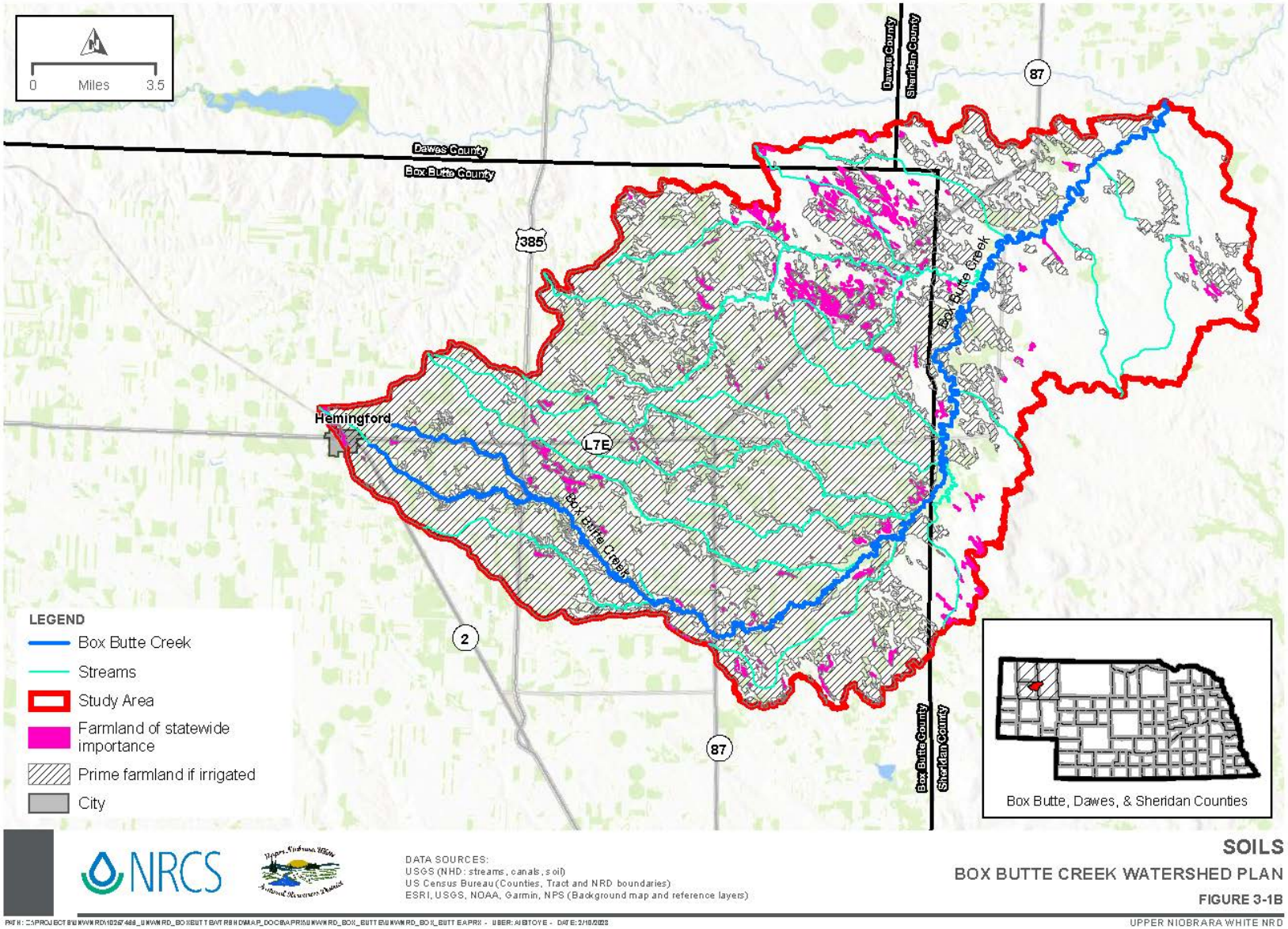

Figure 3-2B. Soils

3.3 Water Resources

3.3.1 Wetlands and Waters of the United States

Wetlands and water resources were identified using readily available information from USGS (2021b) and the U.S. Fish and Wildlife Service (USFWS 2020). The study area contains 236.8 miles of National Hydrography Dataset (NHD) waterways and 1,221.5 acres of National Wetlands Inventory (NWI) wetlands. These water resources are detailed further in Table 3-2 and Table 3-3 and Figure 3-3.

Table 3-2. NHD Waterways in the Study Area

Type	Length (miles)
Connector	0.9
Artificial path	23.4
Intermittent stream	180.0
Perennial stream	32.5
Total NHD Waterways	**236.8**

Source: USGS 2021b

Table 3-3. NWI Resources in the Study Area

Wetland Type	Acres
Freshwater pond	125.8
Freshwater emergent wetland	678.8
Freshwater forested/shrub wetland	22.5
Riverine	396.2
Total NWI Wetlands	**1,223.3**

Source: USFWS 2020

3.3.2 Surface Water Hydrology

The study area is located entirely within the Upper Niobrara Hydrologic Unit Code (HUC) 8 (10150003) and the Box Butte Creek HUC 10 watershed (see Figure 3-4). Water in Box Butte Creek generally flows from the west to the southeast-northeast in the watershed and empties into the Niobrara River beyond the study area. The watershed (and the study area) is slightly larger than 162,000 acres (253 square miles). There are three named streams (North Branch Box Butte Creek, South Branch Box Butte Creek, and Box Butte Creek) that total 282.55 miles in the Box Butte Creek HUC 10 watershed. See Section 3.4 for existing floodplain information.

3.3.3 Water Quality

From Section 303(d) of the Clean Water Act (CWA), the Nebraska Department of Environment and Energy (NDEE) prepares a list of impaired waters that do not meet the standards associated with their assigned use classification. NDEE has designated Box Butte Creek (NI4-11000) as a Category 3 waterbody under the 2020 Water Quality Integrated Report. A Category 3 waterbody is a waterbody with insufficient data to determine whether any beneficial uses are being met (NDEE 2021a). There are no other impaired waters in the study area.

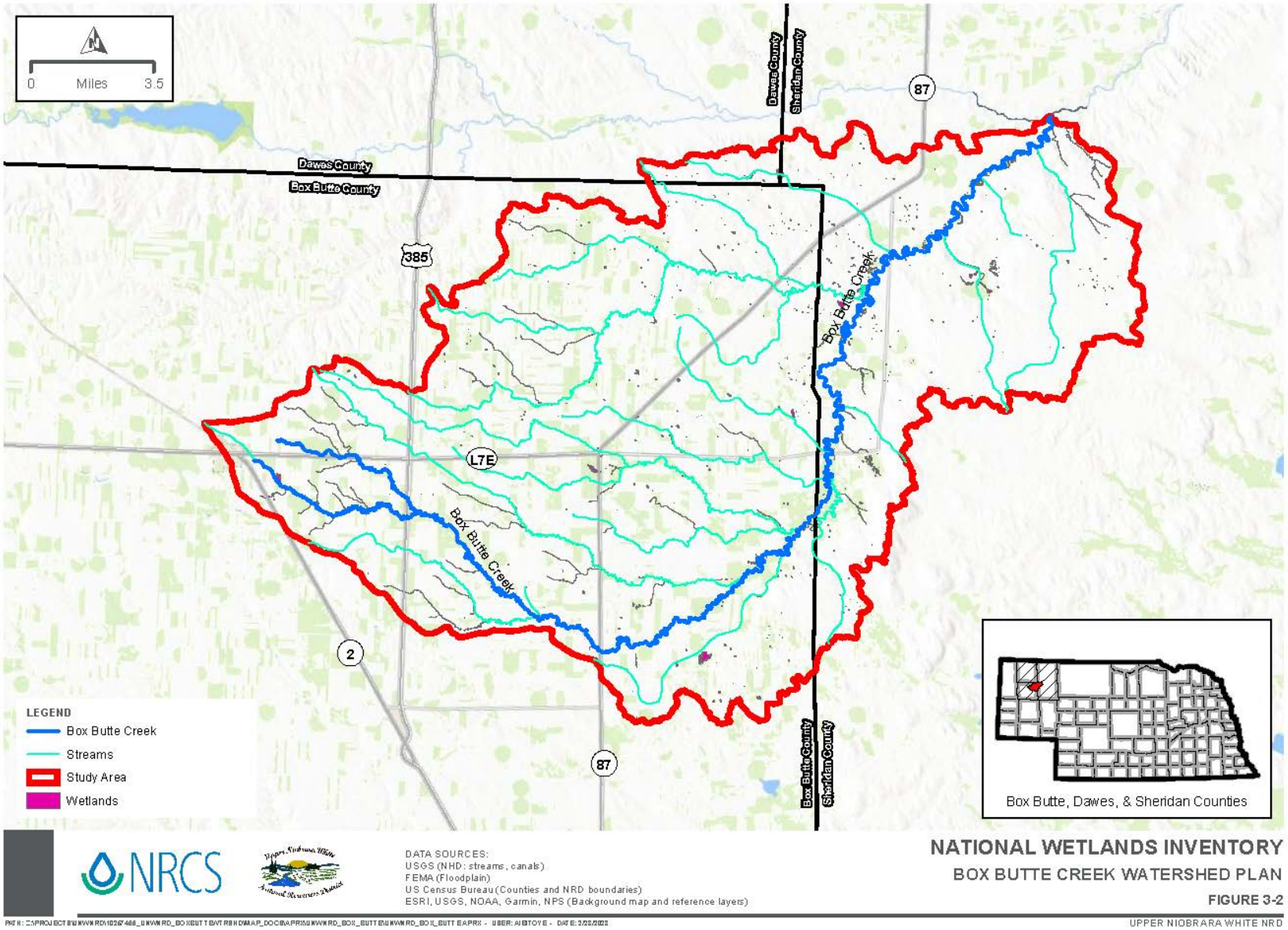

Figure 3-3. National Wetlands Inventory

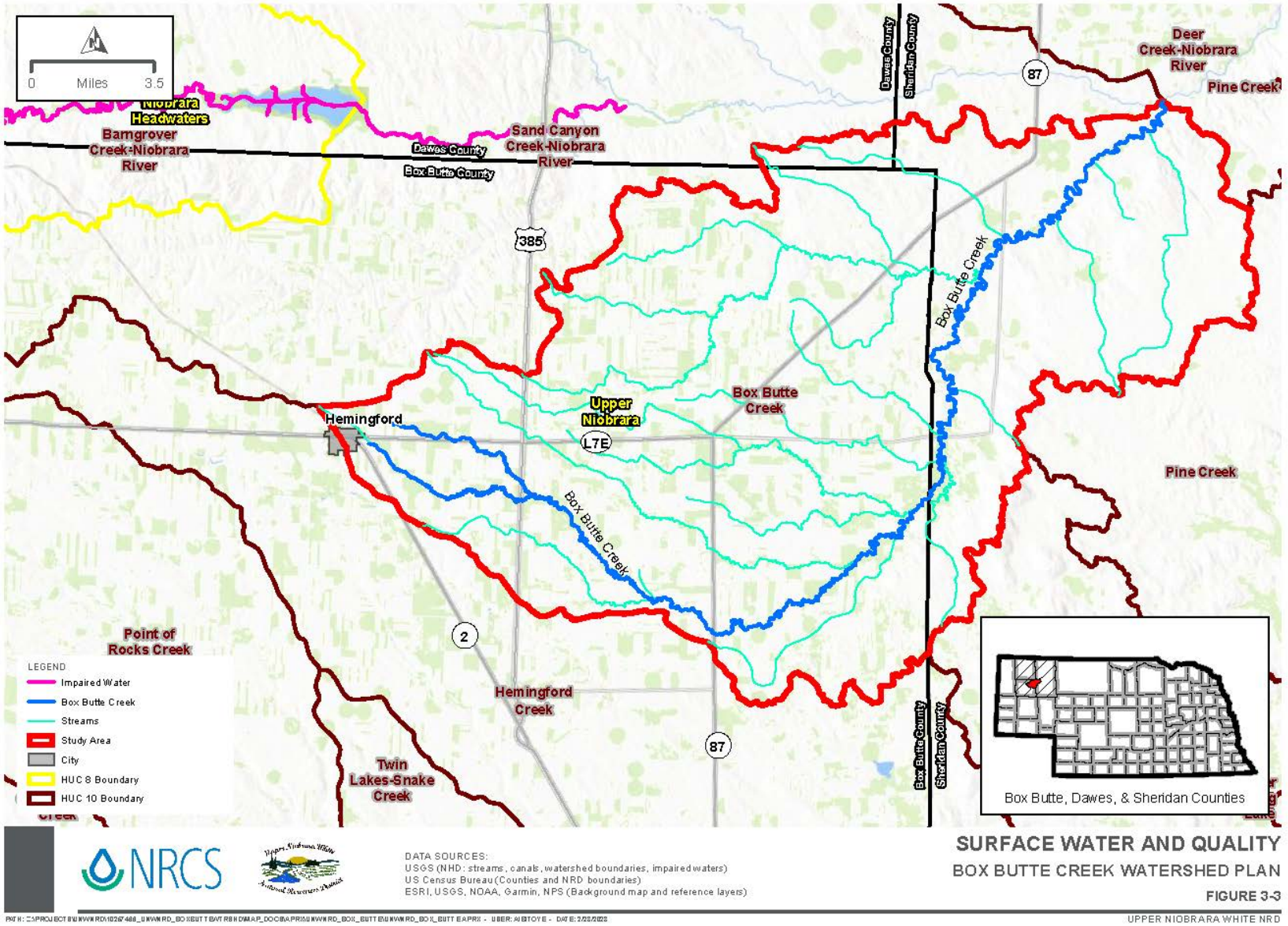

Figure 3-4. Surface Water and Quality

NDEE addresses ongoing water quality management through its implementation of Sections 401 and 402 of the CWA. Section 401 provides that the certifying authority (the NDEE in Nebraska) review Section 404 Permit applications and provide certification that the permit will comply with applicable water quality standards, effluent limitations, new source performance standards, toxic pollutant restrictions, and/or other appropriate water quality requirements.

Section 402 establishes the National Pollutant Discharge Elimination System (NPDES) Program, which requires a permit for sewer and storm water discharges from developments, construction sites, livestock facilities (for operations defined within Title 130 – Livestock Waste Control Regulations), or other areas of soil disturbance. The Hemingford wastewater treatment facility is within the study area and has an active NPDES permit. There are 13 regulated animal feeding operations within the study area (NDEE 2021b). Per investigation of NDEE records, there are no compliance issues or enforcement actions against any of the regulated facilities in the study area.

3.3.4 Groundwater

The study area is situated atop the Ogallala aquifer, also known as the High Plains aquifer, which provides a large portion of the water used for irrigation and other domestic and municipal needs (Divine and Sibray 2017). An aquifer is a body of geologic material that yields water in economically useful quantities. The Box Butte Creek Watershed lies within the UNWNRD-designated groundwater management Subarea IV and has seen substantial declines in static aquifer levels over the last 25 years. These declines have resulted in lost agricultural production, limits on existing and new groundwater uses, required domestic and irrigation well modifications, base stream flow reductions, fish and wildlife habitat impacts, and degraded surface water quality (UNWNRD 2019). From 2022 to 2023, groundwater levels in Box Butte County declined 1 to 5 feet (Young et al. 2024). Net groundwater recharge values are discussed in Section 1.1.1 and shown in Figure 1-3.

Figure 1-4 presents the net groundwater recharge values grouped into three classes and assigned relative ranking index scores. The ranked index values provide the baseline recharge rate for determining the areas with the highest potential for enhanced or induced recharge rates. The higher the net groundwater recharge, the higher the ranking index score.

3.3.5 Surface and Groundwater Management

Two discrete laws govern the beneficial use of groundwater and surface water in Nebraska: (1) the common law concept of correlative rights for groundwater and (2) the prior appropriation doctrine for surface water. NRDs focus on groundwater management, while NeDNR administers surface water rights and may issue groundwater municipal and industrial transfer permits.

The correlative rights rule allows owners to drill wells and extract groundwater from an underlying aquifer for reasonable and beneficial purposes, subject to public management. To execute this right, landowners must first obtain a permit to drill a well from their local NRD (such as the UNWNRD). If the local NRD approves the request, the well permit allows the landowner to drill and extract as much groundwater as needed, subject to NRD limitations in place, as long

as the use is deemed beneficial. When construction is completed, the well permit is registered with NeDNR, which places the information in a statewide database. The UNWNRD provides permits for existing and new groundwater wells. Currently, the study area contains 367 wells; 291 of these are active, and 76 are decommissioned, inactive, suspended, or unregistered decommissioned. Of the 291 active registered wells, 168 are irrigation wells, typically for center pivot systems.

Under the prior appropriation doctrine, surface waters of the state are allowed to be diverted based on the date that the application was filed with NeDNR. Surface water rights entitle landowners or organizations to remove a set amount of water from a specific location. During periods when the overall water supply is insufficient to meet all appropriated water rights, this system protects those who received their water rights first. Thus, the water rights for the same use with the earliest date (or senior priority) is entitled to the full appropriation before a later (or junior) priority date water right receives any water.

3.3.6 Regional Water Management Plans & Agency Programs

NeDNR is responsible for administering and coordinating various water resource management programs within the watershed, including water planning, surface water, floodplain management, dam safety, groundwater, and water administration.

To promote orderly use and distribution of water, Nebraska state laws have provided a means for protection of surface and groundwater supply. Nebraska Legislative Bill 962 allows the NeDNR and the NRDs to work together to manage groundwater and surface water as a hydrologically connected resource under integrated management plans (IMP). With the increasing demand on water resources, it is necessary to recognize the importance of hydrologically connected groundwater and surface water, and the difficulties entailed in their management because of their properties and distribution. The IMP's objective is to manage the river basins, subbasins, or reaches within the NRD boundaries to attain and/or sustain a desired balance between water uses and water supplies for the long term while protecting existing users.

The Box Butte Creek watershed was determined to be fully appropriated in 2004. Therefore, an Integrated Management Plan (UNWNRD 2011) was developed for this watershed (as well as other watersheds within the UNWNBRD boundary). The UNWNRD Integrated Management Plan identifies goals and objectives for surface and groundwater management. In addition, the UNWNRD established a Groundwater Management Area and Integrated Management Area and correlated Rules and Regulations for the implementation of the UNWNRD Groundwater Management Plan (GWMP) and IMP (UNWNRD 2024). The Rules and Regulation address both water quality and quantity. Related to groundwater quantity, the Rules and Regulations establish controls, or Phases, related to the degree of accumulated decline in groundwater levels from a 1990 baseline.

The entire UNWNRD is within Phase I, which includes the UNWNRD conducting educational events, requiring flow meters on all regulated wells, certification of irrigated acres, and may require the allocation of groundwater based on certified acres.

A Phase II designation is implemented when groundwater declines exceed three feet of 1990 levels within a groundwater management area. Phase II requirements, in addition to Phase I requirements, suspends the issuance of new well permits, suspends the addition of irrigated acres, and may require the allocation of groundwater based on certified acres.

A Phase III designation is implemented when groundwater declines exceed six feet of 1990 levels within a groundwater management area. Phase III requirements, in addition to Phase I and Phase II requirements, requires allocation of groundwater based on certified acres. The Study Area is currently in a Phase III designation.

The NeDNR administers Nebraska's Wellhead Protection Program. This is a voluntary program that assists communities and other public water suppliers in preventing contamination of their water supplies. There is a wellhead protection area associated with the village of Hemingford (Nebraska ID NE3101303). The wellhead protection area is 2,415 acres, covering 3.8 square hismiles (NDEE 2021b).

3.3.7 Wild and Scenic Rivers

There are no wild and scenic rivers in the study area; however, the wild and scenic portion of the Niobrara River is located approximately 100 miles downstream of the watershed. The Niobrara National Scenic River includes a 76-mile reach in northcentral Nebraska that protects a unique ecological crossroads where six distinct ecosystems and their associated flora and fauna mix (National Park Foundation 2025). Recreation activities along the reach include canoeing, tubing, and kayaking.

3.4 Floodplains

Box Butte Creek is typically an ephemeral creek with intermittent baseflows. The Federal Emergency Management Agency (FEMA) has given Box Butte Creek a Zone A designation. The 1 percent annual-chance flood event is the probability of a flood occurring and relates to the 100-year storm event. Areas subject to inundation by the 1 percent annual exceedance probability flood event are generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no base flood elevations or flood depths are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply. The floodplains in the study area are confined around waterways. Maps of the 100 year (1% AEP) and 500 year (0.2% AEP) floodplains are provided in Appendix C (Figures 5-5, A-1 through H-4, and Figures 5-6, A-1 through I-4). No floodways were identified in the study area.

See Section 1.1.2 for a detailed discussion of the current flood risks and damages occurring within the study area.

3.5 Air Quality

EPA publishes a list of the annual nonattainment and maintenance status for each county by state under the National Ambient Air Quality Standards (EPA 2023). Any county not listed has

been designated in attainment since 1992. Box Butte, Dawes, and Sheridan Counties are currently in attainment for all criteria pollutants.

3.6 Ecologically Critical Areas

The Upper Niobrara River Biologically Unique Landscape (BUL) occupies the Niobrara River channel and a 2-mile-wide buffer on each side of the river from eastern Cherry County westward to the Nebraska-Wyoming border (see Figure 3-5). In the BUL's far western portion, the landscape has a gently sloping valley with few trees. Rocky outcrops are common along the valley bluffs, and mixedgrass prairie occurs on most of the bluffs. Where the river enters the Sandhills in western Cherry County, the valley is several hundred feet deep. Ponderosa pine woodlands occupy portions of the bluff, and cottonwood-dominated woodlands occupy portions of the floodplain. Portions of the valley bottom are cropland (Schneider et al. 2011). Extreme northern portions of the study area fall in this BUL.

3.7 Vegetation

The study area falls in the Shortgrass Prairie and Sandhills Ecoregions defined by the Nebraska Game and Parks Commission (NGPC) (see Figure 3-5). The Shortgrass Prairie Ecoregion, located in western Nebraska, supports dry mixedgrass prairie, shortgrass prairie, sandsage prairie, sand prairie, pine woodlands, badlands, and other vegetation types. Western Great Plains mixedgrass prairie is the predominant vegetation type in the ecoregion. Shortgrass prairies, mixedgrass prairies, and sandsage prairies are dominated by various grasses, sedges, and forbs. Open canopies of tall cottonwoods (*Populus deltoides*) and shorter peachleaf willows (*Salix amygdaloides*) occur sporadicallyalong riparian woodlands in many stream valleys of the ecoregion. Subcanopies often consist of green ash (*Fraxinus pennsylvanica*), box-elder (*Acer negundo*), Russian-olive (*Elaeagnus angustifolia*), and junipers (*Juniperus sp.*) (Schneider et al. 2011).

In the Sandhills Ecoregion, two principal plant community types are found: dune prairie and valley wetlands. Dune prairies consist of a mixture of sand-adapted grasses. Blowouts, which are wind-excavated depressions in dune tops, are uncommon today because of improved range management that limits the effects of wind on erosion and decreases the frequency of fire. Wet meadows occur in the valleys and support sedges (*Carex sp.*), spikerushes (*Eleocharis sp.*), prairie cordgrass (*Spartina pectinata*), and switchgrass (*Panicum virgatum*) (Schneider et al. 2011).

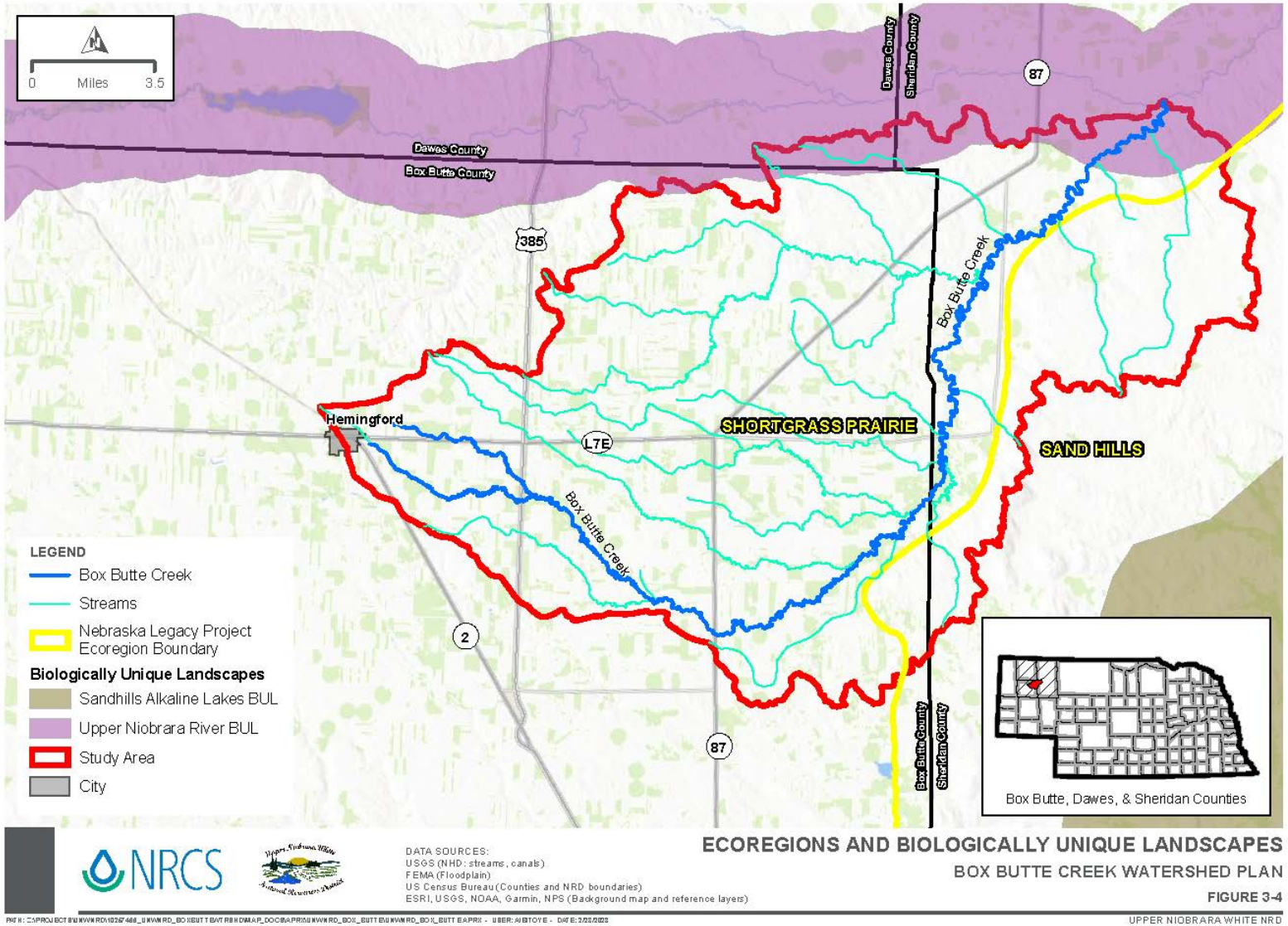

Figure 3-5. Ecoregions and Biologically Unique Landscapes

3.7.1 Noxious Weeds and Invasive Species

The Nebraska Invasive Species Program developed a "watch list" of noxious and invasive plant species (2020). Category 1 plant species are not known to exist in each ecoregion but pose a significant risk if introduced. Category 2 plants are top-priority species for eradication of new and existing populations. Category 3 plants are invasive species that have established in the ecoregion. Table 3-4 lists the Category 1, 2, and 3 plants (both terrestrial and floating aquatic) for the Shortgrass Prairie and Sandhills Ecoregions.

Table 3-4. Noxious and Invasive Plant Species in the Shortgrass Prairie and Sandhills Ecoregions

Common Name	Scientific Name
CATEGORY 1: FUTURE INVASIVE SPECIES	
Giant reed	*Arundo donax L.*
Ripgut brome	*Bromus diandrus*
Flowering rush	*Butomus umbellatus*
Oriental bittersweet	*Celastrus orbiculatus*
Brazilian elodea	*Egeria densa*
Water hyacinth	*Eichhornia crassipes*
Hydrilla	*Hydrilla verticillata*
Creeping water primrose, floating primrose-willow	*Ludwigia peploides*
Parrot's feather	*Myriophyllum aquaticum*
Starry stonewort	*Nitellopsis obtusa*
Yellow floating heart	*Nymphiodes peltata*
Water lettuce	*Pistia stratiotes*
Giant salvinia	*Salvinia molesta*
CATEGORY 2: PRIORITY SPECIES	
Russian knapweed	*Acroptilon repens*
Creeping foxtail	*Alopecurus arundinaceus*
Absinth wormwood	*Artemisia absinthium L.*
Caucasian and Yellow Bluestem	*Bothriochloa bladhii* and *ischaemum*
Black knapweed	*Centaurea moncktonii*
Houndstongue	*Cynoglossum officinale*
Yellow bedstraw	*Galium verum*
Henbane	*Hyocyamus niger*
Yellow flag Iris	*Iris pseudacorus*
Dalmatian Toadflax	*Linaria dalmatica*
Eurasian watermilfoil	*Myriophyllum spicatum*
Brittle naiad	*Najas minor*
Sulphur cinquefoil	*Potentilla recta L.*
Common buckthorn, European buckthorn	*Rhamnus cathartica*
Common tansy	*Tanacetum vulgare L.*
CATEGORY 3: ESTABLISHED INVASIVE SPECIES	
Curly-leaf pondweed	*Potamogeton crispus*

Source: Nebraska Invasive Species Program 2020

3.8 Terrestrial and Aquatic Wildlife

3.8.1 Fish and Aquatic Resources

The Nebraska Natural Legacy Project identifies Tier 1 species, which are those that are globally or nationally most at-risk of extinction (Schneider et al. 2018). Therefore, more research and conservation efforts are focused on these species. Table 3-5 lists the fish and aquatic species (mollusks and crustaceans) that are included on the Tier 1 species list within the Shortgrass Prairie and Sandhills Ecoregions.

Table 3-5. Tier 1 Fish and Aquatic Species in the Shortgrass Prairie and Sandhills Ecoregions

Common Name	Scientific Name	Habitat
FISH		
Blacknose shiner	*Notropis heterolepis*	Headwater streams; spring-fed, clear water pools; quiet waters
Finescale dace	*Chrosomus neogaeus*	Headwaters of clear, cool, high-quality streams
Flathead chub	*Platygobio gracilis*	Large, turbid rivers with relatively fast currents over gravel or sand substrates
Northern redbelly dace	*Chrosomus eos*	Headwater streams; spring-fed, clear water, Sandhills streams; beaver ponds; undercut banks; meandering streams; small pools
Plains minnow	*Hybognathus placitus*	Permanent streams and backwaters with sandy substrate and moderate current
Plains topminnow	*Fundulus sciadicus*	Vegetative backwaters and headwaters, shallow parts of rivers and streams
Topeka shiner	*Notropis topeka*	Cold/cool clear water streams with gravel, low gradient
Western silvery minnow	*Hybognathus argyritis*	Backwaters, pools, and slow-moving waters in medium-to-large rivers
MOLLUSKS		
Niobrara ambersnail	*Oxyloma haydeni*	Moist soil by streams
Oxbow snail	*Galba cockerelli*	Oxbows and backwaters
Plain pocketbook	*Lampsilis cardium*	Small creeks to medium rivers in mud, sand, or gravel
CRUSTACEANS		
Ornate fairy shrimp	*Eubranchipus ornatus*	Clear, cool water with neutral-to-low pH in well-vegetated, ephemeral pools
Potassium-loving fairy shrimp	*Branchinecta potassa*	Shallow-to-ephemeral alkaline lakes with specific range of potassium levels

Source: Schneider et al. 2018

As documented in Section 3.3.1, there are 32.5 miles of perennial streams and 180 miles of intermittent streams in the study area based on NHD data from USGS. According to NWI data from USFWS, there are 125.8 acres of ponds, 678.8 acres of emergent wetlands, 22.5 acres of forested/shrub wetlands, and 396.2 acres of riverine wetlands.

3.8.2 Terrestrial Wildlife

Table 3-6 lists the terrestrial species (insects, mammals, and reptiles) that are included on the Tier 1 species list within the Shortgrass Prairie and Sandhills Ecoregions.

Table 3-6. Tier 1 Terrestrial Species in the Shortgrass Prairie and Sandhill Ecoregions

Common Name	Scientific Name	Habitat
INSECTS		
American burying beetle	*Nicrophorus americanus*	Grassland prairie, forest edge, scrubland, and mesic areas, such as wet meadows, streams, and wetlands; carrion availability is a more important component of habitat than a specific type of vegetation
Colorado rita dotted-blue	*Euphilotes rita coloradensis*	Sparse grasslands with rocky, gravelly soils of ridges, outcrops, and bluffs; specific to two species of wild buckwheat (*Eriogonum*)
Fox mayfly	*Cercobrachys fox*	Medium-sized rivers
Ghost tiger beetle	*Cicindela lepida*	Sparsely vegetated areas with open, sandy soils
Hourglass drone fly	*Eristalis brousii*	Specific habitat requirements unknown
Iowa skipper	*Atrytone arogos iowa*	Tallgrass prairie and mixedgrass prairie along the Niobrara River, native prairie with standing grass stems
Kohler's fritillary	*Boloria selene sabulocollis*	Sandhills and stream valley wet meadows with violets
Lakota mayfly	*Apobaetis lakota*	Medium-sized rivers; specific habitat requirements not known
Long-nosed mayfly	*Sparbarus nasutus*	Oxbows and backwaters
Monarch	*Danaus plexippus*	Broad range of habitats but requires select species of milkweeds as larval host plants
Mottled duskywing	*Erynnis martialis*	Hilly areas with prairie openings; host plant is New Jersey tea (*Ceanothus*)
Nebraska fritillary	*Boloria selene nebraskensis*	Wet meadows with violets
Nine-spotted ladybird beetle	*Coccinella novemnotata*	Predator on aphids found in a variety of habitats
Ottoe skipper	*Hesperia ottoe*	Tallgrass prairie, rolling/hilly prairie, mixedgrass prairie; feeds on bluestems
Pawnee stonefly	*Perlesta xube*	Shaded-to-open canopied, sand-bottomed streams
Regal fritillary	*Speyeria idali*	Tallgrass and mixedgrass prairie with violets, wet meadows
Sandy tiger beetle	*Cicindela limbata limbata*	Blowouts in Sandhills, open sand substrate
Smoky-eyed brown	*Lethe eurydice fumosa*	Sedge meadows in Sandhills and along streams and wetlands
Southern plains bumble bee	*Bombus fraternus*	Prairie grasslands
Suckley's cuckoo bumble bee	*Bombus suckleyi*	Grasslands, wetlands, woodland openings
Tawny crescent	*Phyciodes batesii*	Canyon-type habitat close to water, between stream and dry pine wooded areas with grassland openings
Two-lined stonefly	*Perlesta golconda*	Medium-sized rivers with sand bottoms

Common Name	Scientific Name	Habitat
Two-spotted skipper	*Euphyes bimacula illinois*	Along streams and wetlands, marshes, and wet road ditches; generally associated with wetlands, wet meadows in Sandhills
Western bumble bee	*Bombus occidentalis ccidentalis*	Grasslands, wetlands, woodland openings
Whitney underwing	*Catocala whitneyi*	Tallgrass and mixedgrass prairie; larvae feed on leadplant (*Amorpha*)
Winnebago mayfly	*Cercobrachys winnebago*	Medium-sized rivers; specific habitat requirements not known
MAMMALS		
Bailey's eastern woodrat	*Neotoma floridana baileyi*	Pines and bluffs, woodlands, and rocks
Cheyenne northern pocket gopher	*Thomomys talpoides cheyennensis*	Hard rocky soils, shortgrass prairies
Eastern red bat	*Lasiurus borealis*	Deciduous and pine woodlands, usually associated with water source
Hoary bat	*Lasiurus cinereus*	Deciduous and pine woodlands, usually associated with water source in arid landscapes
Northern long-eared bat	*Myotis septentrionalis*	Interior of deciduous and coniferous woodlands
Pierre northern pocket gopher	*Thomomys talpoides pierreicolus*	Shortgrass, hard soils
Plains spotted skunk	*Spilogale putorius interrupta*	Grasslands and old field habitat close to old structures and wooded areas
Rocky Mountain bighorn sheep	*Ovis canadensis*	Rocky buttes of Pine Ridge and Wildcat Hills
Silver-haired bat	*Lasionycteris noctivagans*	Deciduous and pine woodlands, usually associated with water source
Swift fox	*Vulpes velox*	Shortgrass prairie, western mixedgrass prairie
Tricolored bat	*Perimyotis subflavus*	Deciduous woodlands
REPTILES		
Blanding's turtle	*Emydoidea blandingii*	Requires proximity to water; Sandhills fens, Sandhills freshwater marsh, northern cordgrass wet prairie, small tributaries, Sandhills prairies (upland habitat), marshes and oxbows in eastern portion of state
Glossy snake	*Arizona elegans*	Arid mixed-to-shortgrass prairies with sandy soil and sparse vegetation
Sagebrush lizard	*Sceloporus graciosus*	Open, rocky, shortgrass prairie, usually associated with sagebrush, higher elevations

Source: Schneider et al. 2018

The land use types that are available for terrestrial wildlife habitat in the study area are shown in Figure 3-6. Range, dry cropland, summer fallow, and irrigated crops are the primary land uses in the study area. Other land use types, developed land, water resources, riparian forest, barren, and other agriculture are found in the study area in smaller percentages.

3.8.3 Migratory Birds and Eagles

Three pieces of legislation require NRCS to consider impacts on migratory bird and bald and golden eagle populations and habitats: The Migratory Bird Treaty Act (MBTA) of 1918, as amended; Executive Order (EO) 13186, Responsibilities of Federal Agencies to Protect Migratory Birds; and the Bald and Golden Eagle Protection Act (BGEPA) of 1940, as amended. Migratory birds are essentially all wild birds found in the United States except for the house sparrow, starling, and feral pigeon and resident game birds (50 CFR 10.13). The protections under MBTA and BGEPA cover the birds and their parts (including eggs, nests, and feathers), so it is unlawful for private individuals or federal agencies to kill, capture, collect, possess, buy, sell, trade, ship, import, or export any migratory bird. BGEPA includes protections for any disturbance to bald and golden eagles and their nests.

Although MBTA and BGEPA are applicable year-round, it is accepted that most migratory bird nesting activity occurs in Nebraska from April 1 to July 15. However, some migratory birds nest outside of this range. For example, raptors generally nest in woodland habitats from February 1 to July 15.

Given the size of the study area, many species of migratory birds could be present. Bald eagles can be found in the study area year-round near large bodies of water, including rivers. NGPC discontinued annual monitoring of bald eagle nests in 2018 because the agency estimated around 300 breeding pairs in the state (Jorgensen et al. 2018). Recommendations from NGPC were provided to evaluate and address impacts to existing populations of burrowing owl in proximity to proposed actions within the watershed plan.

Table 3-7 lists the birds that are included on the Tier 1 species list within the Shortgrass Prairie and Sandhills Ecoregions.

Table 3-7. Tier 1 Bird Species in the Shortgrass Prairie and Sandhills Ecoregions

Common Name	Scientific Name	Habitat
Baird's sparrow	*Ammodramus bairdii*	Native grassland; does not nest in Nebraska
Black-billed cuckoo	*Coccyzus erythropthalmus*	Woodlands and thickets, often in proximity to water
Black-billed magpie	*Pica hudsonia*	Open riparian woodlands, thickets, open country, suburban areas
Black tern	*Chlidonias niger*	Marshes and shallow lakes with emergent vegetation
Brewer's sparrow	*Spizella breweri*	Sandsage prairie, shortgrass prairie, mixedgrass prairie with sandsage component, shrub-associated species (low shrubs)
Burrowing owl	*Athene cunicularia*	Prairie dog towns, shortgrass prairie, mixedgrass prairie, heavily grazed grasslands
Chestnut-collared longspur	*Calcarius ornatus*	Native shortgrass and mixedgrass prairie; prefers taller prairie than McCown's longspur

Common Name	Scientific Name	Habitat
Ferruginous hawk	*Buteo regalis*	Rock outcrop, shortgrass prairie, Sandhills dune prairie, prairie dog towns, trees for nesting
Interior least tern	*Sternula antillarum athalassos*	Present during the April 15–August 15 nesting season; unvegetated or sparsely vegetated sandbars in river channels and sandpits
Loggerhead shrike	*Lanius ludovicianus*	Grasslands with at least some scattered small trees or shrubs
Long-billed curlew	*Numenius americanus*	Sandhills dune prairie, Sandhills valley prairie with mixedgrass
McCown's longspur	*Rhynchophanes mccownii*	Shortgrass prairie with mixedgrass, short stature vegetation, prairie dog colonies
Mountain plover	*Charadrius montanus*	Shortgrass, agricultural fields, prairie dog towns, very low-stature vegetation, flat, rocky areas
Pinyon jay	*Gymnorhinus cyanocephalus*	Open ponderosa pine woodlands
Piping plover	*Charadrius melodus*	Present during the April 15–August 15 nesting season; unvegetated or sparsely vegetated sandbars in river channels and sandpits
Short-eared owl	*Asio flammeus*	Open grasslands with standing cover and little disturbance
Sprague's pipit	*Anthus spragueii*	Shortgrass to tallgrass prairies, grazed pastures, harvested fields (alfalfa or wheat stubble); spring and fall migrant; does not nest in Nebraska
Whooping crane	*Grus americana*	Spring and fall migrant; shallow, sparsely vegetated streams, rivers, and wetlands to feed and roost during migration; frequently stop over near ponds and lakes; may feed in crop fields or hay meadows near roosting locations

Source: Schneider et al. 2018

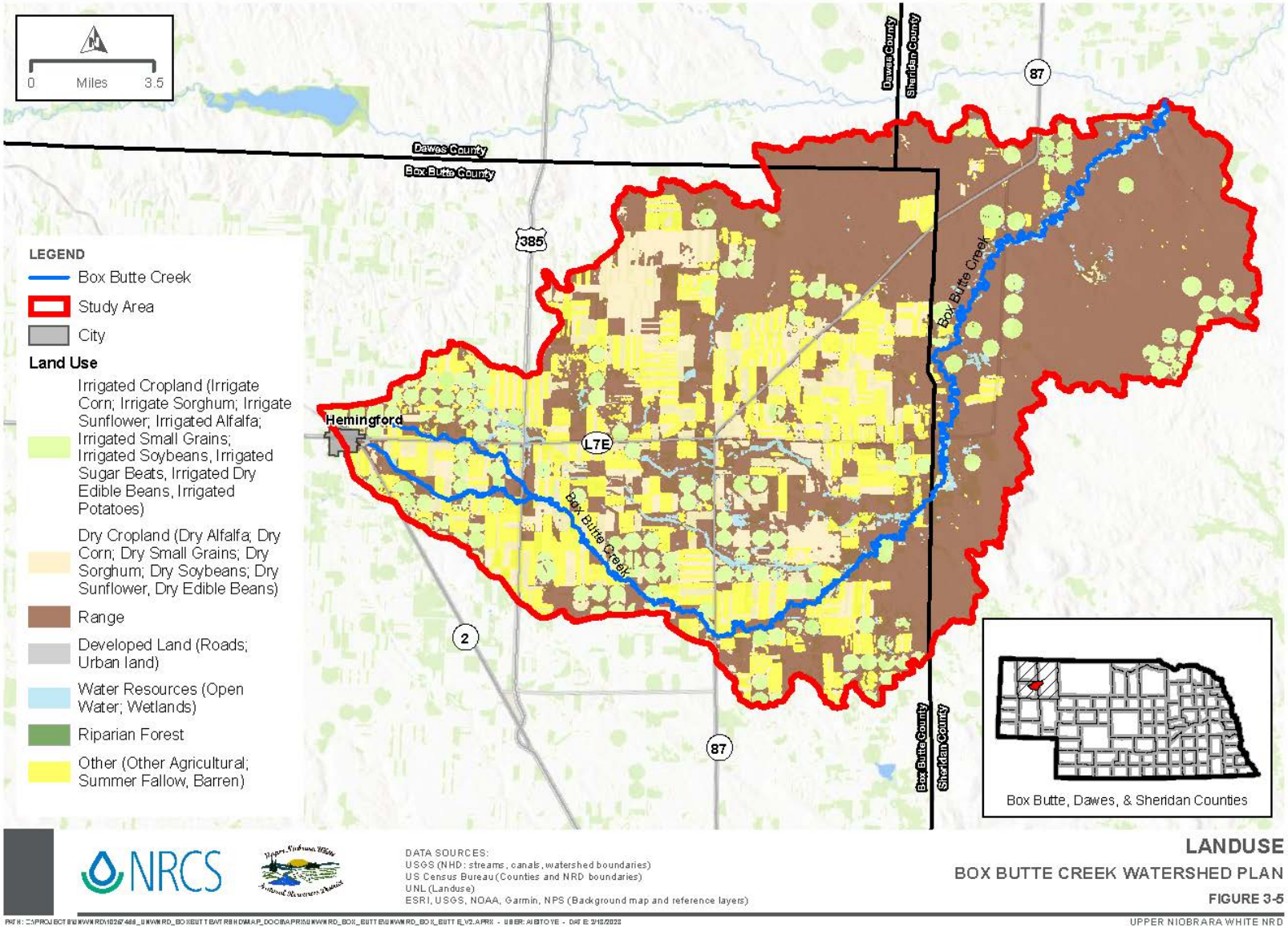

Figure 3-6. Land Use

3.9 Endangered and Threatened Species

The federal Endangered Species Act of 1973 protects plant and animal species considered to be in danger of extinction and their habitats. The USFWS maintains and enforces the national list of threatened and endangered species and assists states in developing conservation programs. In Nebraska, the NGPC maintains the state list of threatened and endangered species, as protected by the Nebraska Nongame and Endangered Species Conservation Act. Additionally, this plan is subject to the Fish and Wildlife Coordination Act of 1934, as amended through PL 116-188 and enacted in 2020, which directs the USFWS to investigate and report on proposed federal actions and provide recommendations to minimize impacts on fish and wildlife resources.

An endangered species is defined as any species that is in danger of extinction throughout all or a significant portion of its range. A threatened species is defined as any species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range. Based on coordination with NGPC and USFWS, review of USFWS's Information for Planning and Consultation (IPaC) website, and review of NGPC's Conservation and Environmental Review Tool (CERT) website there are 15 federally and state-listed endangered, threatened, or proposed species that can occur in the study area. Table 3-8 summarizes the species with the potential to occur in the study area, according to NGPC range maps. IPaC and CERT reports are available in Appendix E.

Table 3-8. Endangered and Threatened Species with Potential to Occur in the Study Area

Common Name	Species Name	Listing	Habitat
Black-footed ferret	*Mustela nigripes*	FE; SE	Prairie dog towns or complexes 1,000 acres or more in size
Blacknose shiner	*Notropis heterolepis*	SE	Headwater streams; spring-fed, clear water pools; quiet waters
Blowout penstemon	*Penstemon haydenii*	FE; SE	Blowouts in Sandhills, open sand substrate
Eastern black rail	*Laterallus jamaicensis jamaicensis*	FT; ST	Wet sedge meadows, shallow wetlands with dense vegetative cover
Eskimo curlew	*Numenius borealis*	FE; SE	Wet meadows, burned-over prairies, newly plowed fields
Finescale dace	*Chrosomus neogaeus*	ST	Headwaters of clear, cool, high-quality streams
Gray wolf	*Canis lupus*	FE; SE	Prairie, mountains, temperate forests, wetlands, tundra, taiga
Monarch butterfly	*Danaus plexippus*	Proposed Threatened	Field, roadside area, open area, wet area, urban garden; milkweed and flowering plants are needed for monarch habitat

Common Name	Species Name	Listing	Habitat
Northern long-eared bat	*Myotis septentrionalis*	FE; SE	Roost singly or in colonies underneath bark or in cavities, crevices, or hollows of live and dead trees and/or snags (typically ≥ 3 inches diameter at breast height); overwinter in hibernacula that include caves and abandoned mines, abandoned railroad tunnels, storm sewer entrances, dry wells, aqueducts
Northern redbelly dace	*Chrosomus eos*	ST	Headwaters of clear, cool, high-quality streams
Pallid sturgeon	*Scaphirhynchus albus*	FE; SE	Large, deep, swift-moving rivers
Piping plover	*Charadrius meoldus*	FT; ST	Unvegetated or sparsely vegetated sandbars in river channels and sandpits
Rufa red knot	*Calidris canutus rufa*	FT; ST	Open mud flats and/or mud and sandy shorelines free of vegetation
Swift fox	*Vulpes velox*	SE	Shortgrass prairie, western mixedgrass prairie
Tricolored bat	*Perimyotis subflavus*	Proposed Endangered	Similar habitat needs as Northern long-eared bat

Source: NGPC 2021a
Notes: FE = federally endangered; FT = federally threatened; SE = state endangered; ST = state threatened

3.10 Riparian Areas

There are approximately 42 acres of riparian forests isolated to reaches, ponds, and wetlands in the study area. Common tree species in riparian areas in Nebraska include peach-leaf willow (*Salix amygdaloides*), cottonwood, green ash, silver maple (*Acer saccharinum*), mulberry (*Morus rubra*), common hackberry (*Celtis occidentalis*) and elm (*Ulmus spp.*).

3.11 Cultural Resources and Historic Properties

Cultural resources are physical or other expressions of human activity or occupation and include archeological sites, buildings, bridges, business districts, culturally significant landscapes, isolated artifacts or features, culturally sacred places, and objects of cultural and historic significance. Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended (54 U.S.C. § 306108), and its implementing regulations (36 CFR Part 800) require federal agencies to take into account the effect of undertakings on cultural resources that are listed on or are eligible for listing on the National Register of Historic Places (NRHP).

In order for a cultural resource to be eligible for listing on the NRHP, it must be associated with events significant to the broad patterns of history; associated with the lives of persons significant in the past; embody distinctive characteristics of a type, period, or method of construction; represent the work of a master; possess high artistic value; represent a significant and distinguishable entity; and/or yield or be likely to yield information important to history or

prehistory. If an undertaking will alter, damage, or destroy a historic property, the agency has a responsibility to avoid, minimize, or mitigate the adverse effect.

Consultation with the State Historic Preservation Office (SHPO), Federally Recognized Tribes, and other interested parties is required for any federal action that may impact historic properties. The identification and analysis of cultural resources was carried out in accordance with the guidance found in the National Cultural Resources Procedures handbook and the Nebraska SHPO's NHPA Archaeological Properties Section 106 Guidelines (2017).

The Area of Potential Effects (APE), as shown in Appendix C, is based on the initial scope and design of the proposed actions. The APE totals 235 acres and includes the construction footprint, borrow locations, staging areas, road raises, utility relocation sites, tree removal sites, etc., as well as the areas considered for potential visual and other effects on cultural resources.

The Nebraska State Archaeologist's Office performed a cultural resources desktop review of the Nebraska Cultural Resources Geographic Information System (NCRGIS) database, NRHP, National Historic Landmark database, and other online resources in June 2022. Three Class III archaeological and architectural field investigations of the APE were conducted between July 5, 2022, and October 16, 2024. The surveys were completed following Nebraska SHPO guidelines. All cultural resources identified by the survey were evaluated for the NRHP according to the guidelines provided in National Register Bulletin No. 15.

Redacted copies of the cultural resources inventory reports are provided in Appendix E and include a summary of previously performed surveys, the record of archaeological sites and historic buildings within 1 mile of the APE, a description of the survey methods, and the results of the survey. One cultural resource was identified by the survey, 25SH20. The site consists of a single flake of Spanish Diggings quartzite. Site 25SH20 is not associated with events or persons of local, regional, or national significance (Criteria A and B), nor does it possess any unique architectural elements (Criterion C). Subsurface testing conducted in the surrounding area yielded no additional cultural material indicating that the archaeological site in question is unlikely to provide information important in prehistory (Criterion D).

NRCS determined that no historic properties will be affected by the proposed channel improvements or diversion to off-channel storage structures in accordance with 36 CFR 800.4(d)(1). SHPO concurred with the determination of effect in a letter dated January 13, 2025. The Crow Creek Sioux Tribe Tribal Historic Preservation Office (THPO) concurred with the determination of effect in an email received January 16, 2025. The Northern Arapaho Tribe THPO concurred with the determination of effect in a letter dated January 21, 2025. Copies of all NHPA Section 106 correspondence are available in Appendix A.

3.12 Parklands & Recreation

The study area does not contain any federal-, state-, or district-owned properties used for recreation (see Figure 3-7). However, hunting, trapping, and fishing activities are allowed on

open fields and waters (OFW) lands in the study area, and there are village-owned properties in Hemingford used for family-based recreation.

3.12.1 NGPC Open Field and Waters Program Lands

In 2009, NGPC initiated the OFW program to increase public access opportunities on private lands. OFW is a voluntary program that offers financial incentives to landowners willing to allow public walk-in access for hunting, trapping, and/or fishing. Landowners who enroll in OFW are afforded protection from liability through the Nebraska Recreation Liability Act (NGPC 2021b).

Three OFW lands are in the study area, all within Box Butte County. A 149.6-acre property is located southeast of the intersection of U.S. Highway 385 (US 385) and Nebraska Highway 87 (N-87)/Nebraska Spur Highway 7A. A 335.4-acre property is located northeast of the intersection of Dodge Road and County Road 57. Finally, a 31.6-acre property is located southeast of N-87 and north of Cass Road (NGPC 2022).

3.12.2 City Parks and County Fairgrounds

Hemingford has a city park on the west side of town. Facilities include modern playground equipment, picnic tables, a shelter house, restrooms, a swimming pool, sand volleyball, and a basketball court. Hemingford also has a minipark at the main intersection of town. Benches and a fountain are found at this location (Hemingford, Nebraska 2021).

The Box Butte County Fairgrounds are located on the west side of Hemingford, north of Nebraska Highway 2 (N-2). The fair is typically held in August and includes a rodeo, truck and tractor pull, demolition derby, and open class 4-H exhibits (Box Butte County Fair 2021).

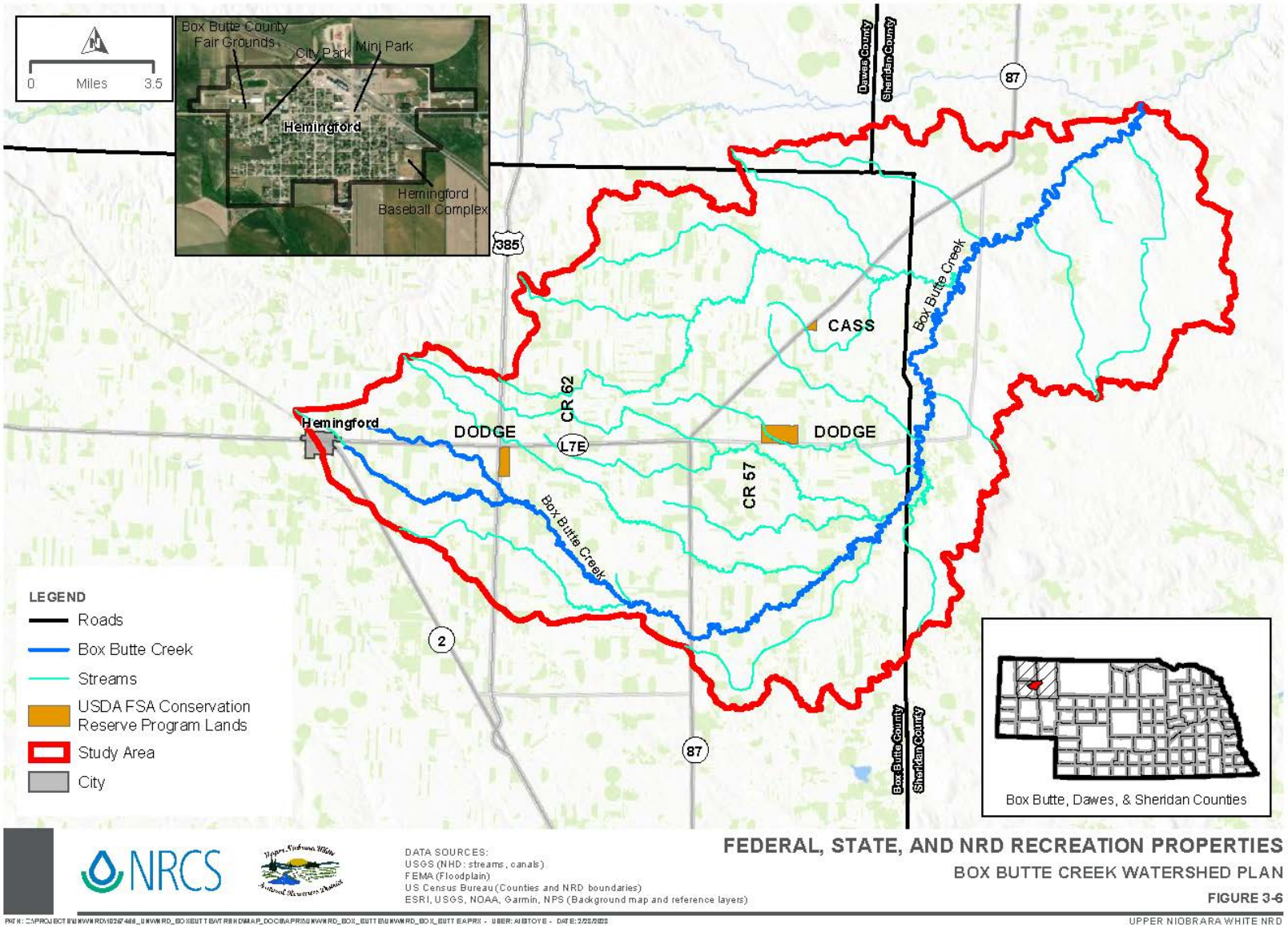

Figure 3-7. Federal, State, and NRD Recreational Properties

3.13 Public Health and Safety

As discussed in Section 1.1, the project is needed to address agricultural water management through promotion of groundwater recharge and to provide flood prevention through flood damage reduction within the Box Butte Creek Watershed study area. The Box Butte Creek Watershed has experienced four major flooding events with watershed-wide impacts in the last 10 years, including the major flood events in both 2018 and 2019 and several intense rainfall events resulting in substantial flooding along Box Butte Creek and its tributaries. This enhanced flood damage has created a public health and safety issue for access to emergency services and emergency service providers during a flood event.

The study area is serviced by U.S. 385 (north-south), N-2 (north-south), N-87 (north-south and east-west), and Nebraska Link Highway 7E (east-west). The remainder of the study area is serviced by a grid network of county roads. The Nebraska State Patrol Troop E (Nebraska State Patrol 2021) and the Box Butte, Dawes, and Sheridan County sheriffs provide law enforcement within the study area. Medical services are located beyond the study area and include Box Butte General Hospital in Alliance and the Chadron Community Hospital in Chadron.

As discussed in Section 1.1.2, the study area has experienced an increased frequency of flooding events. The 2019 road damage locations are shown in Figure 1-7. Access to and by emergency services within the study area could be limited due to roadways being covered in water for extended periods or washed out, posing an increased risk to public health and safety.

3.14 Social and Economic Conditions

3.14.1 Population

The population estimates for the study area, which contains portions of Box Butte, Dawes, and Sheridan Counties and a portion of the village of Hemingford, are provided in Table 3-9.

Table 3-9. Population of Counties and Places in the Study Area

Place	2019 Population
Box Butte County	10,970
Dawes County	8,810
Sheridan County	5,231
Village of Hemingford	909

Source: U.S. Census Bureau 2020a

3.14.2 Local and Regional Economy

The study area's socioeconomic condition can be defined by the income and employment for the counties and places within which the study area lies. The median income for families in Box Butte, Dawes, and Sheridan Counties and the village of Hemingford are provided in

Table 3-10.

Table 3-10. Median Family Income for Counties and Places in the Study Area

Place	2019 (in dollars)
Box Butte County	72,721
Dawes County	71,750
Sheridan County	59,671
Village of Hemingford	73,000

Source: U.S. Census Bureau 2020b

The number of people employed within a county has been a historically reliable aid in predicting trends for economic growth or decline. The number of people employed and the unemployment rates in Box Butte, Dawes, and Sheridan Counties and the village of Hemingford are provided in Table 3-11.

Table 3-11. Number of People Employed for Counties and Places in the Study Area

Place	People Employed	Unemployment Rate (%)
Box Butte County	5,363	5.0
Dawes County	4,772	2.2
Sheridan County	19,254	1.7
Village of Hemingford	476	0.6

Source: U.S. Census Bureau 2020c

3.15 Scenic Beauty

The viewshed in the study area is dominated by agricultural areas, including corn and soybean crops, rangeland, pastures, and alfalfa fields. Box Butte Creek, its tributaries, and their associated riparian and wetland areas intersect those agricultural areas throughout the study area. The viewshed in the village of Hemingford is primarily urban, consisting of urban and residential properties.

3.16 Land Use

Land use in the study area is primarily agricultural, including grassland and shrubland used for grazing and cultivated cropland. Cultivated crops in the study area include corn, soybeans, and alfalfa. The amount of each cultivated crop varies yearly due to crop rotations and environmental conditions. Approximately 20,682 acres of cropland are irrigated. Landcover in the study area is characterized in

Table 3-12.

Table 3-12. Land Use

Land Use Type	Acres
Barren	95
Dry Cropland	29,507
Irrigated Cropland	18,964
Open Water	32
Other Agricultural Land	72

Land Use Type	Acres
Rangeland	88,679
Riparian Forest	42
Developed Land	272
Summer Fallow	22,431
Wetlands	2,025
Total	**162,119**

Source: National Land Cover Dataset 2019

3.17 Ecosystem Services

The resource concerns discussed above include all categories of ecosystem services present within the Box Butte Creek Watershed. Flooding can interrupt or negatively impact all forms of ecosystem services.

Public scoping comments, planning documents, watershed plans from surrounding areas, and discussions with the project sponsor and federal agencies further suggests the project's primary benefits will result from reducing flood damages to buildings and people in Hemingford, as well as reducing damages on agricultural land in the surrounding areas.

3.17.1 Provisioning Services

Provisioning services include tangible goods provided for direct human use and consumption. Within this watershed, these include resources directly related to food production (prime and unique farmland) and land use and those that indirectly impact food production (erosion and sedimentation and water quality and quantity).

The provisioning services identified for groundwater recharge in the Box Butte watershed is groundwater availability for irrigation, which is directly related to the amount of food production for human use and consumption. The ability to irrigate increases yields and provides more tangible goods. The provisioning service identified for flood damage reduction in the Box Butte watershed is agricultural production. Reducing the amount of crop damage by flooding increases the yields of tangible goods for human use and consumption.

3.17.2 Regulating Services

Regulating services maintain a world in which it is possible for people to live and provide critical benefits that buffer against environmental catastrophes. For the scope of this project's analysis, these include resources that are predominantly related to flood control (water quantity, floodplain management, flood damages, wetlands, riparian areas, and public safety). Additional resources are directly or indirectly related to erosion control (erosion, sedimentation, and riparian areas) and water filtration and disease control (water quality, wetlands, and streams).

The regulating services identified for groundwater recharge in the Box Butte watershed is terrestrial and aquatic wildlife, which is directly related to species existence and bequest value related to groundwater recharge, including those resources dependent on groundwater. The regulating services identified for the Box Butte watershed is flood damage reduction and water

quality. Controlling flood flows will reduce the amount of damage and improve water quality in the watershed.

3.17.3 Supporting Services

Supporting services refer to the underlying processes that maintain conditions for life. Supporting services allow the other ecosystem services to exist and are not evaluated in this plan.

3.17.4 Cultural Services

Cultural services make the world a place in which people want to live. Archeological and historical resources, floodplain management, and local and regional economy are important cultural services. Wetlands, streams, and fish and wildlife habitat are additional resources within the watershed that have aspects related to cultural services. For the scope of this project analysis, culture and heritage ecosystem services are in the ARA.

The cultural services identified for groundwater recharge in the Box Butte watershed is culture and heritage, which are directly related to aesthetic viewsheds. Improving groundwater recharge will improve the aesthetic viewshed by providing groundwater for those resources. No culture and heritage services were identified for flood damage reduction in the Box Butte watershed.

4 Alternatives

Formulating alternative plans included considering actions that may address the need(s) of the existing resource conditions. Local, state, regional, federal, and non-governmental agencies and organizations participated in the process.

4.1 Formulation Process

The formulation process is the basis for selecting combinations of measures to include as alternatives. The alternatives developed are combinations that could meet the project purposes and take into consideration multiple federal requirements to streamline the planning and decision-making process. This analysis is meant to satisfy the alternatives development and screening criteria requirements of NEPA; CWA Section 404(b)(1) guidelines; and PR&G for federal investments in water resources. This means that a wider range of alternatives was used to satisfy all applicable federal alternatives analysis requirements and to reduce the time, cost, and cumbersome agency reviews that often come with multiple analysis documents. Table 4-1 describes when each of these regulations is required.

Table 4-1. Federal Requirements for Alternatives Analyses

NEPA	404(b)(1)	PR&G
Requirement for federal agencies to assess the environmental effects of proposed major federal actions prior to making decisions.	Guidelines for an alternatives analysis when an individual permit for fill in jurisdictional wetlands and/or streams is required from the U.S. Army Corps of Engineers.	Alternatives analysis requirements when federal funds are used for water projects. Agencies have specific guidelines, including the USDA (who is funding this Plan).

After an appropriate range of alternatives is selected, each alternative is screened to determine whether it should be carried forward for a more detailed analysis, which includes a more refined preliminary design, analysis of environmental and social consequences (both beneficial and detrimental), and a detailed economic analysis. This pre-screening allows a detailed look at a narrower range of alternatives for a more efficient decision-making process. Different federal requirements and guidelines present different screening criteria based on the policy's overarching goal. This screening process is shown in Figure 4-1.

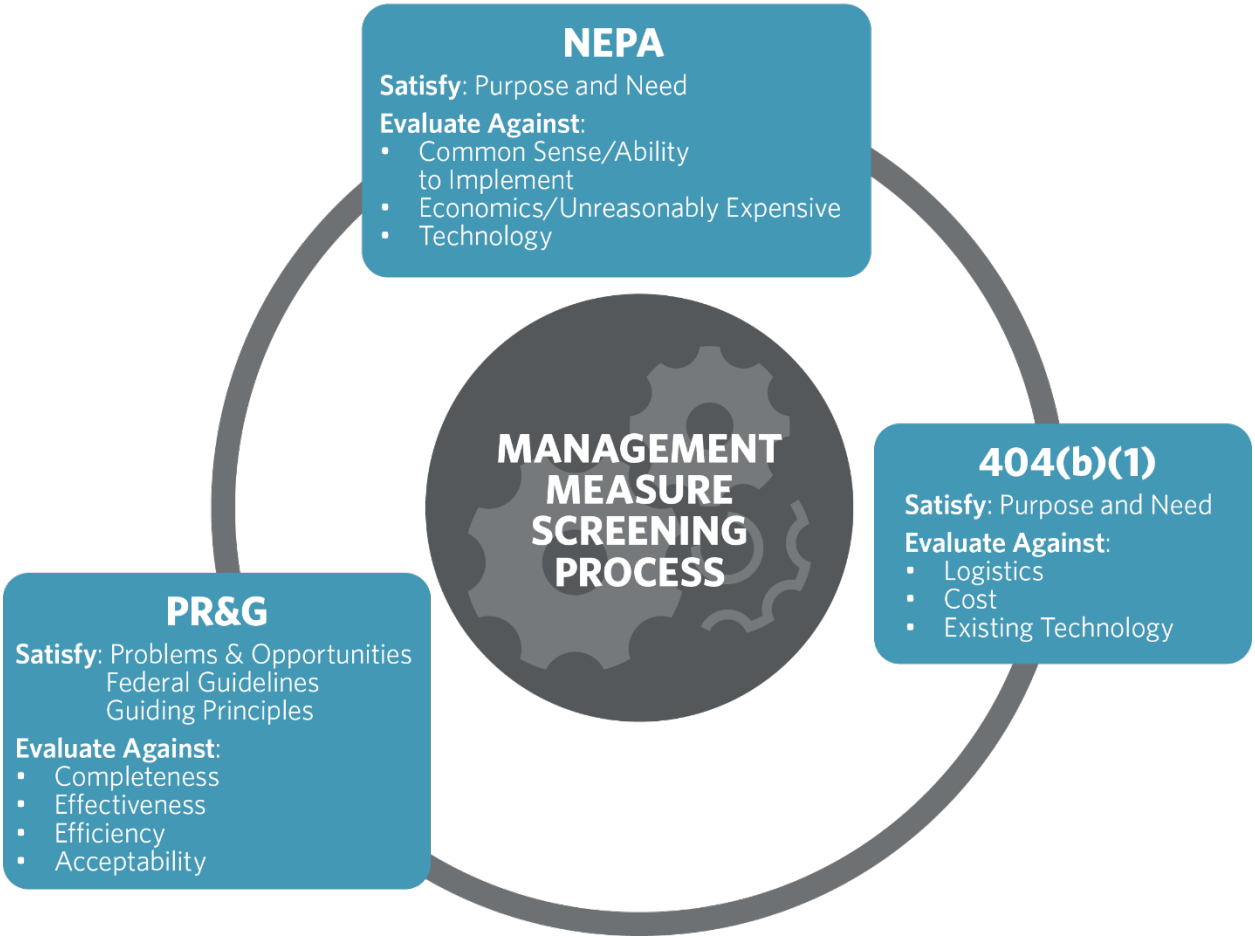

Figure 4-1. Alternatives Screening Process

4.2 Alternatives Considered/Eliminated from Detailed Study

During the scoping phase of this Plan, several alternatives were considered to address the agricultural water management and flood damage reduction purposes and corresponding needs. The alternatives were evaluated using the process described in Section 4.1. Table 4-2 and Table 4-3 summarize the alternatives and screening process results and identify the alternative(s) to be carried forward for detailed study in the Plan. Additional details about the screening process and results are provided in Appendix D, Attachment 1. Section 4.3 provides details about the alternatives carried forward for detailed study.

Table 4-2. Summary of Alternatives – Agricultural Water Management

Alternative	Summary of Alternative	Meets Purpose and Need	Reasonable/ Practicable[1]	PR&G (Completeness, Effectiveness, Efficiency, Acceptability)	Carried Forward for Detailed Study
No Action/Future Without Federal Project	No federal assistance would be provided. The Sponsor would continue to implement measures of their Integrated Management Plan to address groundwater resources.	The purpose and need would not be met, and the problems associated with groundwater declines would continue.	Not applicable	Not applicable	Yes
Off-Channel Storage (passive)	Small detention areas in the upper reaches of the watershed within or adjacent to tributaries to Box Butte Creek providing up to 1,000 acre-feet per year of overland flow (runoff from excess precipitation, snowmelt, or irrigation return flows).	No. Does not provide meaningful groundwater recharge potential due to limited drainage areas.	Not applicable	Not applicable	No
Diversion to Off-Channel Storage (passive)	Diversion from tributary or main channel stream flows to off-channel detention basins within floodplains or adjacent low-lying areas.	Yes	Yes	Yes	Yes

Alternative	Summary of Alternative	Meets Purpose and Need	Reasonable/ Practicable[1]	PR&G (Completeness, Effectiveness, Efficiency, Acceptability)	Carried Forward for Detailed Study
On-Channel Storage (passive recharge)	On-channel detention structures to promote ponding, infiltration, and passive groundwater recharge.	Yes	No. The drainage areas needed to support passive recharge would require an in-channel structure to meet NRCS standards (TR-60) for earth dams and reservoirs. These standards set minimum performance requirements for design parameters, including dam height, storm event storage, and spillway types and capacities. These standards do not benefit the purpose of agricultural water management. The cost to meet these standards makes on-channel storage unreasonable or impracticable.	No. The need to meet dam safety criteria without any additional benefit for the purpose of groundwater recharge means this alternative does not address the problem of groundwater declines or achieve the desired opportunity efficiently.	No

Alternative	Summary of Alternative	Meets Purpose and Need	Reasonable/ Practicable[1]	PR&G (Completeness, Effectiveness, Efficiency, Acceptability)	Carried Forward for Detailed Study
Injection Recharge	Process of collecting available surface water and injecting it directly into groundwater (below water table) in areas where geologic factors for passive recharge are limiting.	Yes	Yes	No. The nature of this alternative requires infrastructure for both surface water storage and injection well components. The added infrastructure reduces the efficiency of this alternative when compared to passive recharge options. There are also acceptability constraints from state regulatory agencies due to regulatory requirements and water quality concerns due to injection of surface water into groundwater.	No
Agricultural Best Management Practices (conservation measures) – Nonstructural	Full implementation of conservation measures on agricultural lands within the Box Butte Creek drainage basin.	No. Irrigation efficiency practices are already promoted and widely implemented. There is not enough area available to implement the type and quantity of best management practices (BMP) needed to meet the purpose and need.	Not applicable	Not applicable	No

[1] Addresses both reasonableness under NEPA and practicability under Section 404(b)(1) guidelines.

Table 4-3. Summary of Alternatives – Flood Damage Reduction

Alternative	Summary of Alternative	Meets Purpose	Reasonable/ Practicable[1]	PR&G (Completeness, Effectiveness, Efficiency, Acceptability)	Carried Forward for Detailed Study
No Action/Future Without Federal Project	No federal assistance would be provided, and the sponsor would not pursue further action. Box Butte County would repair road damages on an as-needed basis.	Not applicable	Not applicable	Not applicable	Yes
On-Channel Storage	Construction of flood-retarding structures within the channel.	Yes	No. The magnitude of the infrastructure needed is cost prohibitive in relation to the flood damage benefits that would be achieved.	No. The need to meet dam safety criteria means the cost of this alternative exceeds the benefits of county road damage reduction.	No

Alternative	Summary of Alternative	Meets Purpose	Reasonable/ Practicable[1]	PR&G (Completeness, Effectiveness, Efficiency, Acceptability)	Carried Forward for Detailed Study
Off-Channel Storage	Construction of small, upland detention basins that would capture surface water runoff.	No	No. Localized topography would dictate substantial infrastructure and investment, such as grading to achieve sufficient surface water storage from storm events to reduce the potential for roadway overtopping and/or earth dams and reservoirs (meeting associated dam design standards) to achieve purpose and need.	No. Due to the substantial infrastructure and investment, such as grading to achieve sufficient surface water storage for storm events to reduce the potential for roadway overtopping and/or earth dams and reservoirs (meeting associated dam design standards), this alternative does not efficiently address the problem of flood damage reduction or realize the opportunities at reasonable cost.	No
Channel/Infrastructure Improvements	Increased conveyance system capacity through modification of the channel alignment and/or geometry, replacement of undersized drainage structures, and/or improvement of other infrastructure (roadways) to provide protection from a defined damage storm.	Yes	Yes	Yes	Yes

Alternative	Summary of Alternative	Meets Purpose	Reasonable/ Practicable[1]	PR&G (Completeness, Effectiveness, Efficiency, Acceptability)	Carried Forward for Detailed Study
Flood Protection Dikes/Levees	Implementation of specific flood projection barriers to provide flood damage reduction for specific areas of interest.	Yes	No. The general topography and perpendicular nature of the problem areas makes flood protection dikes/levees unreasonable or impracticable to implement.	No. Due to the general topography and perpendicular nature of the problem areas, flood protection dikes/levees cannot be effectively implemented.	No
Diversions	Redirecting excess flows upstream and constructing a diversion around problem areas to reduce flows to no-damage flows. Use existing drainages or drainage ditches to convey excess floodwaters.	Yes	No. Due to the general topography and perpendicular nature of the problem areas, diversion around the problem areas to reduce flows is not reasonable to implement.	No. Due to the general topography and perpendicular nature of the problem areas, diversion around the problem areas to reduce flows cannot be effectively implemented.	No

Alternative	Summary of Alternative	Meets Purpose	Reasonable/ Practicable[1]	PR&G (Completeness, Effectiveness, Efficiency, Acceptability)	Carried Forward for Detailed Study
Floodplain Connectivity	Use the historic floodplain for temporary storage of floodwaters.	Yes	No. The floodplain is already inundated at the 1-year flood event identified in the project need. No additional connection to the floodplain is reasonable or logically practicable.	No. The floodplain is already inundated at the 1-year flood event identified in the project need. Additional connection to the floodplain cannot be effectively implemented.	No
Physical Nonstructural Measures	Use physical but nonstructural measures, such as relocation or acquisition of property prone to flood damage.	Yes	No. The existing roadways cannot be relocated or acquired, so this alternative is not reasonable or logistically practicable.	No. The existing roadways cannot be relocated or acquired, so this alternative cannot be effectively implemented.	No
Nonphysical Nonstructural Measures	Use physical measures, such as relocation or acquisition of property, and/or nonphysical measures, such as flood warning systems, land use regulation, and/or flood emergency preparedness planning.	No. Flood damage would continue to occur.	Not applicable	Not applicable	No

Alternative	Summary of Alternative	Meets Purpose	Reasonable/ Practicable[1]	PR&G (Completeness, Effectiveness, Efficiency, Acceptability)	Carried Forward for Detailed Study
Agricultural Best Management Practices (conservation measures)	Full implementation of conservation measures on agricultural lands within the Box Butte Creek drainage basin.	No. There is not enough area available to implement the type and quantity of BMPs needed to meet the purpose and need.	Not applicable	Not applicable	No

[1] Addresses both reasonableness under NEPA and practicability under Section 404(b)(1) guidelines.

4.3 Alternatives Description

The following sections discuss the alternatives for each project purpose that were carried forward for detailed environmental and economic analysis.

4.3.1 Alternative 1 – No-Action Alternative

No Action/Future Without Federal Investment

This alternative is the most likely course of action if the sponsor does not receive federal funding for the project. The Sponsor would continue to implement their Integrated Management Plan (UNWNRD 2011) to address groundwater management for agricultural use. Box Butte County would repair road damages on an as-needed basis.

4.3.2 Alternative 2 – Dam Diversion to Off-Channel Storage

Dam Diversion to Off-Channel Storage (Passive Recharge)

This alternative would involve an on-channel dam diversion structure to an off-channel storage (or catchment) to promote ponding, infiltration, and passive groundwater recharge. In areas where passive recharge factors and recharge needs are present, locations for dam diversion to off-channel storage would be available to provide meaningful recharge.

Locations for dam diversions to off-channel storage were determined through a multi-phase screening process. Refer to Appendix D, Attachment 4 for descriptions of the data sources used for the screening process.

Using topographic data and statewide water table map data during Phase I, locations were identified where passive recharge could occur based on the depth to groundwater as well as the thickness of silt and clay in the UZ using test hole and NeDNR well records. Any locations identified had between 10 and 120 feet available in the UZ (depth to groundwater) and had relatively little UZ thickness of silt and clay (see Appendix C, Figure 4-2).

In Phase II, locations of recharge need were identified in the project area based on historic groundwater level declines (since predevelopment) and net groundwater recharge deficit (as the difference between deep drainage of water below the plant root zone and the rate of groundwater pumping by high-capacity irrigation wells) (see Appendix C, Figure 4-3).

Appendix C, Figure 4-4 shows the areas where Phase I and Phase II locations overlap. Within this area, locations were reviewed as part of a Phase III screening, which evaluated the surface area potential for any given site. A target of 750 acre-feet per year of overland flow (runoff from excess precipitation, snowmelt, or irrigation return flows) was considered to have the potential to provide meaningful recharge on a site-by-site basis. Locations were identified based on the distance of other nearby on-channel water detention structures/dams so as not to limit available supplies or unduly limit any functional benefits of such features downstream. Locations on sites with single property owners were also preferred for ease of potential acquisition and site design.

As a result of this screening, a total of eight potential off-channel recharge sites were identified. Appendix C, Figure 4-5 shows the locations of these sites within the project area.

Design Considerations

Structural Design

Each diversion to off-channel storage (passive recharge) sites would include the construction of a low earthen berm, which would be designed to divert portions of run-off to an off-channel storage basin (or catchment) and to have all other flows generated from runoff events overtop the structure at a controlled location. A culvert (low-flow outlet pipe) would be placed in the berm to allow for normal flows (< 1-year) to pass. Based on hydrologic and hydraulic analysis, the structure configuration would provide for flows in excess of the culvert through pipe capacity to be diverted to the off-channel storage basin. Additional information regarding the analysis and structure details at each location is included in Appendix D. These dam diversion structures would be designed to meet NeDNR criteria (NeDNR 2008) for either Minimal Hazard potential (a dam failure or misoperation would likely result in no economic loss beyond the cost of the structure itself and limited to the property owner) or Low Hazard potential (a dam failure or misoperation would result in no probable loss of human life and low economic loss). In addition, these dam diversion structures would meet NRCS Conservation Practice Standard 348 (Dam, Diversion).

Table 4-4 summarizes the dimensions and anticipated storage area for each dam diversion.

Table 4-4. Dam Diversion to Off-Channel Storage (Passive Recharge) Site Detail

Site Identifier	Structure Length (feet)	Structure Height[1]	In-Channel Storage Volume (acre-feet)	Off-Channel Storage Basin Volume (acre-feet)	Annual Aquifer Recharge Rate (acre-feet/year)[2]	Applicable NRCS Standards
1	160	3.5	5.0	17.4	510	348
2	2,200	5.9	6.6	9.2	277	348
4a	2,625	3.0	0.6	25.0	34	348
5	190	5.9	35.2	6.8	605	348
6	1,510	4.3	2.5	40.6	277	348
7	155	5.9	5.4	6.6	288	348
8	2,150	4.4	3.6	18.6	200	348
9a	2,165	5.9	25.0	21.9	274	348

[1] Determined from the bottom of the channel to the top of the structure.
[2] Adjusted for upstream flow capture, mounding height, and ranking of silt/clay thickness in the UZ.

Figure 4-2 and Figure 4-3 show the typical design centerline profile and cross-section for the dam diversion structures, respectively.

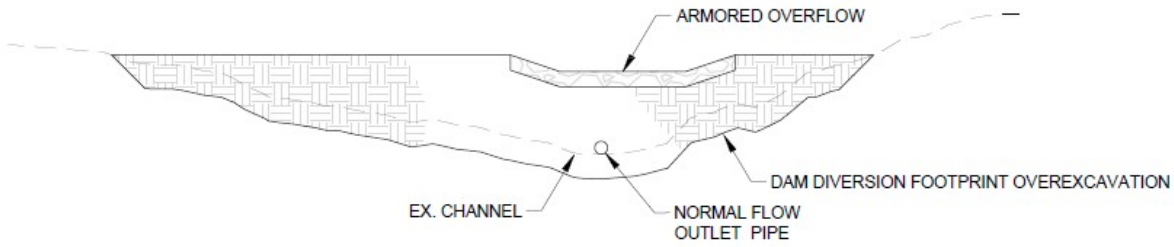

Figure 4-2. Typical Dam Diversion Structure Center Profile

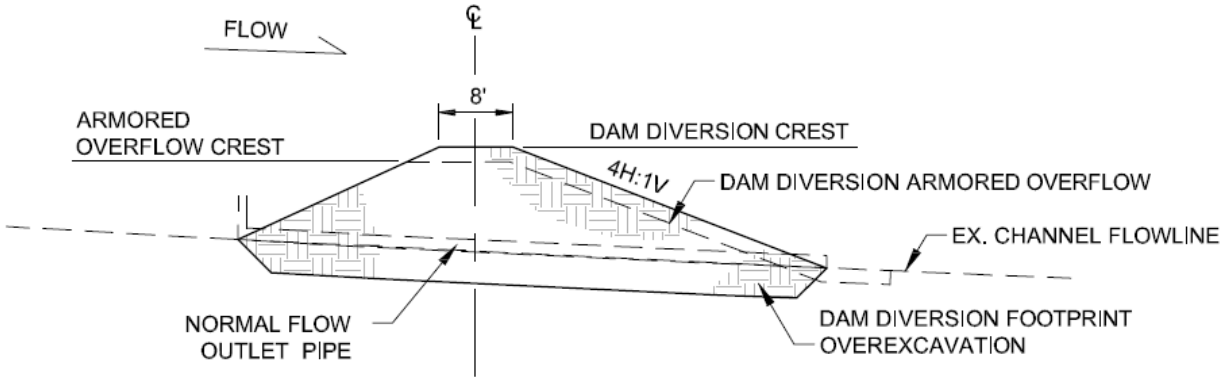

Figure 4-3. Typical Dam Diversion Section

The dam diversion structure would effectively convey water to an off-channel storage basin (catchment). These basins would be excavated in the floodplain adjacent to the diverted water source. The off-channel storage basin depth would be no deeper than the bottom elevation of the diverted water source. Side slopes would be a minimum of 3:1. Extension of the dam diversion structure would be placed around the off-channel storage basins, as site topography dictates, to contain the desired storage volume. The dam diversion extension elevation would be set at the elevation of the in-channel dam diversion structure. Borrow material for the dam diversion extension would obtained from the excavated material for the off-channel storage basins. Figure 4-4, Figure 4-5, and Figure 4-6 show the typical design of the off-channel storage basin and associated extension of the dam diversion structure.

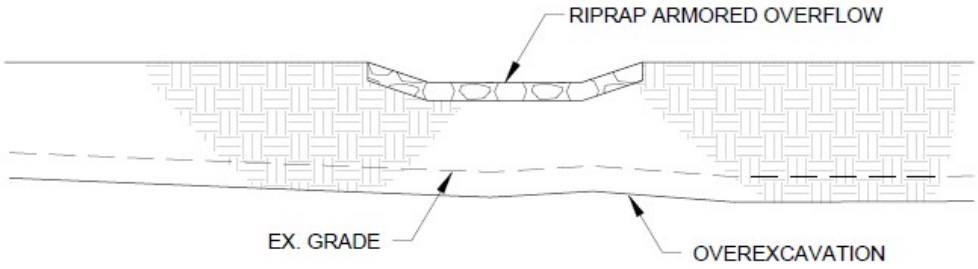

Figure 4-4. Dam Diversion Extensions for Off-Channel Storage Basin Containment Profile

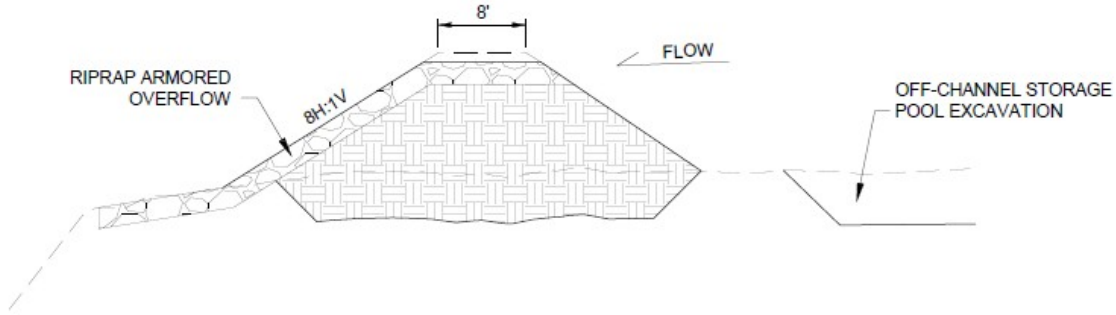

Figure 4-5. Typical Dam Diversion Extension Overflow Crest Section

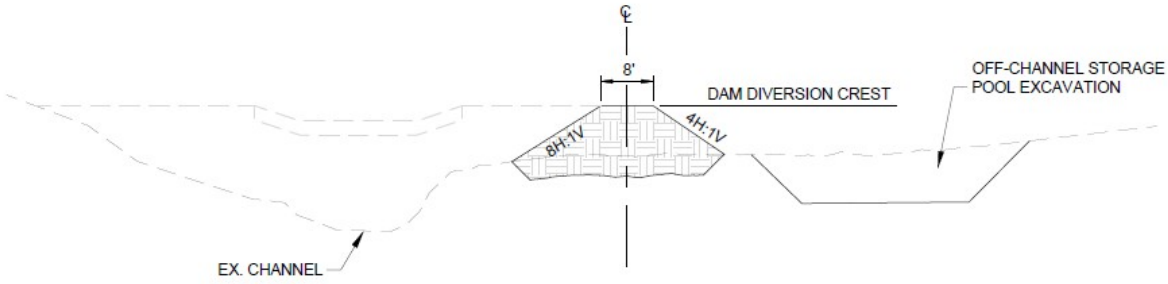

Figure 4-6. Typical Dam Diversion Extension and Off-Channel Storage Section

A hydrologic and hydraulic analysis was performed at the dam diversion sites similar to that performed at road damage locations (Section 4.3.3). See Appendix D, Attachment 1 for further information regarding the analysis and results.

During the design phase, geologic and geotechnical investigations for structures will be performed in accordance to NRCS policy and initiated in the design phase. Combined with a detailed hydraulic analysis, design determinations for appropriate armoring and scour protection will be made.

Sediment Management

Post-construction, exposed surfaces and disturbed areas would be stabilized in accordance with the criteria in NRCS Conservation Practice Standard 342 (Critical Area Planting) for downstream sediment management.

Typical Operations

The dam diversion to off-channel storage sites would be designed to capture runoff and store a specific volume of the runoff within the storage basin to allow infiltration, which would provide a hydrologic connection between surface water (runoff) and groundwater to enhance recharge to the aquifer. In general, dam diversion to off-channel storage sites are designed to capture and infiltrate a specific amount of runoff while being capable of adequately bypassing flows after the design capacity is met so as not to negatively impact upstream or downstream flows and/or adjacent property owners. On an annual basis, the off-channel storage basin storage volume is between 1 and 8.5 percent of the estimated annual runoff from the contributing watershed. During operations and maintenance, annual inspections will determine whether sediment removal would be needed to maintain the desired storage capacity to maximize the groundwater recharge potential. In addition, the compaction of the bottom of the recharge area would be evaluated to determine the need for soil disturbance, such as discing, to promote infiltration. Annual inspections of the dam diversion structure will be conducted to identify any maintenance actions required to maintain the integrity of the structure.

4.3.3 Alternative 3 – Channel/Infrastructure Improvements

This alternative was evaluated for multiple locations throughout the project area where routine county road damage was identified by the Box Butte County Highway Department. A hydrologic and hydraulic analysis was performed at each location, which determined the magnitude of the runoff events that contribute to potential road damage. As part of this study, it was determined to focus on reducing flood damages to the smaller, more frequent events (see Appendix D, Attachment 1). Based on available data and modeling, this was determined to be a 1-year storm event. Focusing on smaller, more frequent events would allow county road improvements to occur within existing county right-of-way, minimizing implementation costs. Appendix C, Figure 4-11 identifies the locations for which road improvements were considered. A total of nine sites were evaluated.

Road improvements for each site would consist of raising the roadbed by a maximum of 2 feet and increasing the capacity of flow conveyance by adding and/or enlarging the culverts under the roadway. The roadway embankment side slopes would be 3:1. With the limited increase in roadway height, the 3:1 slopes are a conservative estimate for footprint and fill. If future geotechnical exploration of the soils suggests another slope is more appropriate for the berms,

the slopes would be modified. Figure 4-7 shows the typical design for the county road improvements, and Table 4-5 summarizes each site.

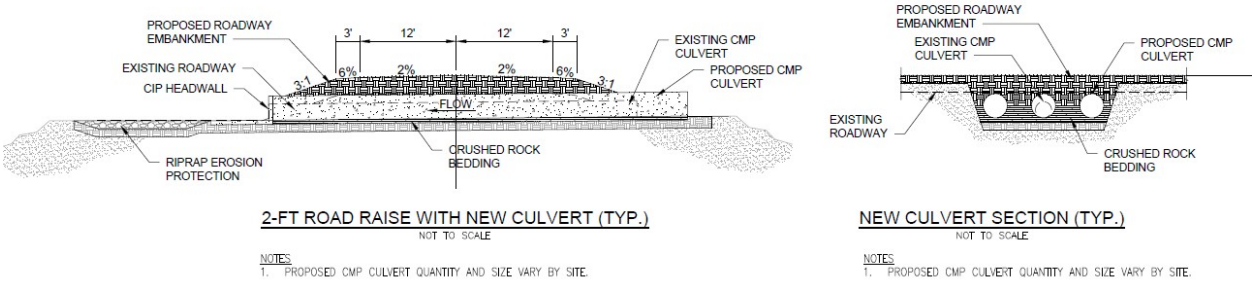

Figure 4-7. Typical County Road Improvement Design Cross-Section

Table 4-5. Conveyance/Infrastructure Improvement Site Details

Site Identifier	Conveyance Improvement	Road Raise Length (feet)
8	3 x 36-inch CMPs[1]	515
10	3 x 48-inch CMPs	2450
11	3 x 36-inch CMPs	655
12b	3 x 36-inch CMPs	325
16	3 x 36-inch CMPs	660
17	3 x 36-inch CMPs	1175
20	4 x 36-inch CMPs	745
25	3 x 24-inch CMPs	370
27	14 x 24-inch CMPs	235

[1] CMP = corrugated metal pipe

5 Environmental Consequences

In accordance with the National Watershed Program Manual (Title 390, 501.38), the National Environmental Policy Act, and PR&G the environmental consequences analysis considers impacts and their duration, intensity, type, and context; cumulative impacts; and measures to mitigate impacts.

The descriptions of environmental consequences that follow address the potential economic, environmental, and social effects of each alternative. The comparisons include four aspects of assessment:

- Intensity: Negligible (slight or not detectable), minor (measurable but small), moderate (measurable and apparent), and substantial (significant).
- Duration: Short term (transitory, days, or months), long term (years), and permanent.
- Type: Direct (caused by the action and occurs at the same time and place) or indirect (caused by the action and is later in time or farther removed in distance but still reasonably foreseeable). Impacts can be either beneficial or adverse.
- Context: Circumstances or actions that form the environmental consequence.

There are three alternatives: No-Action/Future Without Federal Investment (FWOFI; No-Action) for both agricultural water management and flood damage reduction purposes, Diversion to Off-Channel Storage (agricultural water management), and Channel/Infrastructure Improvements (flood damage reduction). The Diversion to Off-Channel Storage alternative includes eight geographic areas (see Appendix C, Figure 4-5). The Channel/Infrastructure Improvements alternative includes nine geographic areas (see Appendix C, Figure 4-11). When appropriate in this document, environmental consequences are presented by geographic areas, depending on the resource concern. Affected Resource Areas (ARA) and APE maps were created for each component of the final array of alternatives. Both ARA and APE are the geographic area within which each alternative is evaluated for potential impacts. APE is used for analyzing effects on cultural and historic properties, while ARA is used to analyze effects for all other environmental resources. Both ARA and APE include areas impacted by the construction of a potential alternative, including areas for construction access, materials stockpiling, visual effects, etc. However, ARA also considers lateral effects to wetlands.

For reference, Chapter 4 provides a description of the alternatives, and Chapter 3 presents a description of existing conditions. Cumulative impacts are discussed in Section 5.19.

5.1 Soils

5.1.1 Geology

No-Action Alternative

There would be no beneficial or adverse impacts on subsurface geology. The continued use of groundwater for irrigation, including the imposition of restrictions per the UNWNRD Ground Water Management Plan, would not affect the region's geological setting, and sediments would remain unchanged. The continued flood damages of county roadway infrastructure and agricultural land would not affect the region's geological setting, and sediments would remain unchanged.

Diversion to Off-Channel Storage

Geological materials are not expected to have a beneficial or adverse impact on the design of the alternative. Geologic and geotechnical conditions that may affect the design of this alternative would be thoroughly explored during the design phase. Per the USGS Quaternary Faults map, there are no active faults near the project sites.

Channel/Infrastructure Improvements

Geological materials are not expected to have a beneficial or adverse impact on the design of the alternative. Geologic and geotechnical conditions that may affect the design of this alternative would be thoroughly explored during the design phase. Per the USGS Quaternary Faults map, there are no active faults near the project sites.

5.1.2 Erosion and Sedimentation

No-Action Alternative

The continued use of groundwater for irrigation, including the imposition of restrictions per the UNWNRD Ground Water Management Plan, would not affect erosion and sedimentation. The No-Action alternative would have minor, permanent, direct, adverse impacts on existing erosion rates due to the continued overtopping of county roadways and roadway damage during heavy rain events, including erosion and loss of roadway surfacing (gravel) and road grade soils.

Diversion to Off-Channel Storage

The proposed action would have negligible, permanent, direct, adverse impacts on erosion and sedimentation within the Box Butte Creek bed and bank due to the removal of sediment from the stream system as a result of the diversion of smaller more frequent runoff events. Sediment transported during normal follows and larger less frequent runoff events would be consistent with what is transported under the existing conditions.

The proposed action would have negligible, short term, direct, adverse impacts on erosion and sedimentation due to temporary soil disturbances and grading associated with construction that would result in short term increases to the rates of erosion and sedimentation at each site. Under Section 402 of the CWA, an NPDES Storm Water General Permit for Construction

Activities is required for construction activities that disturb more than 1 acre and discharge pollutants to surface waters. Proper best management practices (BMP) would be installed to prevent and control soil erosion, and the contractor would develop a Stormwater Pollution Prevention Plan (SWPPP) and submit it to NDEE.

Design features and BMPs that would be applied during the proposed action are described below. During construction, work crews would carry spill cleanup kits, and in times of burn bans or wildfire concerns, each crew would have a fire suppression kit. Construction stormwater plans and measures that meet local, state, and federal guidelines and intent would be developed and implemented during construction and revegetation activities.

The following BMPs would be implemented to reduce and mitigate impacts on soils:

- Compaction, grading, and clearing activities would be minimized to the extent practicable.
- During construction, topsoil would be saved and then redistributed after completion of construction activities.
- Straw wattles, silt curtains, cofferdams, dikes, straw bales, or other suitable erosion control measures would be used to minimize soil erosion and prevent soil erosion from entering water bodies during construction.
- Disturbed areas would be smoothed, shaped, contoured, and reseeded to as near their pre-project conditions as practicable.
- Lands previously in agricultural production would be returned to agricultural production following construction.
- For project-specific components that would disturb an acre of soil or more, the project coordinator or contractor would submit a Stormwater Management Plan to NDEE for approval to reduce potential impacts of sedimentation on water bodies.

Channel/Infrastructure Improvements

Construction may result in negligible, short term, direct, adverse impacts to soils due to temporary increases to erosion and sedimentation. However, following construction, road improvements would result in minor, permanent, direct, beneficial impacts to soils due to reduced erosion and sedimentation during future flood events. Proper BMPs would be installed to prevent and control soil erosion, and the contractor would develop a SWPPP and submit it to NDEE. Design features and BMPs that would be applied during the proposed action are similar to those described in Section 5.1.2 for the Diversion to Off-Channel Storage alternative.

5.2 Prime and Unique Farmlands

5.2.1 No-Action Alternative

The No-Action alternative would not result in the conversion of any prime or unique farmland or farmland of statewide importance. However, declining groundwater recharge would result in

minor, permanent, direct, adverse impacts on existing farmland by limiting production on prime and unique farmlands in the project area due to restrictions on using groundwater for irrigated agriculture. The continued flood damages of county roadway and agricultural land would continue to have minor, permanent, direct, adverse impacts on the use of existing farmland through continued damage and erosion.

5.2.2 Dam Diversion to Off-Channel Storage Alternative

Under the proposed action, permanent, direct, adverse impacts on 33.2 acres and, short-term, direct, adverse impacts on 37.4 acres of agriculturally important lands, including prime and unique farmlands, would occur. Given there are a total of 98,530 acres of prime farmland in the project area, the impacts on 70.6 acres would be minor to prime farmland in the project area. Dam diversion structure, pool, storage, and ROW project components would all result in permanent use of prime farmland as grass and/or conveyance. See Table 5-1 for specific impacts. No prime farmland or farmland of statewide importance would be impacted. Given the project areas are located primarily around existing drainage ditches that are inundated regularly, these areas would be clear of significant FPPA concerns.

Additional short-term, direct, adverse impacts to prime and unique farmland could occur by placing fill material on the land, but the impact on the use of the farmland would be negligible because construction would occur during the non-growing season to prevent disruption to normal farming operations. Following construction, those areas temporarily impacted would return to normal farming operations.

The combined Farmland Conversion Impact Rating for the proposed action is 138. The FPPA law states that sites with a rating less than 160 do not need further consideration or protection and no additional evaluation is necessary.

Table 5-1. Box Butte Subwatershed Prime Farmland Impacts

Map Symbol	Map Unit Name	Acres Impacted
1362	Bridget very fine sandy loam, 1 to 3 percent slopes	2.1
1683	Manter-Satanta fine sandy loams, 0 to 3 percent slopes	0.5
1809	Satanta fine sandy loam, 1 to 3 percent slopes	25.6
5100	Alliance loam, 0 to 1 percent slopes	8.7
5101	Alliance loam, 1 to 3 percent slopes	0.2
5179	Hemingford loam, 0 to 1 percent slopes	5.7

Map Symbol	Map Unit Name	Acres Impacted
5180	Hemingford loam, 1 to 3 percent slopes	5.5
5181	Hemingford loam, 3 to 6 percent slopes	0.3
5616	Craft very fine sandy loam, occasionally flooded	18.5
5625	Duroc loam, occasionally flooded	0.2
5943	Duroc loam, 1 to 3 percent slopes	3.3
	TOTAL	**70.6**

Source: NRCS, 2024

5.2.3 Channel/Infrastructure Improvements Alternative

Under the proposed action, road improvements would remain within the current right-of-way. Therefore, no impacts on prime and unique farmland are anticipated.

5.3 Water Resources

5.3.1 Wetlands and Waters of the United States

No-Action Alternative

The No-Action alternative would not result in impacts on existing conditions. Water resources within the watershed would continue to experience minor, permanent, direct, adverse impacts due to degradation from declining groundwater recharge. Floodwater overtopping county roadways and roadway damage would continue to occur, including erosion and loss of roadway surfacing (gravel) and road grade soils. While inundated during a flood, wetlands can become clogged by debris or scoured due to the erosive forces of floodwater, resulting in minor, short-term, direct, adverse impacts.

Diversion to Off-Channel Storage

Wetland delineations were performed in the project impact footprints in accordance with the 1987 Corps of Engineers Wetlands Delineation Manual and the Great Plains Regional Supplement to the Corps of Engineers Wetland Delineation Manual. The delineation identified wetlands (palustrine emergent temporarily flooded [PEMA], palustrine forested temporarily flooded [PFOA], and palustrine scrub-shrub temporarily flooded [PSSA]), streams (ephemeral), and open water habitat (Appendix E, Attachment 1).

All applicable provisions of the CWA and EO 11990 would be complied with during the permitting and construction of this alternative. The project would be permitted with a CWA Section 404 Individual Permit. Multiple steps were identified to avoid and minimize impacts on aquatic resources; however, impacts on water resources are anticipated. The placement of fill

associated with constructing the dam diversion structures would result in minor, permanent, direct, adverse wetland impacts. Other construction activities, such as vehicle traffic, would result in minor, short-term, direct, adverse impacts on wetlands. During 2-year flow events, the diversion of flow to off-channel storage areas would have minor, short-term, direct, adverse impacts on hydrology in the areas both upstream and downstream of the off-channel storage. See Table 5-2 and Appendix C, Figures 5-3A through Figure 5-3H for a summary of these impacts.

Table 5-2. Summary of Impacts on Aquatic Resources

Site	Permanent Impact (acres)	Temporary Impact (acres)
1	**0.00**	**0.04**
Riverine Wetland	0.00	0.04
2	**0.07**	**3.92**
Freshwater Pond	0.00	0.72
Freshwater Emergent Wetland	0.00	0.65
Riverine Wetland	0.00	1.27
PEMA Wetland	0.07	1.10
Open Water	0.00	0.18
4a	**0.03**	**2.85**
Freshwater Emergent Wetland	0.00	0.29
Riverine Wetland	**0.03**	**2.56**
5	**0.07**	**24.24**
Freshwater Pond	0.00	4.60
Freshwater Emergent Wetland	0.00	5.84
Riverine Wetland	0.00	0.08
PEMA Wetland	0.02	12.40
PUB Wetland	0.05	1.32
6	**0.08**	**6.75**
Freshwater Emergent Wetland	0.00	1.59
Riverine Wetland	0.00	3.71
PEMA Wetland	0.08	1.45
7	**0.00**	**0.004**
Riverine Wetland	0.00	0.004
8	**0.07**	**10.12**
Freshwater Emergent Wetland	0.00	3.88
Riverine Wetland	0.00	2.04
PEMA Wetland	0.07	4.05

Site	Permanent Impact (acres)	Temporary Impact (acres)
Open Water	0.00	0.15
9a	**0.51**	**6.64**
Freshwater Pond	0.00	0.08
Freshwater Emergent Wetland	0.00	0.13
PEMA Wetland	0.51	6.43
TOTAL	**0.83**	**54.56**

Source: HDR 2022

Channel/Infrastructure Improvements

All applicable provisions of the CWA and EO 11990 would be complied with during the permitting and construction of this alternative. The project would be permitted with a CWA Section 404 Individual Permit. Multiple steps were identified to avoid and minimize impacts on aquatic resources; however, impacts on wetlands are anticipated. Due to the nature of the work, all wetland impacts are presumed to be minor, permanent, direct, and adverse. No impacts on streams are anticipated. See Table 5-3 and Appendix C, Figure 5-4A through Figure 5-4I for a summary of these impacts.

Table 5-3. Summary of Impacts on Aquatic Resources

Site	Permanent Impact (acres)[1]
8	**0.06**
Freshwater Emergent Wetland	0.01
PEMA Wetland	0.05
10	**0.00**
11	**0.01**
PEMA Wetland	0.01
12b	**0.01**
Riverine Wetland	0.01
16	**0.00**
17	**0.20**
PEMA Wetland	0.20
20	**0.01**
Riverine Wetland	0.01
25	**0.06**
PEMA Wetland	0.06
27	**0.01**
Riverine Wetland	0.01
TOTAL	**0.36**

Source: HDR 2022
[1] Those impacts outside the originally delineated area were calculated using National Wetland Inventory features.

5.3.2 Surface Water Hydrology

No-Action Alternative

The continued use of groundwater for irrigation, including restrictions from the UNWNRD Ground Water Management Plan, and the continued flood damage to county roadway infrastructure and agricultural land would not impact surface water hydrology. The existing conditions of the Upper Niobrara HUC 8, Box Butte Creek HUC 10 watershed, Box Butte Creek and its tributaries, and the Niobrara River would remain unchanged. Therefore, the No-Action alternative would not result in any impacts on existing surface water hydrology conditions.

Diversion to Off-Channel Storage

This alternative would have a negligible, permanent, direct, adverse impact on surface water hydrology due to the diversion of small, frequent runoff events to off-channel storage basins. The diversion structures are designed with a culvert at the base of the structures to allow normal flows to continue through the structure and downstream, consistent with current conditions. The more frequent (and therefore larger) runoff events would be diverted through the bypass channel to the off-channel storage basin to promote groundwater recharge. After the off-channel storage basins are full (reached design capacity), any additional flows would return to Box Butte Creek. Indirect flows to Box Butte Creek would also occur due to groundwater migration to surface flows and/or return flows from irrigation.

The sites represent up to a total of approximately 43 percent of the total drainage area within the Box Butte Creek Watershed (Study Area). Therefore, surface water would not be diverted and would have no change in surface water flows in over half of the watershed.

Channel/Infrastructure Improvements

This alternative would not result in any impacts to surface water quantity. However, it would have a negligible, permanent, direct, adverse impact on the timing of small, frequent runoff events due to improved infrastructure (increased size and/or number of culverts) and raising the roadway elevation at roadway crossings. Smaller, frequent runoff events would be conveyed through new culverts over a slightly longer timeframe than the existing condition. Under the existing condition, the roadway overtops and therefore the time to convey smaller, frequent runoff events is less, but results in roadway damage. The time to convey larger, less frequent runoff events, would be similar between the proposed condition and the existing condition. Therefore, no impacts are anticipated for these larger, less frequent runoff events.

5.3.3 Water Quality

No-Action Alternative

The continued use of groundwater for irrigation, including the restrictions from the UNWNRD Ground Water Management Plan, and the continued flood damages of county roadway infrastructure and agricultural land would not impact water quality. The existing conditions of the Upper Niobrara HUC 8, Box Butte Creek HUC 10 watershed, Box Butte Creek and its

tributaries, and the Niobrara River would remain unchanged. Therefore, the No-Action alternative would not result in any changes to existing water quality conditions.

Diversion to Off-Channel Storage

This alternative may have a negligible, permanent, direct, beneficial impact on water quality due to reducing the nutrients from agricultural runoff by trapping pollutants and sediment in upland areas and decreasing pollutants and sediments in downstream waterbodies, including Box Butte Creek.

Channel/Infrastructure Improvements

This alternative is not anticipated to impact water quality. Improved culvert placement and design would allow water quality within the area to remain unchanged.

5.3.4 Groundwater

No-Action Alternative

The No-Action alternative would not result in any changes to existing groundwater conditions. Currently, recharge occurs across the watershed through water moving downward directly from rivers/creeks into the ground. Overall, the current recharge rates across the watershed are relatively low, ranging from approximately -0.4 to 3.0 inches/year (see areas in blue on Figure 1-3 that do not have active irrigation wells). At each off-channel site, recharge occurs from precipitation (rainfall and melting snow/ice) and excess irrigation water soaking into the ground and percolating to the water table. Some of the water that soaks into the ground as infiltration returns to the atmosphere through evaporation and transpiration and does not become recharge.

Diversion to Off-Channel Storage

This alternative would have minor, permanent, direct, beneficial impacts on groundwater due to the passive recharge of the groundwater supply. Table 5-4 describes the anticipated recharge rates for each site in terms of volume of water recharged over an average year; the units of recharge volume shown in Table 5-4 are acre-feet, which is equal to 1 acre of land covered with water 1 foot deep. This alternative involves diverting surface water to off-channel storage basin where water is allowed to pond which provides the conditions that promote the infiltration of water and increase passive groundwater recharge. Given the total inundation area of all eight recharge sites (off-channel) is 39 acres, the maximum volumetric rate of recharge the under exiting conditions (No-Action) is approximately 9.7 acre-feet/year. As is evident from the recharge rates shown in Table 5-4, the recharge rates anticipated with this alternative are all larger than the existing condition rate.

The water that infiltrates to groundwater then raises the water table up to the land surface, creating a mounding effect within the water table. The effect of the area influenced by the mounding of the water table can be thought of as being similar to an inverted cone. The radius of the mounded water table caused by the recharge of water at a given site is relatively small, ranging from approximately 200 feet up to nearly a half mile. Site 1 would have the largest areas

affected because it has the deepest initial water table and largest amount of mounding of the water table caused by the recharge water.

Table 5-4. Summary of Groundwater Recharge Rates

Site	Recharge Rate (acre-feet/year)
1	510
2	277
4a	34
5	605
6	277
7	288
8	200
9a	274

Source: HDR 2024

Channel/Infrastructure Improvements

This alternative is not anticipated to impact groundwater. Culvert placement and improvements would allow for groundwater recharge rates to continue unchanged.

5.3.5 Surface and Groundwater Management

No-Action Alternative

The NRDs and NeDNR would continue to administer groundwater and surface water rights, including the restrictions from the UNWNRD Ground Water Management Plan. The continued flood damages of county roadway infrastructure and agricultural land would not impact surface water and groundwater management. The existing groundwater wells would remain unchanged. Therefore, the No-Action alternative would not result in any changes to existing surface water and groundwater management conditions.

Diversion to Off-Channel Storage

This alternative would have a minor, permanent, direct, beneficial impact by helping to maintain the current well operations or permits and prevent further restriction of groundwater usage.

Channel/Infrastructure Improvements

This alternative is not anticipated to impact any well operations or permits.

5.3.6 Regional Water Management Plans and Agency Programs

No-Action Alternative

NeDNR would continue to administer and coordinate its water resource management programs in the watershed. Therefore, the No-Action alternative would not result in any changes to existing regional water management plans or agency program conditions.

Diversion to Off-Channel Storage

This alternative would have minor, permanent, beneficial, direct impacts on supporting the goals and objectives of the UNWNRD Integrated Management Plan, GWMP, and IMP due to the negligible impacts to surface water and groundwater described in Sections 5.3.2 and 5.3.4. This alternative would result in groundwater recharge that would help support the transition from Phase III to Phase I of the Rules and Regulations. This alternative would have no impact on the village of Hemingford wellhead protection area.

Channel/Infrastructure Improvements

As described in Sections 5.3.2 and 5.3.4, this alternative would have no impacts on surface or groundwater quantity and therefore would be consistent with the UNWNRD Integrated Management Plan, GWMP, and IMP.

5.3.7 Wild and Scenic Rivers

No-Action Alternative

The continued use of groundwater for irrigation, including the restrictions from the UNWNRD Ground Water Management Plan, and the continued flood damages to county roadway infrastructure and agricultural land would not impact wild and scenic rivers. The existing conditions of the Niobrara National Scenic River would remain unchanged. Therefore, the No-Action alternative would not result in any changes to wild and scenic rivers.

Diversion to Off-Channel Storage

This alternative would have a negligible, permanent, indirect, adverse impact on the surface water quantity in the drainage area of the Niobrara River above the confluence with Box Butte Creek due to the diversion of surface water from small, frequent runoff events into off-channel storage basins to promote groundwater recharge (see Section 5.18). However, those negligible impacts on surface water quantity would not impact the free-flowing condition of the Niobrara National Scenic River nor would it impede the recreational activities along the reach.

Channel/Infrastructure Improvements

As described in Sections 5.3.2 and 5.3.4, this alternative would have no impact on surface or groundwater quantity and therefore would not impact the free-flowing condition of the Niobrara National Scenic River nor would it impede the recreational activities along the reach.

5.4 Floodplains

5.4.1 No-Action Alternative

The continued use of groundwater for irrigation, including the restrictions from the UNWNRD Ground Water Management Plan, and the continued flood damages of county roadway infrastructure and agricultural land would not impact floodplains. The existing conditions of the floodplain would remain unchanged. Therefore, the No-Action alternative would have no impact on the 100- or 500-year floodplain.

5.4.2 Diversion to Off-Channel Storage

All the diversion to off-channel storage sites are located in a Zone A FEMA 100-year floodplain. Because the FEMA maps were developed using approximate methods, detailed hydraulic analyses were not been performed to generate FEMA FIRM mapping for the 1 percent and 0.2 percent annual-chance exceedance events (100- and 500-year events, respectively). Therefore, new hydraulic modeling was performed to identify the effects on the floodplain (see Appendix D for details about floodplain analysis methodology).

Modeling results indicate that changes to the 100- and 500-year modeled floodplain would occur due to the construction of the off-channel storage structures in the floodplain. Appendix C, Figures 5-5 A-1 through H-4 illustrate the extent of the existing and proposed modeled 100- and 500-year floodplain. While the modeled 100- and 500-year floodplain may differ from the FEMA-generated FIRM mapping, the impacts on regulated floodplains are anticipated to be moderate, permanent, direct, and adverse.

Impacts would be mitigated through further design refinements within the existing project footprint. Impacts that cannot be mitigated to a less than 1-foot rise would require coordination with local, state, and federal floodplain jurisdictions.

5.4.3 Channel/Infrastructure Improvements

Channel and infrastructure improvement sites 8, 10, 11, 20, and 25 are located in a Zone A FEMA 100-year floodplain. Because the FEMA maps were developed using approximate methods, detailed hydraulic analyses were not been performed to generate the FEMA FIRM mapping for the 1 percent and 0.2 percent annual-chance exceedance events (100- and 500-year events, respectively). Therefore, new hydraulic modeling was performed to identify the effects on the floodplain (see Appendix D for details about floodplain analysis methodology).

Modeling was also performed on sites 12, 16, 17, and 27, even though these sites are not in a FEMA-regulated floodplain, to assess effects on the modeled 100- and 500-year flood inundation areas. Modeling results indicate that changes to the 100- and 500-year flood inundation boundaries would occur due to the construction of the roadway improvements in the floodplain. Appendix C, Figures 5-6 A-1 through I-4 illustrate the extent of the existing and proposed modeled 100- and 500-year floodplain. While the modeled 100- and 500-year floodplain may differ from the FEMA-generated FIRM mapping, the impacts on regulated floodplains are anticipated to be moderate, permanent, direct, and adverse.

Impacts would be mitigated through further design refinements within the existing project footprint while still preventing roadway overtopping during smaller, frequent runoff events. Impacts that cannot be mitigated to a less than 1-foot rise would require coordination with local, state, and federal floodplain jurisdictions.

5.5 Air Quality

5.5.1 No-Action Alternative

The continued use of groundwater for irrigation, including the restrictions from the UNWNRD Ground Water Management Plan, and the continued flood damages of county roadway infrastructure and agricultural land would not impact air quality. Box Butte County would remain in attainment. Therefore, the No-Action alternative would have no impact on air quality.

5.5.2 Diversion to Off-Channel Storage

This alternative would result in minor, short-term, direct, adverse impacts on air quality during construction due to an increase in emissions. Construction activities that would generate emissions include earthwork (i.e., land clearing, ground excavation, and cut-and-fill operations), aggregate/material handling, construction of project structures, fugitive dust from soil disruption, and combustion emissions from the construction equipment and on-road vehicles. Emissions associated with construction equipment and on-road vehicles include criteria pollutants (PM2.5, PM10, carbon monoxide, ozone, and sulfur dioxide), greenhouse gases, and small amounts of air toxics. These emissions are expected to be within acceptable air quality standards. In addition, the following general actions would help to avoid or minimize impacts on air quality during construction:

- Minimize clearing vegetation in all construction work areas to lessen soil disturbance and keep the dust down
- Conduct construction activities in a manner to minimize the creation of dust, including measures such as limitations on equipment, speed, and/or travel routes
- Implement measures to minimize the transfer of mud onto public roads
- Maintain construction equipment in good working order
- Implement a fugitive particulate emission control plan that specifies steps to minimize fugitive dust generation
- Plan construction scheduling to minimize vehicle trips

5.5.3 Channel/Infrastructure Improvements

This alternative would result in minor, short-term, direct, adverse impacts on air quality similar to those described for the Diversion to Off-Channel Storage alternative. Similar actions would also be employed to help to avoid or minimize impacts on air quality during construction.

5.6 Ecologically Critical Areas

5.6.1 No-Action Alternative

The continued use of groundwater for irrigation, including the restrictions from the UNWNRD Ground Water Management Plan, and the continued flood damages of county roadway

infrastructure and agricultural land would not impact ecologically critical areas. The existing conditions of the Upper Niobrara River BUL would remain unchanged. Therefore, the No-Action alternative would have no impact on ecologically critical areas.

5.6.2 Diversion to Off-Channel Storage

The off-channel storage structures are located outside the Upper Niobrara River BUL. Therefore, no impacts on ecologically critical areas are anticipated. Additionally, the negligible impacts on surface water hydrology described in Section 5.3.2 are not anticipated to impact features, resources, or function of the Upper Niobrara River BUL.

5.6.3 Channel/Infrastructure Improvements

The channel/infrastructure improvements are located outside the Upper Niobrara River BUL. Therefore, no impacts on ecologically critical areas are anticipated.

5.7 Vegetation

5.7.1 Noxious Weeds and Invasive Species

No-Action Alternative

The continued use of groundwater for irrigation, including the restrictions from the UNWNRD Ground Water Management Plan, and the continued flood damages of county roadway infrastructure and agricultural land would not impact noxious weeds and invasive species. The existing Category 1, 2, and 3 plants of the Shortgrass Prairie and Sandhills Ecoregions would remain unchanged. Therefore, the No-Action alternative would have no impact on noxious weeds or invasive species.

Diversion to Off-Channel Storage

Noxious weeds and invasives species, including those described in Section 3.7.1, could be introduced or spread by heavy equipment and foot traffic traveling between sites. The potential spread of noxious weeds and invasives species would result in negligible, permanent, direct, adverse impacts on the native vegetation and existing vegetation at each site. Measures would be taken to avoid the introduction or spread of invasive species during the implementation of this alternative. This includes using seeding plans with certified native species to ensure erosion is minimized and invasive species or noxious weeds are not introduced or spread, locating access roads away from any known populations of invasive species, and cleaning equipment before arriving at and leaving the project site.

Channel/Infrastructure Improvements

Impacts on noxious weeds and invasive species and prevention measures would be similar to those described for the Diversion to Off-Channel Storage alternative.

5.8 Terrestrial and Aquatic Wildlife

5.8.1 Fish and Aquatic Resource and Terrestrial Wildlife

No-Action Alternative

The No-Action alternative would have no impact on existing terrestrial and aquatic wildlife due to the on-going implementation of the UNWNRD Groundwater and Integrated Management Plans. The UNWMRD actions are in place to prevent future declines, allow for drought management, and aid in the conjunctive management of ground and surface water resources, including ground and surface water quality and quantity that supports aquatic and terrestrial habitat and species. The continued flood damages of county roadway infrastructure and agricultural land would not impact fish and aquatic resources or terrestrial wildlife habitats.

Diversion to Off-Channel Storage

A desktop evaluation was completed of the Shortgrass Prairie and Sandhills Ecoregions of Nebraska Tier 1 Fish and Aquatic resources and Tier 1 Terrestrial resources. The evaluation assessed the habitat of the specific project impact areas and the likelihood of impact for each species (Appendix D, Attachment 5). Of the 71 Fish and Aquatic and Terrestrial Tier 1 species evaluated, 21 species were determined to have suitable habitat in the project impact areas and a potential for impact:

- Plains topminnow (*Fundulus sciadicus)*
- Potassium-loving fairy shrimp (*Branchinecta potassa)*
- Ghost tiger beetle (*Cicindela lepida)*
- Hourglass drone fly (*Eristalis brousii)*
- Iowa skipper (*Atrytone arogos iowa)*
- Monarch (*Danaus Plexippus)*
- Nine-spotted ladybird beetle (*Coccinella novemnotata)*
- Ottoe skipper (*Hesperia ottoe)*
- Regal fritillary (*Speyeria idalia)*
- Southern plains bumble bee (*Bombus fraternus)*
- Suckley's cuckoo bumble bee (*Bombus suckleyi)*
- Two-spotted skipper (*Euphyes bimacula Illinois)*
- Whitney underwing (*Catocala whitneyi)*
- Eastern red bat (*Lasiurus borealis)*
- Hoary bat (*Lasiurus cinereus)*
- Northern long-eared bat (*Myotis septentrionalis)*
- Plains spotted skunk (*Spilogale putorius interrupta)*
- Swift fox (*Vulpes velox)*
- Tricolored bat (*Perimyotis subflavus)*
- Eastern black rail (*Laterallus jamaicensis jamaicensis)*
- Eskimo curlew (*Numenius borealis)*

Construction of this alternative would result in the conversion of an upland environment to an aquatic environment by diverting water to an off-channel storage basin to promote ponding. The off-channel storage basins would have the capacity to store 6.6 to 40.6 acre-feet of volume depending on the site. Ponding conditions are likely to promote the development of a wetland fringe. The development of a 1-foot wetland fringe at each site would result in an additional 0.5 acre of wetland habitat project-wide. Therefore, this alternative would result in negligible, permanent, direct, beneficial impacts on those species whose preferred habitat consists of an aquatic environment due to increased habitat. This conversion would also have negligible,

permanent, direct, adverse impacts on those species whose preferred habitat consists of an upland environment due to decreased habitat. Species-specific conservation conditions that would minimize the effects to those species are described in Appendix E.

This alternative would alter the channel by placing a minimal amount of fill to construct the diversion berm. However, the hydrology in the channel would retain normal flows both up- and downstream of the diversion berm. There would be negligible, permanent, direct, adverse impacts on those species whose preferred habitat consists of an unobstructed channel due to the construction of the diversion berm. Species-specific conservation conditions that would minimize the effects on those species are described in Appendix E. Refer to Section 5.3.1 for temporary and permanent wetland and waterway impact quantities.

There would be minor, short-term, direct, adverse impacts on species due to disturbance caused by construction activities. BMPs minimize the effects on species are described in Appendix E.

Channel/Infrastructure Improvements

Impacts on fish and aquatic resource and terrestrial wildlife would be similar to those described for the Diversion to Off-Channel Storage alternative. Refer to Section 5.3.1 for temporary and permanent wetland and waterway impact quantities.

5.8.2 Migratory Birds and Eagles

No-Action Alternative

The continued use of groundwater for irrigation, including the restrictions from the UNWNRD Ground Water Management Plan, and the continued flood damages of county roadway infrastructure and agricultural land would not impact the birds or their habitats protected under the MBTA and BGEPA. Therefore, the No-Action alternative would have no impact on migratory birds and eagles.

Diversion to Off-Channel Storage

This alternative has the potential to impact the birds and their habitats protected under the MBTA and BGEPA. However, the project would comply with the MBTA and BGEPA. To avoid impacts on migratory birds, there would be no tree clearing from April 1 to July 15. Per the CERT report, there have been occurrences of bald eagles within 1 mile of the Box Butte Creek watershed. Eagle surveys would be conducted within 0.5 mile of each project site during leaf-off (dormant season) prior to construction. If bald eagles are nesting in the area, consultation with NGPC and USFWS would be initiated. In addition, burrowing owls are known to occur in close proximity to propose project sites. These areas will also be surveyed for the presence/absence of burrowing owls prior to the initiation of construction and, if present, avoidance measures would be implemented. Therefore, this alternative would have no impact on migratory birds and eagles due to using BMPs during construction.

Channel/Infrastructure Improvements

Impacts on migratory birds and eagles would be similar to those described for the Diversion to Off-Channel Storage alternative.

5.9 Endangered and Threatened Species

In the development of the Plan, a desktop evaluation of the identified state- and federally listed threatened and endangered species was completed using USFWS's IPaC and NGPC's CERT tools, to determine species that could be impacted by the construction of each alternative. Table 5-6 provides the list of those Endangered and Threatened Species evaluated for potential impacts for each alternative.

Table 5-5. Endangered and Threatened Species Evaluated for Impacts

Common Name	Species Name	Listing
Black-footed ferret	*Mustela nigripes*	FE; SE
Blacknose shiner	*Notropis heterolepis*	SE
Blowout penstemon	*Penstemon haydenii*	FE; SE
Eastern black rail	*Laterallus jamaicensis jamaicensis*	FT, ST
Eskimo curlew	*Numenius borealis*	FE; SE
Finescale dace	*Phoxinus neogaeus*	ST
Gray wolf	*Canis lupus*	FE; SE
Monarch butterfly	*Danaus plexippus*	Proposed Threatened
Northern long-eared bat	*Myotis septentrionalis*	FE; SE
Northern redbelly dace	*Phoxinus eos*	ST
Pallid sturgeon	*Scaphirhynchus albus*	FE; SE
Piping plover	*Charadrius melodus*	FT; ST
Rufa red knot	*Calidris canutus rufa*	FT; ST
Swift fox	*Vulpes velox*	SE
Tricolored bat	*Perimyotis subflavus*	Proposed Endangered
Suckley's cuckoo bumble bee	*Bombus suckleyi*	Proposed Endangered

Determinations of potential impacts from the alternatives are discussed below, with additional information in Appendix D, Attachment 5. Where impacts could not be completely avoided, conservation measures were identified to avoid any adverse impacts.

Early coordination was performed with the USFWS and NGPC (November 2020). Consultation was initiated with USFWS and NGPC on August 1, 2025. During the design and construction phase, consultation with both USFWS and NGPC will be required to further analyze impacts to listed or proposed species. A biological assessment will be completed at that time to compile and document any impacts, determinations, surveys, or additional information required for each alternative selected as the preferred alternative prior to any concurrence.

5.9.1 No-Action Alternative

The continued use of groundwater for irrigation, including the restrictions from the UNWNRD Ground Water Management Plan, and the continued flood damages of county roadway infrastructure and agricultural land would not impact the species or the habitat described in Section 3.9. Therefore, the No-Action alternative would have no impact on threatened or endangered species.

5.9.2 Diversion to Off-Channel Storage

An evaluation assessing the habitat and potential impacts to each species listed in Table 5-5 for this alternative is evaluated below. Further details and analysis can be found in Appendix D, Attachment 5.This alternative is within the NGPC-estimated range for black-footed ferret, Eastern black rail, Eskimo curlew, gray wolf, and rufa red knot. However, no known occurrences have been documented for these species and suitable habitat is absent or marginal. Therefore, no impacts to these species are anticipated resulting in a No Effect determination. If information becomes available that these populations may exist within or near the project area at the time of design and construction, technical assistance will be requested from USFWS and/or NGPC in regard to how to proceed.

There are no areas of active blowouts which could provide suitable habitat for blowout penstemon in proximity to the proposed sites. In addition, the areas near the proposed sites are unlikely to develop active blowouts based on soils features, topography and land use. Therefore, there will be no effect to that plant species.

Marginal habitat for piping plover could be present near proposed project sites on a temporary basis following implementation and the creation of bare soils in proximity to surface water features. This habitat is not expected to be persistent due to revegetation. If the sites were made suitable, avoidance measures including surveying for presence/absence of the species or avoiding nesting and brood rearing timeframes could be used to reduce the impacts to piping plover.

The Northern long-eared bat and the proposed tricolored bat have marginal suitable habitat present within the vicinity of the proposed project sites. No known or potential hibernacula are known to occur within several miles of the watershed. The potential may exist to require removal of deciduous trees or the modification of bridges or large culverts for construction of the proposed sites. These features could serve as roosting habitat for either bat species. Tree removal would be limited to that specified in project plans and contractors would understand clearing limits which would be marked in the field. Prior to any disturbance, either a survey to determine presence/absence of these species could be conducted or the action could be conducted outside of the active season (April 1 through October 31).

The presence of suitable habitat for swift fox near proposed project sites will necessitate the use of surveys for potential swift fox den sites during the design phase and again immediately prior to construction. These surveys would be conducted to avoid any direct impacts to swift fox which are actively using dens in the project area.

Aquatic species, including the blacknose shiner, finescale dace, Northern redbelly dace and pallid sturgeon do not have any on-site habitat present since the proposed project sites are located in stream segments which are frequently dry and without a flowing current. There is potential suitable habitat located downstream of the project sites. Pallid sturgeon are only known to occur at the extreme lower end of the Niobrara River and a great distance from the mouth of Box Butte Creek. The proposed features to be installed will not retain significant amounts of surface water and will not result in any measurable depletion or alteration of flows in the lower reaches of Box Butte Creek and the upper Niobrara River where the shiner and dace species are known to occur. Similarly, any depletions or alterations of flow would only cause minimal impacts to pallid sturgeon habitat. During the design phase, technical assistance from USFWS and NGPC can be obtained to aid in reducing any potential impacts to these aquatic species.

For the proposed threatened monarch butterfly and the proposed endangered Suckley's cuckoo bumble bee, the project footprint would be reduced to the maximum extent possible prior to construction to avoid impacts to perennial herbaceous vegetation and flowering plant species used for feeding. Best Management Practices would be employed during construction to limit habitat disturbance, including enforcing erosion control methods and limiting mowing and tillage. Following construction, all temporarily impacted areas would be returned to their pre-project conditions or possibly more favorable with the inclusion of flowing forbs in reseeding mixtures.

Therefore, with the implementation of applicable conservation measures, this alternative may affect but is not likely to adversely affect the piping plover, Northern long-eared bat, and swift fox. This alternative also may affect but is not likely to adversely affect aquatic species located downstream including blacknose shiner, finescale dace, Northern redbelly dace, and pallid sturgeon.

5.9.3 Channel/Infrastructure Improvements

Potential habitat and impacts for this alternative are similar to those discussed for the Diversion to Off-Channel Storage alternative. Further details and analysis can be found in Appendix D, Attachment 5. Therefore, with the implementation of applicable conservation measures, this alternative may affect but is unlikely to adversely affect the piping plover,Northern long-eared bat, and swift fox. This alternative also may affect but is not likely to adversely affect aquatic species located downstream including blacknose shiner, finescale dace, Northern redbelly dace, and pallid sturgeon.

5.10 Riparian Areas

5.10.1 No-Action Alternative

The continued use of groundwater for irrigation, including the restrictions from the UNWNRD Ground Water Management Plan, and the continued flood damages of county roadway infrastructure and agricultural land would not impact riparian areas. The reaches, ponds, wetlands areas, and riparian areas would remain unchanged. Therefore, the No-Action alternative would have no impact on riparian areas.

5.10.2 Diversion to Off-Channel Storage

The tree clearing required for construction and potential inundation in the diversion pool and off-channel storage areas would result in permanent, direct, adverse impacts on riparian areas. However, given there are a total of 42 acres of riparian forest in the project area, the impacts would be minor.

Additionally, construction of this alternative would result in the conversion of an upland environment to an aquatic environment by diverting water to an off-channel storage basin to promote ponding. Ponding conditions are likely to promote the development of additional riparian areas. The development of a 1-foot riparian area at each site would result in an additional 0.5 acre of riparian areas project-wide. Therefore, there would be a minor, permanent, direct, beneficial impact due to increased riparian areas.

5.10.3 Channel/Infrastructure Improvements

The tree clearing required for construction would result in permanent, direct, adverse impacts on riparian areas. However, given there are a total of 42 acres of riparian forest in the project area, the impacts would be minor.

5.11 Cultural Resources and Historic Properties

5.11.1 No-Action Alternative

The continued use of groundwater for irrigation, including the restrictions from the UNWNRD Ground Water Management Plan, would not result in a federal action or an immediate change to the surrounding lands. However, historic properties in the watershed, both known and undocumented, would continue to be at risk of damage due the continued flooding of county roadway infrastructure and agricultural land.

5.11.2 Diversion to Off-Channel Storage

No historic properties would be impacted by this alternative. Archaeological site 25SH20 is the only cultural resource within the APE, and it is not eligible for the National Register of Historic Places. No ground disturbance will occur within the boundaries of the site.

Visual impacts of the proposed off channel storage structures will be minimal. The structures will be less than 6 feet in height and will be vegetated with grasses to blend in with their surroundings. The off-channel storage structures will not be visible from any historic properties. There are no anticipated adverse cumulative impacts to cultural resources from this alternative.

5.11.3 Channel/Infrastructure Improvements

No historic properties will be impacted by the channel/infrastructure improvements. There are no historic properties within the APE for this alternative. Historic properties within the watershed, both known and undocumented, would continue to be at risk of damage due to flooding. There are no anticipated adverse cumulative impacts to cultural resources from this alternative.

5.12 Parklands & Recreation

5.12.1 No-Action Alternative

The continued use of groundwater for irrigation, including the restrictions from the UNWNRD Ground Water Management Plan, and the continued flood damages of county roadway infrastructure and agricultural land would not impact parklands or recreational lands. The four OFW properties in the project area, city parks, and county fairgrounds would remain unchanged and open to the public for use. Therefore, the No-Action alternative would have no impact on parklands and recreation.

5.12.2 Diversion to Off-Channel Storage

There would be no impact on the four OFW properties, city parks, or county fairgrounds because they are located away from the recharge sites.

5.12.3 Channel/Infrastructure Improvements

There would be no impact on the four OFW properties, city parks, or county fairgrounds because they are located away from the proposed road improvements.

5.13 Public Health and Safety

5.13.1 No-Action Alternative

The continued use of groundwater for irrigation, including the restrictions from the UNWNRD Ground Water Management Plan, would not impact public health and safety. However, under the No-Action alternative, flooding would continue to damage roads and threaten public health and safety. Overtopped roads can result in injuries and lack of access for emergency personnel during flood events, resulting in adverse impacts on public health and safety.

5.13.2 Diversion to Off-Channel Storage

This alternative is not anticipated to result in impacts on public health and safety.

5.13.3 Channel/Infrastructure Improvements

This alternative would have a minor, permanent, direct, beneficial impact to public health and safety due to the reduction in the occurrence of overtopped roads and increase access for emergency personnel during flood events.

5.14 Social and Economic Conditions

5.14.1 Population

No-Action Alternative

The continued use of groundwater for irrigation, including the restrictions from the UNWNRD Ground Water Management Plan, and the continued flood damage to county roadway

infrastructure and agricultural land would not impact the population. Development and connectivity in Box Butte, Dawes, and Sheridan Counties would remain unchanged. Therefore, no changes to the population are anticipated. The No-Action alternative would have no impact on population.

Diversion to Off-Channel Storage

This alternative would reduce the potential for restrictions on the use of groundwater for irrigated agriculture. The restoration of groundwater use would not result in additional irrigated acres or agricultural populations. Therefore, the proposed action would have no direct or indirect impacts on population and demographic trends in the counties or subwatersheds.

Channel/Infrastructure Improvements

This alternative would improve connectivity to existing rural residences during smaller, more frequent flooding events. Increased connectivity would not result in increased capacity or development. Therefore, the proposed action would have no direct or indirect impacts on population and demographic trends in the counties or subwatersheds.

5.14.2 Local and Regional Economy

No-Action Alternative

Under the No-Action alternative, economic activity in the region would continue to be limited by water resources, and road damage from flooding would continue to occur. Agriculture and the industries supporting agriculture are the primary economic drivers of Box Butte and Sheridan Counties. The current groundwater recharge decline threatens agricultural land use. In addition, road damage from flooding could impact travel in relation to agriculture and the industries supporting agriculture, potentially adversely impacting the local and regional economy.

Diversion to Off-Channel Storage

This alternative would reduce the potential for restrictions on the use of groundwater for irrigated agriculture. This reduction in restrictions would result in a minor, permanent, direct, beneficial impact on the local and regional economy by supporting local producers in capturing their investment in irrigation infrastructure and maximize cropland productivity. Increased productivity from local producers would support local and regional economies. Additionally, project construction may provide minor, short-term, direct, beneficial economic benefits if local residents are hired to work during construction.

Channel/Infrastructure Improvements

This alternative would have a minor, permanent, direct, beneficial impact to the local and regional economy by reducing flood damage to local county roadway systems, which are essential for local agricultural producers as well as property and homeowners. In rural areas where access is provided by only a single roadway system, reducing the frequency of roadway flooding would maintain local connectivity and support transportation to places of employment, access to all agricultural needs, and unrestricted movement of goods and services. Additionally,

construction may provide minor, short-term, direct, beneficial economic benefits if local residents are hired to work during construction.

5.15 Scenic Beauty

5.15.1 No-Action Alternative

The continued use of groundwater for irrigation, including the restrictions from the UNWNRD Ground Water Management Plan, and the continued flood damages of county roadway infrastructure and agricultural land would not have an immediate impact on scenic beauty. The viewshed would remain dominated by agricultural areas, including fields of corn and soybeans, rangeland, pastures, and alfalfa fields. Box Butte Creek, its tributaries, and their associated riparian and wetlands areas would remain unchanged. Therefore, the No-Action alternative would have no impact on scenic beauty.

5.15.2 Diversion to Off-Channel Storage

The construction of this alternative would result in the development of off-channel storage basins. Construction would have minor impacts on farmland and riparian areas (see Sections 5.2 and 5.3.1). However, throughout the study area, multiple storage basins, agricultural ponds, and open water areas are present. Therefore, because the project improvements would be consistent with other elements of the existing landscape, this alternative would have no permanent impact on scenic beauty.

The presence of heavy construction equipment and machinery would result in minor, short-term, direct, adverse impacts on the scenic beauty. Following construction, equipment and machinery would be removed.

5.15.3 Channel/Infrastructure Improvements

Following construction, the roadway would be slightly larger. However, the viewshed would still include the road and its adjacent, maintained ROW. Therefore, this alternative would have no permanent impact on scenic beauty.

Short-term impacts due to construction would be similar to those described for the Diversion to Off-Channel Storage alternative.

5.16 Land Use

5.16.1 No-Action Alternative

The continued use of groundwater for irrigation, including the restrictions from the UNWNRD Ground Water Management Plan, and the continued flood damages of county roadway infrastructure and agricultural land would not have an immediate impact on land use. Land use would remain primarily agricultural, including grassland and shrubland used for grazing and cultivated crops. Therefore, the No-Action alternative would have no impact on land use.

5.16.2 Diversion to Off-Channel Storage

For sites with pasture, construction of the alternative would convert portions of grazing areas to wallowing areas. This conversion would have no impact on land use because cattle would still be able to occupy the area. For sites with row crop agriculture, there would be a minor, permanent, direct, adverse impact on land use due to the conversion of agricultural land to an off-channel storage basin, removing those areas from being used for cultivated crops. See Section 5.2 for prime and unique farmland impacts.

5.16.3 Channel/Infrastructure Improvements

Following construction, the land use would still include the road and its adjacent, maintained ROW. Therefore, this alternative would have no impact on land use.

5.17 Ecosystem Services

Note that quantification of ecosystem service flow changes is provided in Table 5-10.

The resource concerns discussed in previous sections include all categories of ecosystem services present in the Box Butte Creek watershed. The ecosystem services evaluated for groundwater recharge include the groundwater available for irrigation, terrestrial and aquatic wildlife, and culture and heritage services. The ecosystem services evaluated for flood damage reduction include agricultural production, water quality, and culture and heritage services. Public scoping comments, planning documents, watershed plans from surrounding areas, and discussions with the project sponsor and federal agencies further suggest the project's primary benefits will result from groundwater recharge and flood damage reduction in the Box Butte Creek watershed.

Figure 5-1 and Figure 5-2 illustrate how the groundwater recharge and flood damage reduction actions would create social benefits in the Box Butte Creek watershed. The illustration, when used as part of the benefits-costs analysis, describes the changes in ecosystem composition all the way through to effects on social outcomes and human well-being. This project would change the ecological structure of the watersheds through the construction of water harvesting basins, which includes a diversion structure and berms for some locations, to obtain enough storage for groundwater recharge. Roadway improvements would increase the public's ability for safe travel on existing infrastructure and replace undersized drainage structures to provide protection from a defined damage storm.

The described changes would provide groundwater recharge in the Box Butte Creek watershed, increasing the value of groundwater availability for irrigation services. The Channel/ Infrastructure alternative would reduce the damages to public roadways and increase the value of water quality, flood damage reduction, and dependable infrastructure.

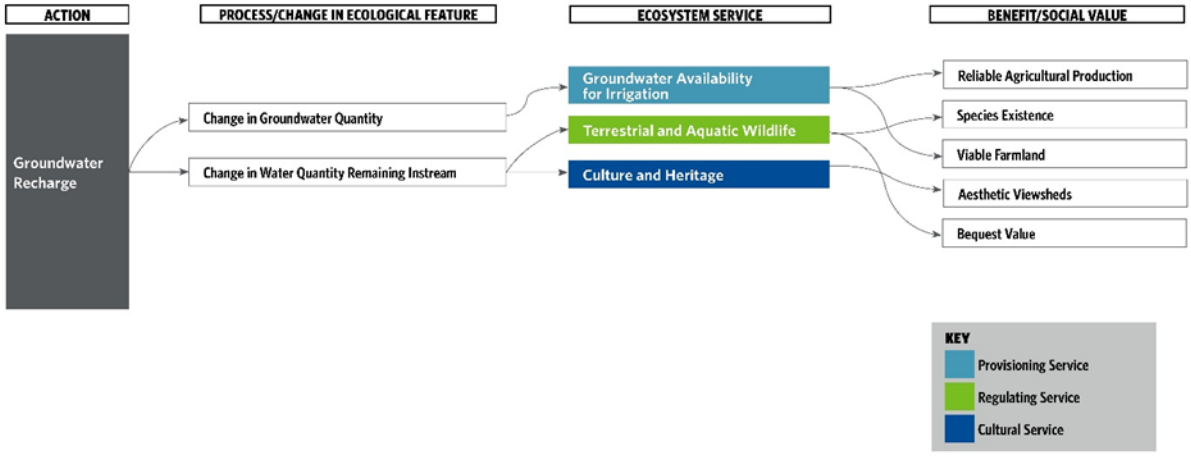

Figure 5-1. Ecosystem Services for Groundwater Recharge

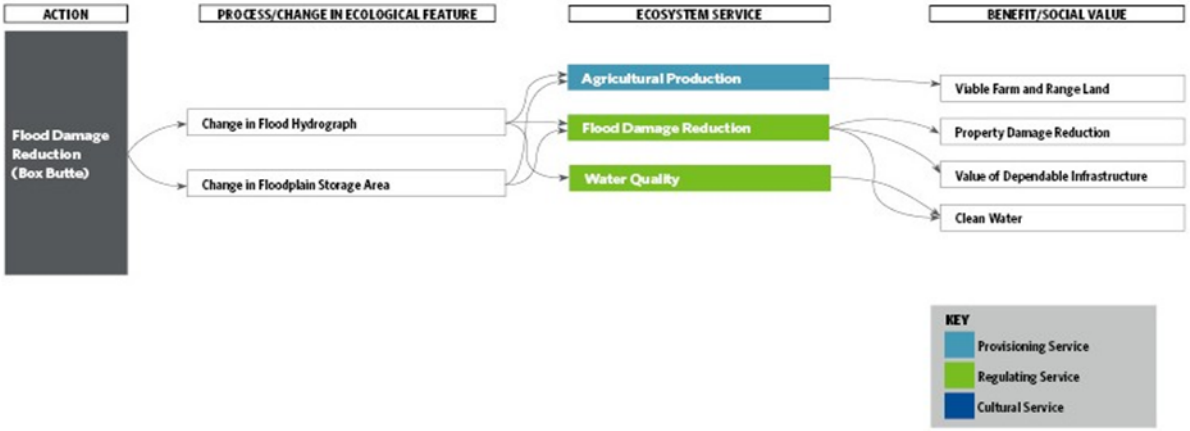

Figure 5-2. Ecosystem Services for Flood Damage Reduction

5.17.1 Prioritizing Services

Services were prioritized based on their expected contribution to groundwater recharge and flood damage reduction. As a result, ecosystem services shown in Figure 5-1 and Figure 5-2 were prioritized for analysis. While the primary benefits come from changes to regulating services, the project may result in smaller, secondary changes to other ecosystem services.

5.17.2 Ability to Characterize, Quantify, and Monetize Services

The passive groundwater recharge rates expected to occur at each of the eight on-channel storage (recharge) sites that are inclusive in the Dam Diversion to Off-Channel Storage

alternative were analyzed using a stepwise procedure. This stepwise procedure involves using a steady-state analytical equation for groundwater mounding height bounded on the upper end by the water supplies (from runoff) available to each site. The analytical equation is used in an iterative fashion to limit the recharge rate when the calculated mounding height is above the land surface. Further reductions in recharge rates follow, including multiplication by defined fractions based on the combined influence of silt and clay in the unsaturated zone (potentially limiting deep percolation to the water table) and evapotranspiration, in addition to reductions to account for all sites being in operation (i.e., reductions at sites affected by operation of upstream sites).

The resulting groundwater recharge rates are presented in terms of depth and volume per year in Table 5-6. In addition, Table 5-6 provides values for the storage volume for full (top of the berm) conditions, the average annual surface (field) runoff volume at each site, the calculated radius of influence, and the remaining depth to groundwater after the steady-state adjustment to the water table (i.e., mounding) has occurred.

Table 5-6. Groundwater Recharge Rates by Site

Site Number	Storage Volume at Top of Berm (acre-feet)	Average Annual (2007–2015) Runoff Rate (acre-feet/year)	Radius of Influence (feet)	Remaining Depth to Ground-water (feet)	Recharge Rate (ft/d)	Recharge Rate (acre-feet/year)
1	23.34	1,600	1,807	0.0	0.190	531
2	26.68	2,705	990	2.4	0.193	468
4a	18.07	1,022	533	46	0.006	35
5a	4.18	7,184	984	0.1	0.435	604
6	56.55	953	407	52	0.003	30
7	14.75	706	1,039	31	0.175	353
8	49.85	893	780	42	0.063	446
9a	56.24	8,747	188	0.0	0.042	328

Hydraulic modeling was performed to estimate the discharge capacity of existing roadway culverts and the resulting roadway overtopping frequency discharge on 12 site locations that experience routine flooding. These locations were selected based on damages resulting from 2019 flooding, as documented by UNWNRD and Box Butte County.

Table 5-7. Length of Damaged Roadway from the 1-Year Event

Site	Length (ft)
8a	183
8b	183
10	536
11	106
12a	76
12b	76
16	0
17	108

Site	Length (ft)
20a	311
20b	311
25	67
27	139

5.17.3 Metrics to Evaluate Services

Provisioning and regulating services are evaluated by quantifying and monetizing changes to the amount of groundwater recharge (groundwater availability for irrigation) and flood damage reduction. The monetized values are in Appendix D, Section 3.4.4.

5.17.4 No-Action Alternative

Provisioning Services

This alternative would have minor, long-term impacts on provisioning services (agricultural production). Continued groundwater decline would lead to a decrease in agricultural production. Continued road damage would lead to disruptions in supply chains used for delivery of commodity crops.

Regulating Services

This alternative would no impact on flood damage reduction and water quality services. Continued road damage would lead to increased impacts on public safety and a loss of delivery of commodity crops. No impact to water quality would occur.

Supporting Services

Supporting services refer to the underlying processes that maintain conditions for life and allow the other ecosystem services to exist. They are not evaluated in this plan.

Cultural Services

This alternative would not provide groundwater recharge nor provide flood damage reduction to rural infrastructure and therefore, continue to have minor, long-term impacts on cultural services

5.17.5 Diversion to Off-Channel Storage and Channel Infrastructure/Improvements Alternative

Provisioning Services

This alternative would have a moderate, long-term benefit on provisioning services. Groundwater recharge would occur via capture, infiltration would increase food production, and groundwater levels would increase, which would improve agricultural production and water quality services.

Regulating Services

This alternative would have a temporary impact due to construction. This alternative would have a moderate, long-term benefit on flood damage reduction with infrastructure improvements

(roadways) and a minor, long-term benefit to water quality with the reduction of sediment and erosion from roadways. A negligible, short-term impact would occur to water quality due to project construction.

Supporting Services

Supporting services refer to the underlying processes that maintain conditions for life and allow the other ecosystem services to exist. They are not evaluated in this plan.

Cultural Services

This alternative would have a moderate, long-term benefit on cultural services. Stress and the financial hardship caused by displacement and disruption from flooding would be alleviated with implementation of the project. Bequest value would also be improved by preserving the rural infrastructure.

5.18 Indirect Effects

Indirect impacts are caused by a project after installation and can occur at any time or any distance from the project. They are predictable, can be linked back to the project installation, and can be positive or negative. Indirect effects were considered for all resource topics.

The Diversion to Off-Channel Storage alternative would result in a negligible, permanent, indirect effect to the surface water quantity in the drainage area of the Niobrara River above the confluence with Box Butte Creek due to the diversion of surface water of small, frequent runoff events into off-channel storage basins to promote groundwater recharge. While surface water flows of smaller, more frequent runoff events would be diverted, normal flows and larger, less frequent runoff events would remain unchanged.

The smaller, more frequent runoff events that are diverted would be stored as groundwater in aquifers for future use either through groundwater migration to surface water systems (back to drainageways, streams, etc.) and/or through irrigation water runoff. Therefore, those flows that were initially diverted to the off-channel storage basins would eventually return to surface water systems.

In addition, the sites represent less than 2 percent of the total drainage area of the Niobrara River watershed above the confluence with Box Butte Creek. Because that area is so small and a portion of the diverted surface water would eventually return to surface water systems, the change in surface water volume delivered to the Niobrara River would be negligible.

No indirect effects are anticipated as a result of implementation of the Channel Conveyance/Infrastructure Improvements alternative.

5.19 Cumulative Impacts

Cumulative impacts analysis is required by PR&G and include both direct and indirect impacts of a proposed project and any other past or future projects. Reasonable, foreseeable actions should be carried through planning or design.

5.19.1 Past Projects

Past projects include the development of groundwater irrigation wells in the study area. Through documentation of groundwater well registration (NeDNR 2025), the number of groundwater wells increased from 44 during the period of 1947 to 1969 to 101 from 1970 to 1979, a 130 percent increase. From 1980 to 2002, well installation slowed to less than 2 wells per year. The years 2003 and 2004 saw an increase in installation (approximately 6.5 per year). From 2005 to 2025, well installation averaged less than 1 per year. As documented in Section 1.2.1, groundwater use for agricultural irrigation has contributed to the increase in irrigated acres and the decline in aquifer storage levels and volume.

Past projects also include routine county roadway maintenance and repair following flood damages. Routine roadway maintenance includes grading rural gravel roadways and ditch cleanout. Roadway repair resulting from flood damage includes roadbed repair and raising and culvert replacements. In addition to expenditure of county funds, roadway maintenance and repair have negligible, short-term, indirect, adverse effects on air quality.

5.19.2 Current Projects

This Plan is the only current NRCS watershed plan for the area, and no other current projects were identified during scoping.

5.19.3 Reasonably Foreseeable Future Actions

There were no specific reasonably foreseeable future actions identified during scoping.

General reasonably foreseeable future actions in the study area include the continued use of groundwater for agricultural irrigation, which would be managed through the UNWNRD Ground Water Management Plan and the 2009 Integrated Management Plan. Due to the implementation of these management plans, future declines in aquifer storage and volume are not anticipated. However, continued restrictions on groundwater use on a seasonal basis would continue to occur.

Routine county roadway maintenance and maintenance following flood damages would also continue.

5.19.4 Cumulative Effects

Diversion to Off-Channel Storage

The Diversion to Off-Channel Storage alternative, combined with other past, present, and reasonably foreseeable future actions, would have the following effects:

- Beneficial, permanent, direct effect on existing irrigated agricultural land use due to the anticipated reduction in the restrictions on irrigation use allowed by the UNWRD in the study area

- Beneficial, permanent, direct effect on groundwater levels due to the anticipated increase in groundwater recharge that would occur due to implementation of this alternative combined with ongoing UNWRD management policies

- No effect on all resources due to the nonexistent or combined negligible effects of these actions

Channel/Infrastructure Improvements

The Channel/Infrastructure Improvements alternative, combined with other past, present, and reasonably foreseeable future actions, would have the following effects:

- Negligible, short-term, indirect, adverse impacts on air quality due to the potential for overlapping construction activities for the alternative and roadway maintenance and/or repair activities. Collectively, these effects would be minimized to the greatest extent possible due to the implementation of BMPs identified in Section 5.5.2.

- No effect on all resources due to the nonexistent or combined negligible effects of these actions.

5.20 Possible Conflicts with Plans and Policies

No potential conflicts among land use plans, regional water resource management plans, policies, or controls for the area were identified.

5.21 Risk and Uncertainty

Proposed alternatives and projects could change in cost and benefits in coming years. The cost and benefits were evaluated based on an estimated life of 100 years. All estimated costs and benefits are subject to change due to local, regional, or world economics. Further uncertainties in economic calculations are detailed in Appendix D, Attachment 3. Uncertainty is also involved in the hydrology and hydraulics analysis, including limited terrain and hydraulic structure data. Further uncertainties in the hydrology and hydraulics analysis are detailed in Appendix D, Attachment 1. Preliminary analysis suggests that geological materials at any project site should not impose any impacts to future designs. Geological and geotechnical investigations will be completed during the design phase of the project to support these initial analyses and confirm material suitability for any structures installed. However, investigations could reveal unknown material characteristics that could affect potential designs.

Variability in weather conditions has the potential to affect existing infrastructure, economies, and the environment. Future weather patterns are anticipated to include increased heavy precipitation and runoff events nationally, including Nebraska (UNL 2014), which is likely to lead to increases in flood frequency, intensity, or water volumes. As it relates to the proposed action,

the risk of short- and long-term weather changes has been considered as part of the conceptual design and will continue to be a factor of consideration during final design.

5.22 Precedent for Future Actions with Significant Impacts

The proposed action does not set a precedent for future actions with significant impacts. Future projects to mitigate groundwater recharge declines and flood damage in the project area would be analyzed on their own and evaluated for effects on resources identified during a separate scoping process.

5.23 Controversy

The existing landowners and agencies largely support the implementation of the project. During alternative development, public scoping comments were taken into consideration and addressed.

5.24 Alternative Summary and Comparison

Table 5-8 details the environmental effects/impacts and ecosystem services trade-offs between alternatives. Table 5-9 provides a summary and comparison of the alternatives selected for detailed study. This summary includes items identified in Chapter 2 and detailed in Chapter 3.

Table 5-8. Environmental Effects/Impacts and Ecosystem Services Trade-offs

Ecosystem Service Trade-Offs	Item or Concern	No Action Alternative	Diversion to Off-Channel Storage and Channel Infrastructure/Improvements Alternative
Provisioning	Agricultural Production	Minor, long-term, adverse impacts	Moderate, long-term, beneficial impacts
Provisioning	Groundwater	Moderate, long-term, adverse impacts	Moderate, long-term, beneficial impacts
Provisioning	Road Damage	Minor, long-term, adverse impacts	Moderate, long-term, beneficial impacts
Regulating	Flood Damage	No change	Moderate, long-term, beneficial impacts
Regulating	Water Quality	No change	Minor, long-term, beneficial impacts (alternative) Negligible, short-term, adverse impacts (construction)
Regulating	Public Safety	Minor, long-term, adverse impacts	Minor, long-term, beneficial impacts
Supporting	N/A	N/A	N/A
Cultural	Groundwater Recharge	Minor, long-term, adverse impacts	Moderate, long-term, beneficial impacts
Cultural	Flood damage Reduction	Minor, long-term, adverse impacts	Moderate, long-term, beneficial impacts

Table 5-9. Summary and Comparison of Selected Alternative Impacts on Resource Concerns

Item or Concern	No Action/Future Without Federal Investment	Diversion to Off-Channel Storage	Channel/Infrastructure Improvements
Soils			
Geology	No change.	No impact.	No impact.
Erosion and sedimentation	Minor, permanent, direct, adverse impact on existing erosion rates.	Negligible, short term, direct, adverse impact associated with construction. Negligible, permanent, direct, adverse impacts due to minor amounts of sedimentation.	Negligible, short term, direct, adverse impact associated with construction. Minor, permanent, beneficial impacts due to less erosion and sedimentation during future flood events.

Item or Concern	No Action/Future Without Federal Investment	Diversion to Off-Channel Storage	Channel/Infrastructure Improvements
Prime and Unique Farmland			
Prime and Unique Farmland	Minor, permanent, direct, adverse impacts due to continued irrigation restrictions.	Minor, permanent, direct, adverse impacts to 33.2 acres and minor, short term, direct, adverse impacts to 37.4 acres of agriculturally important lands.	No impact.
Water Resources			
Wetlands and Waters of the United States	Minor, permanent, direct, adverse impacts due to degradation from declining groundwater recharge.	Minor, permanent, direct, adverse impacts to 0.83 acre and minor, short term, direct, adverse impacts to 54.56 acres of aquatic resources.	Minor, permanent, direct, adverse impacts to 0.36 acre.
Surface Water Hydrology	No change.	Negligible, permanent, direct, adverse impact.	No impact on surface water quantity. Negligible, permanent, direct, adverse, impact on the timing of small, frequent runoff events.
Water Quality	No change.	Negligible, permanent, direct, beneficial impact.	No impact.
Groundwater	No change. Continued depletion.	Minor, permanent, direct, beneficial impact due to increased passive recharge.	No impact.
Surface and Groundwater Management	No change.	Minor, permanent, direct, beneficial impact.	No impact.

Item or Concern	No Action/Future Without Federal Investment	Diversion to Off-Channel Storage	Channel/Infrastructure Improvements
Regional Water Management Plans and Agency Programs	No change.	Minor, permanent, direct, beneficial impact. Compliant with regional water management plans and agency programs.	No impact. Compliant with regional water management plans and agency programs.
Wild and Scenic Rivers	No change.	Negligible, permanent, indirect, adverse impact.	No impact.
Floodplains			
Floodplains	No change.	Moderate, permanent, direct, adverse impact.	Moderate, permanent, direct, adverse impact.
Air Quality			
Air Quality	No impact.	Minor, short-term, direct, adverse impact during construction.	Minor, short-term, direct, adverse impact during construction.
Ecologically Critical Areas			
Ecologically Critical Areas	No change.	No impact.	No impact.
Vegetation			
Noxious Weeds and Invasive Species	No impact.	Negligible, permanent, direct, adverse impacts on native vegetation.	Negligible, permanent, direct, adverse impacts on native vegetation.
Terrestrial and Aquatic Wildlife			

Item or Concern	No Action/Future Without Federal Investment	Diversion to Off-Channel Storage	Channel/Infrastructure Improvements
Fish and Aquatic Resource and Terrestrial Wildlife	No impact.	Negligible, permanent, direct, beneficial impacts on aquatic species. Negligible, permanent, direct, adverse impacts on upland species. Negligible, permanent, direct, adverse impacts on unobstructed channel habitat.	Negligible, permanent, direct, beneficial impacts on aquatic species. Negligible, permanent, direct, adverse impacts on upland species. Negligible, permanent, direct, adverse impacts on unobstructed channel habitat.
Migratory Birds and Eagles	No impact.	No impact.	No impact.
Endangered and Threatened Species			
Endangered and Threatened Species	No impact.	May affect, not likely to adversely affect with the implementation of conservation conditions.	May affect, not likely to adversely affect with the implementation of conservation conditions.
Riparian Areas			
Riparian Areas	No impact.	Minor, permanent, direct, adverse impact due to tree clearing. Minor, permanent, direct, beneficial impact due to increased ponding.	Minor, permanent, direct, adverse impact due to tree clearing.
Cultural Resources and Historic Properties			

Item or Concern	No Action/Future Without Federal Investment	Diversion to Off-Channel Storage	Channel/Infrastructure Improvements
Cultural Resources and Historic Properties	No change.	No impact.	No impact.
Parklands & Recreation			
Parklands & Recreation	No impact.	No impact.	No impact.
Public Health and Safety			
Public Health and Safety	No change.	No impact.	Minor, permanent, direct, beneficial impact.
Social and Economic Conditions			
Population	No impact.	No impact.	No impact.
Local and Regional Economy	No change.	Short-term, minor, direct, beneficial impacts due to construction. Minor, permanent, direct, beneficial impact by supporting local producers.	Short-term, minor, direct, beneficial impact due to construction. Minor, permanent, direct, beneficial impact by reducing flood damages.
Scenic Beauty			
Scenic Beauty	No impact.	Minor, short-term, direct, adverse impacts due to construction.	Minor, short-term, direct, adverse impacts due to construction.
Land Use			

Item or Concern	No Action/Future Without Federal Investment	Diversion to Off-Channel Storage	Channel/Infrastructure Improvements
Land Use	No impact.	Minor, permanent, direct, adverse impact for cultivated crops.	No impact.

Table 5-10 provides a comparison of the effects of each alternative for its contribution to the federal objective and each of the guiding principles using an ecosystem services approach.

In terms of tradeoffs, the preferred alternative's investment in the watershed would generate significant public benefit by promoting ponding, infiltration, and passive groundwater recharge; reducing flood damage; and reducing costs to repair infrastructure as compared to the FWOFI. While the FWOFI does not require any investment of public money, the tradeoff with avoiding monetary infrastructure investments is accepting continued decline in groundwater levels and continued damage to infrastructure in the Box Butte Creek Watershed as compared to the alternative plans. Table 5-10 shows that the annual net benefits are negative with all sites included from each alternative plan. Additional discussion about the cost of individual sites in each alternative is located in Chapter 7 as is the Benefit-Cost Analysis (BCA) for individual sites within each alternative.

Table 5-10. Summary and Comparison of Alternative Plans

Item or Concern	No Action/Future Without Federal Project	Diversion to Off-Channel Storage (Passive Recharge)	Channel/Infrastructure Improvements
Alternative Plans			
Locally preferred		X	X
National Economic Efficiency (NEE)		X	X
Environmentally preferred		X	X
Socially preferred		X	X
Nonstructural	X		
PR&G Guiding Principles			
Healthy and resilient ecosystems[1]		X	X
Sustainable economic development[1]		X	X
Floodplains[1]		X	X
Public safety		X	X
Watershed approach	X	X	X
Provisioning Services			
Agricultural production	A moderate, long-term effect would occur with continued disruption to delivery of commodity crops. No benefit would occur to agricultural production, and no groundwater recharge would occur.	A moderate, long-term benefit would occur, allowing groundwater recharge to increase agricultural production.	A moderate, long-term benefit would occur with no disruption to delivery of commodity crops.
Regulating Services			

Item or Concern	No Action/Future Without Federal Project	Diversion to Off-Channel Storage (Passive Recharge)	Channel/Infrastructure Improvements
Flood damage reduction	A moderate, long-term effect would occur with continued road damage.	Not applicable[2]	A moderate, long-term benefit would occur with increased safety to the traveling public.
Water quality	No effect. The existing surface water quality would remain unchanged.	A temporary, short-term, negligible effect would occur due to project construction. No long-term effects on water quality would occur.	A short-term, negligible effect would occur due to project construction. A minor, long-term, benefit on water quality would occur due to reduced road materials being transported during flood events.
Cultural Services			
Culture and heritage	No effect due to no project construction.	A minor, short-term effect due to project construction.	A minor, short-term effect due to project construction.
NEE Analysis			
Installation Costs			
Federal PL-566 (NRCS contribution)	$0	$6,264,211	$56,940
Sponsor contribution	$0	$2,734,279	$1,194,534
TOTAL	$0	$8,998,490	$1,251,474
Average Annual Cost			
Installation	$0	$301,122	$43,558
Operation and maintenance	$0	$6,500	$59,674
Other	Not applicable	Not applicable	Not applicable

Item or Concern	No Action/Future Without Federal Project	Diversion to Off-Channel Storage (Passive Recharge)	Channel/Infrastructure Improvements
TOTAL	**$0**	**$307,622**	**$94,268**
Annual Benefits	**$0**	**$186,031**	**- $60,687**
Annual Costs	**$0**	**$307,622**	**$94,268**
Annual Net Benefits	**$0**	**-$121,590**	**-$154,954**

[1] Represents the federal objective.
[2] Not applicable to this alternative because the action is specific to the related project purpose.
[3] Negligible impacts are generally those that might be perceptible but at a lower level of detection. A minor effect is slight but detectable. A moderate effect is readily apparent. Major or significant effects are those that, in their context and because o f their magnitude (severity), have the potential to meet the threshold for significance and warrant heightened attention and examination of potential means for mitigation to fulfill the policies set forth in NEPA.
[4] Beneficial effects include only those related to labor income and do not include the net economic benefits quantified in the NEE.
[5] Adverse effect annualized includes only the direct costs (no indirect/induced costs included).
[6] Prepared January 2025.

6 Preferred Alternative

6.1 Rationale for the Proposed Action (Preferred Alternative)

Alternative 2 (Dam Diversion to Off-Channel Storage) and Alternative 3 (Channel/Infrastructure Improvements) both meet their related project purposes and need. Both alternatives were evaluated for environmental considerations and economic efficiency. Environmentally, the impacts to resources were reviewed for each of the independent measures (dam diversion to off-channel storage sites 1, 2, 4a, 5, 6, 7, 8, and 9 and channel/infrastructure improvement sites 8, 10, 11, 12b, 16, 17, 20, 25, and 27). The environmental review didn't identify any significant impacts or other environmental consequences that were of special concern.

Economically, the average annual benefits of the Dam Diversion to Off-Channel Storage alternative has a negative net benefit of -$96,955 and a benefit-cost ratio (BCR) of 0.66. Through incremental analysis, Sites 1, 5, and 7 are all incrementally justified, yielding an average annual net benefit of $105,818 and a BCR of 1.48. The Channel/Infrastructure Improvements alternative has a negative net benefit of -$156,330 and a BCR of -0.63. Through incremental analysis, Sites 11, 12b, and 16 are all incrementally justified, yielding an average annual net benefit of $18,192 and a BCR of 1.22.

The sites that are incrementally justified for each alternative were combined to formulate the preferred alternative (Alternative 4). The preferred alternative has an average annual net benefit of $128,090 and a BCR of 1.43. See Appendix C for the conceptual design drawings for Alternative 4.

6.2 Measures to Be Installed

The preferred alternative would involve constructing three (Site 1, 5, and 7) on-channel dam diversion structures to off-channel storages (or catchment) to promote ponding, infiltration, and passive groundwater recharge. Each dam diversion to off-channel storage (passive recharge) sites would include the construction of a low earthen dam diversion structure, which would be designed to divert portions of run-off event flows to an off-channel storage basin (or catchment) and to have all other flows generated from runoff events overtop the structure at a controlled location. A culvert pipe would be placed in the dam diversion structure to allow for normal flows to pass. These dam diversion structures would be designed to meet NeDNR criteria (NeDNR 2008) for either Minimal Hazard potential (a dam failure or misoperation would likely result in no economic loss beyond the cost of the structure itself and limited to the property owner) or Low Hazard potential (a dam failure or misoperation would result in no probable loss of human life and low economic loss). In addition, these dam diversion structures would meet NRCS Conservation Practice Standard 348 (Dam, Diversion). The dam diversion structure would effectively convey water to an off-channel storage basin (catchment). These basins would be excavated in the floodplain adjacent to the diverted water source. The off-channel storage basin depth would be no deeper than the bottom elevation of the diverted water source. Side slopes

would be a minimum of 3:1. Extension of the dam diversion structure would be placed around the off-channel storage basins, as site topography dictates, to contain the desired storage volume. The dam diversion extension elevation would be set at the elevation of the in-channel dam diversion structure. HDR reviewed existing soil survey data (USDA NRCS 2025) for the excavated areas of the off-channel storage basins for its use as borrow material for the dam diversion structures. For these structures (less than 6 feet high), the excavated material is suitable. Cost estimates for potential geological and geotechnical investigations have been included in the engineering costs. Geotechnical investigations would be completed, as needed, for design purposes. The contingency added to the project accounts for potential to obtain borrow from a permitted off-site source.

The preferred alternative would also include conducting road improvements at three locations (Site 11, 12b, and 16). Road improvements for each site would consist of raising the roadbed by a maximum of 2 feet and increasing the capacity of flow conveyance by adding and/or enlarging the culverts under the roadway.

6.3 Irreversible or Irretrievable Commitment of Resources

Irreversible effects are those caused by the Proposed Action that cannot be reversed and are considered permanent. Irretrievable effects are gains and losses of outputs such as land use and may occur in the short term or long term.

The Proposed Action (Preferred Alternative) would require construction equipment and materials and other energy in the form of labor and fossil fuels. Using these items would generally be irretrievable. No components of the Proposed Action would be retrievable. The expenditure of financial resources is irretrievable in the short-term, but the investment would reduce long-term risks to critical infrastructure.

6.4 Areas of Controversy

No areas of controversy have been identified relative to the Proposed Action (Preferred Alternative). No comments of opposition to the project were received during the 30-day public review period, and no new issues of concern were raised.

6.5 Permits and Compliance

Under implementation of the Proposed Action (Preferred Alternative), the following permits are required:

- Section 404 of the CWA;
- Section 401 State Water Quality Certification;
- Ground disturbance permit with erosion and sedimentation control plan; and
- Construction permits.

As required by NEPA and NRCS Planning policy, State DEC Project review, Section 7 ESA consultation, and Section 106 of the NHPA have been completed for the planning phase and documented throughout the Plan. Ongoing consultation would be carried out as required, such as for updating ESA Section 7 consultation at specific time intervals.

As required by FEMA, impacts to FEMA-regulated 100- and 500- year floodplains that cannot be mitigated to a less than 1-foot rise would require coordination with local, state, and federal floodplain jurisdictions. Coordination would include development of a Certified Letter of Map Revision (CLOMR), notification to landowners, and potential purchase of additional flowage easements.

The NRCS has determined that it has fulfilled its responsibilities under the following laws, regulations, policies, and guidance, as shown in Table 6-1.

Table 6-1. Compliance with Federal Laws and Responsibilities

Laws, Regulations, Policies, and EOs	Yes	N/A
Section 7(a)(2) of the ESA, PL 93-205, ESA	Yes	
PL 94-265 provisions of the Magnuson-Stevens Act, EFH		N/A
Section 12 PL 83-566	Yes	
Section 106 of the NHPA	Yes	
Tribal Interests: PL 89-655, NHPA; PL 95-341, AIRFA; PL 101-601, NAGPRA; PL 103-344, AIRFA Amendments of 1994; PL 92-203, Alaska Native Claim Settlement Act; PL 93- 638, Indian Self-Determination and Education Assistance Act; EOs 13007 and 13175; Secretarial Orders (SO) 3206 and 3403; Office of Science and Technology Policy30/CEQ Joint Memoranda, Indigenous Knowledge; PM, Government-to- Government Relations; PM, Uniform Standards; 230- GM, Part 403, Special Emphasis Programs; 410-GM, Part 405, American Indians and Alaska Natives; 190-NI, Part 315, TALC; Departmental Regulation (DR) 1350-001, Tribal Consultation; DR 1340-007, Policies on American Indians and Alaska Natives	Yes	
CZMA – PL 92-583, Coastal Zone Management Act (CZMA)		N/A
Wild and Scenic Rivers Act, PL 90-542	Yes	
Section 408 – 33 USC 408		N/A
PL 99–198, Title XII, The Food Security Act of 1985	Yes	
Prime and Unique Farmland, Farmland of Statewide or Local Importance: FPPA, PL 97-98, FPPA	Yes	
Waters of the United States (U.S.), including Wetlands: PL 112-328, Federal Water Pollution Control Act, CWA	Yes	
Water Quality: PL 112-328	Yes	

Laws, Regulations, Policies, and EOs	Yes	N/A
NRCS Wetland and Highly Erodible Land Policy (PL 99–198, Title XII, The Food Security Act of 1985), HEL	Yes	
Other		N/A

6.6 Mitigation of Potential Effects

During construction, site mitigation measures would include erosion and sediment control, dust control, and other practices identified during the design process. BMPs would be implemented during construction to minimize the mobilization of the sediment into stream systems. Typical BMPs include silt fencing, bank stabilization, construction entrances, sediment storage, matting, and grassing/vegetative cover.

The project would be permitted with a CWA Section 404 Individual Permit. At this time, permanent impacts to jurisdictional wetlands are below the current threshold (0.1 acre) that require mitigation. All applicable provisions of the CWA and EO 11990 would be complied with during the permitting and construction of this alternative.

6.7 Costs and Cost Sharing

Cost sharing between PL 83-566 and other sources is shown in Table 6-3 through Table 6-10.

Construction costs for program measures are direct costs for installation (Table 6-3). Construction includes such items as excavation, staging of materials, labor and material costs, and seeding of disturbed areas with native species. Engineering services include the direct cost of engineers and other technicians for surveys, investigations, designs, and preparation of plans and specifications for program measures and the preparation of operation and maintenance plans.

Project administration costs include the cost of contract administration, review of engineering plans prepared by others, contract administrators, and inspection services during construction.

Land rights costs are direct and related costs for the right to install, operate, and maintain works of improvement and are borne entirely by the Sponsor.

6.8 Ecosystem Services Benefits

The Proposed Action (Preferred Alternative) would protect ecosystem services from impacts of declining groundwater recharge and flooding and would enhance some services through installation. This would include increased food production and groundwater levels, which would improve agricultural production and water quality services. It is expected to improve conditions related to all Guiding Principles: Healthy and Resilient Ecosystems, Sustainable Economic Development, Floodplains, Public Safety, and Watershed Approach.

6.9 Installation and Financing

This subsection details the installation and financing requirements associated with the Proposed Action (Preferred Alternative).

6.9.1 Installation

Works of improvement would be installed over a 2-year period following authorization of Federal assistance under the Watershed Protection and Flood Protection Act, PL 83-566. Final design and installation of the works of improvement would commence upon approval of the Plan.

6.9.2 Responsibilities

Responsibilities for carrying out a site-specific project would be shared between NRCS and the Sponsors as follows:

NRCS

- Provide overall project administration;
- Provide engineering design and construction inspection for works contracted by NRCS;
- Provide engineering designs for works contracted by Sponsors;
- Complete all required Federal, Tribal, State, and local consultation processes;
- Provide funds to Sponsors for preparing engineering designs and construction inspection for works contracted by Sponsors;
- Provide up to 75 percent of the construction costs. The cost-share rate is to be commensurate with other national programs at the time of signing project agreements; and
- Provide funds to Sponsors for project management and engineering typically performed by NRCS to implement projects.

Sponsors

- Provide up to 25% of construction cost for project and contract administration costs for installing works of improvement;
- Acquire any land rights necessary for installing the works of improvement;
- Bear the costs of relocating or modifying utilities and construction of infrastructure improvements;
- Secure all required Federal, State, and local permits;
- Provide operation and maintenance of all components of installed works of improvement;
- When funded by NRCS, provide project management and engineering typically performed by NRCS to implement projects

6.9.3 Contracting

This project would be constructed through project agreements between NRCS and the Sponsor for that site by means of a federal contract, local contract, division of work, or force account.

6.9.4 Real Property Rights

The Sponsors would be responsible for acquiring the real property rights and rights-of-way necessary to install, operate and maintain the works of improvement. The Sponsors would also be responsible for the satisfactory relocation or modification of any utilities disturbed as a result of the project.

6.10 Operations, Maintenance, and Replacement

Operation includes the administration, management, and performance of non-maintenance actions needed to keep each completed practice safe and functioning as planned. Maintenance includes the performance of work, preventing deterioration of installed practices, and repairing damage or replacement of the practice if one or more of its components fail. Damages to completed practices caused by normal deterioration, drought, flooding, sedimentation, or vandalism are considered normal maintenance. A conservative estimate of annual sediment volume and storage capacity for each of the off-channel storage basin structures was calculated using the Daily Erosion Project (DEP) tool operated by Iowa State University and NRCS Web Soil Survey (WSS) data. The removal of sediment from the structures, if necessary, based on the sediment storage capacity was considered in the O&M (see Table 6-2).

Table 6-2. Off-Channel Storage Sediment Volumes, Storage, & Capacity

Off-Channel Storage Site	Average Annual Volume (cf)	Off-channel Storage Provided (cf)	Sediment Storage Capacity (Years)
1	4,694	757,944	161
5	7,434	296,208	40
7	2,092	287,496	137

The Sponsor's liability for O&M extends throughout the life of the project. A separate O&M agreement would be developed and signed prior to construction of the project. The agreements would provide for inspections, reports, and procedures for performing the maintenance items. An O&M plan would be included with the agreement. O&M agreements would have strict requirements for Sponsors to inspect and perform maintenance work. Each measure is to be inspected on a regularly scheduled basis, and immediately following major storms, earthquakes or other occurrences which may adversely affect the measure.

The estimated average annual operation and maintenance costs are $108,782, evaluated for a 100-year period (Table 6-10).

6.11 Emergency Action Plan

An emergency action plan would be drafted and approved by the SLO upon completion of the detailed design phase. The plan would outline plausible catastrophic failure scenarios and

include pertinent steps for each considered scenario. Contact information of relevant emergency response agencies would be included and updated on an annual basis. Semi-annual disaster training would also be conducted with local emergency response agencies to drill the most likely disaster response scenarios.

6.12 Economic and Structural Tables

Table 6-3. Economic Table 1 – Estimated Installation Cost, Dollars

Works of Improvement	Unit	Federal Land (acres)	Non-Federal Land (acres)	Total (acres)	Public Law 83-566 Estimated Cost – Federal Land (Dollars[1])	Public Law 83-566 Estimated Cost – Non-federal Land (Dollars[1])	Public Law 83-566 Estimated Cost – Total (Dollars[1])	Other funds Estimated Cost – Federal Land (Dollars[1])	Other funds Estimated Cost – Non-federal Land (Dollars[1])	Other funds Estimated Cost – Total (Dollars[1])	Estimated Cost – Total (Dollars[1])
Dam Diversion to Off-Channel Storage (Sites 1, 5, 7)	Acres	0	71.6	71.6	$0	$1,641,520	$1,641,520	$0	$758,747	$758,747	$2,400,266
Channel/ Infrastructure Improvements (Sites 11, 12b, 16)[1]	Acres	0	1.4	1.4	$0	$14,231	$14,231	$0	$238,560	$238,560	$252,791
Total Project	Acres		73.0	73.0	$0	$1,655,750	$1,655,750	$0	$997,307	$997,3077	$2,653,057

[1]Price base 2024.

Table 6-4. Economic Table 2 – Estimated Cost Distribution, Box Butte Creek Watershed (Dollars[1])

Works of Improvement	PL 83-566 – Construction[2]	PL 83-566 – Engineering	PL 83-566 – Real Prop	PI 83-566 – Project Administration	Total Public Law 83-566 Funds	Other Funds - Construction	Other Funds - Engineering	Other Funds - Real Property Rights	Other Funds – Relocation Payments	Other Funds - Permits	Other Funds – Project Admin	Total Other Funds	Total – Installation Costs
Dam Diversion to Off-Channel Storage (Sites 1,5, 7)	$1,349,490	$179,932	$0	$112,098	$1,641,520	$449,830	$0	$182,820	$0	$89,966	$36,131	$758,747	$2,400,266
Channel/ Infrastructure Improvements (Sites 11, 12b, 16)[1]	$0	$10,830	$0	$3,401	$14,231	$216,370	$0	$0[3]	$0	$10,830	$11,360	$238,560	$252,791
Total Project	$1,349,490	$190,762	$0	$115,498	$1,655,570	$666,200	$0	$182,820	$0	$100,796	$47,491	$997,307	$2,653,057

[1]Price base 2024
[2]Includes construction management, survey, geotechnical studies, and mitigation measures
[3]Work of improvement will occur within the existing County right-of-way and will not require acquisition
[4]Includes legal survey and legal fees

Table 6-5. Economic Table 2a – Cost Allocation and Cost Sharing Summary for Multipurpose Watershed Plans, Box Butte Creek Watershed (Dollars[1])

Works of Improvement	Cost Allocation – Flood Prevention Purpose[1]	Cost Allocation – Agricultural Water Management[1]	Cost Allocation by Purpose – Total	Public Law 83-566 Cost Share Flood Prevention	Public Law 83-566 Cost Share Agricultural Water Management	Public Law 83-566 Cost Share Total	Other Funds Cost Share – Flood Prevention	Other Funds Cost Share – Agricultural Water Management	Other Funds Cost Share Total
Dam Diversion to Off-Channel Storage (Sites 1,5, 7)	$0	$2,400,266	$2,400,266	$0	$1,641,520	$1,641,520	$0	$758,747	$758,747
Channel/Infrastructure Improvements (Sites 11, 12b, 16)	$252,791	$0	$2452,791	$14,231	$0	$14,231	$238,560	$0	$238,560
Total Project	$252,791	$2,400,266	$2,653,057	$14,231	$1,641,520	$1,655,750	$238,019	$758,747	$997,307

[1]Price base 2024.

Table 6-6. Table 3 – Structural Data, Box Butte Creek Watershed

Works of Improvement	Length of Diversion Dam	Dam Diversion Profile (Front Slope, Top Width, Back Slope)	Off-Channel Storage Basin Volume (acre-feet)
Diversion Dam Site 1	160	8H:1V/8'/4H:1V	17.4
Diversion Dam Site 5	190	8H:1V/8'/4H:1V	4.4
Diversion Dam Site 7	155	8H:1V/8'/4H:1V	6.6

Table 6-7. Economic Table 4 – Average Annual Preferred Alternative Annual Costs, Box Butte Creek Watershed (Dollars[1])

Works of Improvement	Average Annual Installation Costs[1]	Average Annual Operation, Maintenance, and Replacement[1, 2]	Other Direct Costs	Total
Dam Diversion to Off-Channel Storage (Sites 1,5, 7)	$69,649	$1,780	$0	$71,429
Channel/Infrastructure Improvements (Sites 11, 12b, 16)	$6,842	$11,350	$0	$18,192
Total Project	$76,490	$13,130	$0	$89,620

[1]Price base 2024. Prepared October 2024, amortized over 100 years at a discount rate of 2.75%
[2]Includes replacement costs of culverts at 50 years.

Table 6-8. Economic Table 5 – Estimated Average Annual Flood Damage Reduction Benefits, Box Butte Creek Watershed (Dollars[1])

Item	Estimated Annual Damage Without Project Agricultural Related[1]	Estimated Annual Damage Without Project Non-Agricultural Related[1]	Estimated Annual Damage With Project Agricultural Related[1]	Estimated Annual Damage With Project Non-Agricultural Related[1]	Damage Reduction Benefit Agricultural Related[1]	Damage Reduction Benefit Non-Agricultural Related[1]
Channel/Infrastructure Improvements (Sites 11, 12b, 16)	$27,322	$0	$5,049	$0	$22,273	$0

[1]Price base 2024, amortized over 100 years at a discount rate of 2.75%

Table 6-9. Estimated Average Annual Agricultural Water Management Benefits, Box Butte Creek Watershed (Dollars)

Item	Agriculture-Related[1]	Non-Agriculture Related[1]
Dam Diversion to Off-Channel Storage (Sites 1,5, 7)	$105,818	$0

[1]Price base 2024, amortized over 100 years at a discount rate of 2.75%

Table 6-10. Economic Table 6 – Comparison of Preferred Alternative Benefits and Costs, Box Butte Creek Watershed (Dollars[1])

Works of Improvement	Agriculture Related – Flood Damage Reduction[1]	Agricultural Related Water Delivery[1]	Non-Agriculture Related Flood Damage Reduction – Residential Structures	Average Annual Benefits[1]	Annual Costs[1]	Benefit Cost Ratio[2]
Dam Diversion to Off-Channel Storage (Sites 1,5, 7)	$0	$105,818	$0	$105,818	$71,429	1.48
Channel/Infrastructure Improvements (Sites 11, 12b, 16)	$22,273	$0	$0	$22,273	$18,192	1.22
Total Project	$22,273	$105,818	$0	$128,091	$89,620	1.43

[1]Price base 2024, amortized over 100 years at a discount rate of 2.75%
[2]Includes Operation, Maintenance, and Replacement

7 Consultation, Coordination, and Public Participation

This chapter summarizes the consultation and coordination processes with other agencies. This chapter also describes the opportunities provided for public participation throughout the planning process, from the initial request to NRCS assistance to preparation of the final watershed project plan.

7.1 Consultation

The following sections describe the consultations that has occurred throughout the planning process.

7.1.1 USFWS and NGPC Consultation (Section 12 of Public Law 83-566, Section 7 of the Endangered Species Act, and Nebraska Nongame and Endangered Species Conservation Act)

Communication and coordination with USFWS and NGPC was initiated concurrently with other agency coordination in November 2020. Communication and coordination has been carried out throughout the planning process. All correspondence can be found in Appendix A.

NRCS sent a P.L. 83-566 Section 12 consultation letter to USFWS on November 25, 2024.

NRCS submitted an informal conference request to USFWS and NGPC on January 23, 2025, with preliminary effects determinations based on IPaC and CERT reports. NGPC responded by email on February 11, 2025, with recommendations on effects determinations and questions about the project in general. NRCS provided answers to the questions on March 3, 2025. USFWS responded by letter on February 11, 2025, and provided recommendations on species to consider, conservation measures to follow during construction and it's response to the Section 12 consultation request. Consultation and a request for concurrence was sent to USFWS and NGPC on August 1, 2025. Copies of correspondence can be found in Appendix A.

7.1.2 Section 106 Consultation

NRCS consulted on a government-to-government basis with federally recognized tribes who have ancestral land claims in the area and will continue to consult through implementation if cultural resources are identified after NHPA Section 106 consultation is complete. The federally recognized tribes consulted from the inception of the project include the following:

- Apache Tribe of Oklahoma
- Cheyenne and Arapaho Tribes of Oklahoma
- Cheyenne River Sioux Tribe
- Comanche Nation

- Crow Creek Sioux Tribe of the Crow Creek Reservation
- Lower Brule Sioux Tribe of the Lower Brule Reservation, South Dakota
- Northern Arapaho Tribe of the Wind River Reservation, Wyoming (Northern Arapaho Tribe)
- Northern Cheyenne Tribe
- Oglala Sioux Tribe
- Omaha Tribe of Nebraska
- Ponca Tribe of Indians of Oklahoma
- Ponca Tribe of Nebraska
- Rosebud Sioux Tribe
- Santee Sioux Nation of Nebraska
- Standing Rock Sioux Tribe of North and South Dakota

On November 13, 2020, NRCS sent letters to representatives of the tribes and the Nebraska State Historic Preservation Office (NeSHPO) to initiate NHPA Section 106 consultation. The letters provided information about the project, invited the tribes to participate in the agency scoping meeting, and requested to consult with them on concerns related to NHPA. The Northern Cheyenne Tribal Historic Preservation Office responded by email on December 21, 2020, saying it was interested in the project and to keep the tribe updated.

NRCS sent NHPA Section 106 consultation request letters to NeSHPO and representatives of the listed tribes by mail on January 6, 2025. The consultation letter presented the area of potential effect, the proposed alternatives, the historic property identification efforts, the determinations of eligibility, and the determination of effect. Copies of the cultural resource inventory reports, site forms, and maps of the area of potential effect were submitted with the consultation letter to support the determination of effect.

Copies of all correspondence related to Section 106 are provided in Appendix A. NeSHPO concurred with the determination of effect in a letter dated January 13, 2025. The Crow Creek Sioux Tribe concurred with the determination of effect in an email received January 16, 2025. The Northern Arapaho Tribe concurred with the determination of effect in a letter dated January 21, 2025. The Comanche Nation concurred with the determination of effect in a letter dated February 10, 2025. The Northern Cheyenne Tribe concurred with the determination of effect in an email received June 3, 2025.

7.1.3 USACE Consultation

USACE consultation included invitation to be a cooperating agency and scoping meetings. NRCS, UNWNRD, and NRCS conducted a Clean Water Act Review on September 20, 2024.

The meeting discussed the project and design, alternative analysis process, aquatic resource impacts, and proposed potential mitigation requirements.

All consultation correspondence is provided in Appendix A.

7.2 Coordination

Coordination began early in the planning process, and agencies provided input on all resource areas that they oversee. The agencies were also asked to comment on the evaluated natural and cultural resource impacts of the project. Sixteen state, county, and local agencies were sent an agency scoping packet on November 13, 2020, which included an introduction and background, a description of the project and alternatives, anticipated impacts, a description of NRCS procedures, and a schedule. A project area figure was also provided. A response was requested within 30 days of receipt of the letter; seven agencies provided comments.

The following organizations were involved in the development of this Plan and provided technical support, information, data analysis, and guidance:

- Box Butte County
- Bureau of Reclamation
- Center for Rural Affairs
- Dawes County
- EPA
- FEMA
- Mirage Flats Irrigation District
- NDEE
- Nebraska Department of Health and Human Services
- Nebraska Department of Transportation
- Nebraska Public Power District
- NeDNR
- NGPC
- National Park Service, Niobrara National Scenic River
- State Emergency Management Agency
- SHPO
- Sheridan County
- USACE
- USFWS

All coordination correspondence is provided in Appendix A.

7.3 Public Involvement

The project development team (NRCS and Sponsor) worked closely with local landowners, residents, and nonresident workers to include them in the planning process, provide timely information, and solicit their input on pertinent issues considered during planning.

The UNWNRD hosted an online public scoping meeting in place of hosting an in-person public meeting due to COVID-19 public gathering guidelines and recommendations. The self-guided online meeting was posted on the UNWNRD website. A press release was distributed on Monday, December 14, 2020, to notify area media outlets of the online meeting. The UNWNRD website also posted information regarding the online public scoping meeting. If individuals did

not have internet access, outreach provided contact information to reach out and obtain hardcopy alternatives for the meeting.

The self-guided online meeting was available for review and comment for 30 days from Tuesday, December 15, 2020, through Thursday, January 14, 2021. During the 30 days, the online meeting had over 33 visitors (website analytics only available the last 15 days of the meeting) and received two comments from the general comment form.

7.4 Plan Development and Review

The plan was developed in close coordination with multiple agencies and the public and underwent the following informal and formal reviews:

- Public and Agency Scoping – November 2020
- State-Level Preliminary Review – May–October 2024
- National Level Technical Review – February – March 2025
- Programmatic Review, Initial – August 2025
- Public and Interagency Review – October – November 2025
- Programmatic Review, Final – Planned for December 2025

7.4.1 Public and Agency Scoping

Public and agency scoping was carried out in 2020 and informed the identification and refinement of resource concerns and ecosystem services relevant to the proposed action as well as potential measures to address the watershed problems.

Additional agency outreach was conducted as needed through 2024 to discuss the initial measures under consideration and the final array of alternatives to be evaluated. The project team worked in close coordination with key agencies and organizations throughout the development of the plan and updated the public regularly via the project website. This enabled key agencies and the public to stay abreast of the planning progress between formal meetings and required review periods.

7.4.2 State-Level Preliminary Review

Upon completion of the preliminary Draft Plan, state NRCS personnel performed an interdisciplinary technical review in October 2024. The project team incorporated the results of this review into the preliminary Draft Plan and returned it to the state NRCS review team.

The State Conservationist verified that all comments had been satisfactorily addressed, and the following requirements had been met:

- Appropriate interdisciplinary planning and evaluation procedures have been followed, and a plan has been formulated that addresses the concerns of the Sponsors and the mission of NRCS with consideration of economic, environmental, and social impacts.
- All surveys, investigations, consultation requirements, and analyses were coordinated concurrently with the development of the plan and are of sufficient scope and intensity to support the project.
- Public and interagency participation is sufficient and properly planned, discussed, and documented to ensure that the plan addresses and focuses on issues of concern to the public and other agencies and that formulation, evaluation, and selection of any alternative are not biased toward any one group.
- The plan clearly and correctly reflects watershed conditions and problems, with and without the project.
- The kind, nature, and estimated cost of measures to be installed, including appropriate mitigation, are properly determined, displayed, and documented in the plan.
- The anticipated effects on the environment and on solving the problems, including the evaluation of benefits and impacts, have been determined and exhibited, and mitigation has been provided as appropriate.
- The manner of financing, installing, operating, and maintaining the project has been determined and discussed.
- The project, as formulated, meets the requirements of PL 83-566, NRCS policy, congressional criteria, EOs, NEPA, PR&G and the supporting agency-specific procedures (Departmental Regulation [DR] 9500-013 and Department Manual 9500-013), and other applicable laws and regulations.
- The plan conforms to established standards and NRCS requirements for technical quality.
- Requirements for permits, consultation, and mitigation have been considered, evaluated, and discussed in the development and evaluation of plan alternatives.
- The plan content and format conform to the requirements of the National Watershed Planning Manual, Part 501, Subpart D.
- An internal interdisciplinary review was conducted by appropriate state NRCS staff, and the comments with resolutions were documented and included with the plan for the National Reviews.

7.4.3 National Level Technical Review

A review of the preliminary Draft Plan was reviewed by the NRCS National Watershed Management Center in February and March of 2025. Comments received were reviewed, evaluated, and addressed individually. Plan revisions were made accordingly.

7.4.4 Programmatic Review, Initial

In August of 2025 a Programmatic Review by the NRCS National Headquarters of the revised preliminary Draft Plan was performed to confirm compliance with all NRCS policies and procedures and adequacy of responses to the National Level Technical review comments. National Headquarters determined that the Plan meets policy and that all NRCS National Watershed Management Center comments were adequately addressed or noted.

7.4.5 Public and Interagency Review

A summary of comments received and actions taken after interagency and public reviews have occurred will be included here.

7.4.6 Programmatic Review, Final

A summary of the final review for programmatic compliance by the appropriate national watershed program manager following public and interagency review will be included here.

7.4.7 Distribution List

The Draft and Final Plan were distributed to the following organizations:

Tribes

- Apache Tribe of Oklahoma
- Cheyenne and Arapaho Tribes of Oklahoma
- Cheyenne River Sioux Tribe
- Comanche Nation
- Crow Creek Sioux Tribe of the Crow Creek Reservation
- Lower Brule Sioux Tribe of the Lower Brule Reservation, South Dakota
- Northern Arapaho Tribe of the Wind River Reservation, Wyoming (Northern Arapaho Tribe)
- Northern Cheyenne Tribe
- Oglala Sioux Tribe
- Omaha Tribe of Nebraska
- Ponca Tribe of Indians of Oklahoma
- Ponca Tribe of Nebraska
- Rosebud Sioux Tribe
- Santee Sioux Nation of Nebraska
- Standing Rock Sioux Tribe of North and South Dakota

Federal

- US Army Corps of Engineers
- US Environmental Protection Agency
- US Fish and Wildlife Service
- National Park Service
- US Bureau of Reclamation

State

- Nebraska Department of Water, Energy, and Environment
- Nebraska Game and Parks Commission
- Nebraska State Historic Preservation Office
- Nebraska Emergency Management Agency

Local and Regional

- Box Butte County Highway Department
- Box Butte County
- Sheridan County
- Mirage Flats Irrigation District
- Center for Rural Affairs

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9 List of Preparers

The Box Butte Watershed Plan was prepared by an interdisciplinary team. Those individuals who were directly responsible for significant input in preparation of the Plan are included in Table 9-1.

Table 9-1. List of Preparers

Name	Title	Education	Years of experience	Other Pertinent Qualifications, Publications, and Professional Licenses
USDA NRCS				
Allen Gehring	State Conservation Engineer	Agricultural Engineering	30+	PE
Melissa Baier	Assistant State Conservationist – Water Resources and Easements/ Archeologist	B.A. Anthropology; B.S. Biology; M.A. Anthropology	23	
Doug Christensen	Economist	B.S. Agricultural Business; PhD. Economics	45	
Joseph Debebe	NEPA Specialist	BSC. Plant Science; MSC. Soil Chemistry; PhD. Agronomy	13	
Merceidez Fabok	Natural Resource Specialist	B.S. (WNMU	3	
Thomas Mountford	Watershed Project Specialist	Assoc. Arts; B.S. Agriculture; B.S. Natural Resources & Accounting	36	
Ritch Nelson	Biologist	B.S. Fisheries and Wildlife	32	
Arlis Plummer	Civil Engineer	B.S. Civil Engineering	43	PE
Alessandra Sealander	Geologist	B.S. Geoscience; M.S. Geoscience	3	G.I.T (Texas)
Robert Sullivan	Dam Safety Engineer	B.S. Civil Engineering	37	PE
Nicole Zimmerman	Hydrology and Hydraulics Engineer	B.S. Geology; M.S. Environmental Engineering	3	
HDR				

Name	Title	Education	Years of experience	Other Pertinent Qualifications, Publications, and Professional Licenses
Matt Hodgson	Technical Editor	M.A. Composition Theory and Rhetoric; B.A. English and Education	18	
Matt Pillard	Environmental Project Manager	B.S. Agricultural Science and Natural Resources; M.S. Community and Regional Planning	27	AICP
Matt Wray	Sr. Environmental Planner	B.S. Environmental Science	25	
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10 Abbreviations and Acronyms

APE	Area of Potential Effects
ARA	Affected Resource Areas
BCA	Benefit Cost Analysis
BGEPA	Bald and Golden Eagle Protection Act
BMP	best management practices
BUL	Biologically Unique Landscape
CEQ	Council on Environmental Quality
CERT	Conservation and Environmental Review Tool
CRP	Conservation Reserve Program
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DR	Departmental Regulation
EO	Executive Order
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FPPA	Farmland Protection Policy Act
FWOFI	Future Without Federal Investment
HEL	highly erodible land
HUC	Hydrologic Unit Code
IMP	integrated management plan
IPaC	Information for Planning and Consultation
LEP	limited English proficiency
MBTA	Migratory Bird Treaty Act
MLRA	major land resource areas
mph	miles per hour
N-2	Nebraska Highway 2
N-87	Nebraska Highway 87
NCRGIS	Nebraska Cultural Resources Geographic Information System
NDEE	Nebraska Department of Environment and Energy
NeDNR	Nebraska Department of Natural Resources
NEE	National Economic Efficiency
NGPC	Nebraska Game and Parks Commission
NHD	National Hydrography Dataset
NHPA	National Historic Preservation Act of 1966

NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRD	Natural Resources District
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
OFW	Open Fields and Waters
Plan	Watershed Plan
PR&G	Principles, Requirements, and Guidelines
SHPO	State Historic Preservation Office
SO	Secretarial Orders
SWPPP	Stormwater Pollution Prevention Plan
UNL	University of Nebraska – Lincoln
UNWGM	Upper Niobrara White Groundwater Model
UNWNRD	Upper Niobrara White Natural Resources District
U.S. 385	U.S. Highway 385
U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UZ	Unsaturated Zone
WFPO	Watershed and Flood Prevention Operations