U.S. DEPARTMENT OF AGRICULTURE

Natural Resources Conservation Service EAXX-005-53-038-1188522331
June 2026

Appendix E: Environmental Assessment for the Supplemental Watershed Plan No. 1 Rehabilitation of Upper Turtle River Watershed Dam No. 9 (Larimore Dam) and Finding Of No Significant Impacts (FONSI)

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PROPOSAL INFORMATION

General Information

Proposal Name: Supplemental Watershed Plan No. 1 – for the Rehabilitation of Upper Turtle River Watershed Dam No. 9 (Larimore Dam)

Proposal Tracking #: EAXX-005-53-038-1188522331

Proposal Initiation Date: 6/4/2025

Proponent Name: Grand Forks County Water Resource District

Signing Authority: ND State Resource Conservationist

Responsible Official: Danial Hovland

Unit: North Dakota State Office

Anticipated Implementation of Proposal: 2030-2031

Proposal Record Location: https://www.nrcs.usda.gov/state-offices/north-dakota/larimore-dam-rehabilitation

GIS Info: https://www.nrcs.usda.gov/state-offices/north-dakota/larimore-dam-rehabilitation

Proposal Webpage: https://www.nrcs.usda.gov/state-offices/north-dakota/larimore-dam-rehabilitation

General Location of Proposal: Larimore Dam is in Section 32 of Hegton Township (T152N, R54W), Grand Forks County, ND. The dam is on the South Branch Turtle River within the Turtle River Watershed. The geologic deposits are alluvial within Turtle River belt width; the river cuts through Glacial Lake Agassiz beach lines with sand and gravel outwash geology. The dam is approximately two miles north and one mile east of the city of Larimore, ND at the intersection of 36th St NE and 18th Ave NE.

Purpose and Need: Why do we need to act?

The purpose of this project is to rehabilitate Upper Turtle River Dam No. 9 (Larimore Dam) to eliminate the threat the dam, in its current condition, poses to human lives, infrastructure, cropland, and natural resources downstream. Larimore Dam delivers important flood prevention and recreation benefits to the watershed, which were the originally authorized purposes of the watershed dam.

The need for the project is that Larimore Dam does not meet current NRCS and State of North Dakota dam safety standards regarding embankment design, principal spillway requirements, and earthen spillway stability requirements. These deficiencies risk the loss of human life, residential structures, agricultural land and property, bridges, roads and historic structures. The normal pool also provides recreation opportunities, consisting primarily of camping, recreating, boating, fishing, hiking, and sport activities.

Proposed Action: What are we proposing to do?

The preferred alternative is the structural rehabilitation of the dam to a high-hazard designation. This has been considered Alternative #2 during evaluation of alternatives. Features include: modification of auxiliary spillway by lining with articulated concrete blocks (ACB); new principal spillway riser tower and a principal spillway conduit; new rock-lined plunge pool; removal of existing principal spillway riser tower; closing existing principal spillway conduit with grout; flattening of downstream embankment slope; new chimney filter and foundation drain to address seepage. See Appendix 1 for schematic summary of proposed action.

No Action: No measures to address dam safety inadequacies

The no action alternative represents a scenario where the existing dam remains in place with no measures taken to address the dam safety inadequacies associated with the dam. This has been considered Alternative #3 during evaluation of alternatives. The dam would remain in place and would function as it currently does for the 2- through 500-year flood events. Flood reduction benefits would remain the same, until such time as the dam fails, which is associated with a 1,844-year flood event. The breach would occur in the existing auxiliary spillway and would begin headcutting near the toe of the spillway. The headcut would progress rapidly upstream until it reached the reservoir of the dam.

Alternatives to the Proposed Action: Are there other ways to meet the purpose and need?

Decommissioning is another way to meet the purpose and need; as this alternative eliminates the threat of a dam failure to human lives, infrastructure, cropland, and natural resources downstream. Three decommissioning alternatives are evaluated. The first is decommissioning with downstream flood protection and environmental impact minimization; this includes removal of embankment, downstream levees, and stabilizing reservoir sediments. The second alternative is decommissioning with environmental impact minimization; this includes removal of embankment and stabilizing reservoir sediments. The third alternative is decommissioning, which is considered Future without Federal Investment (FWOFI); this only includes removal of embankment; this has been considered Alternative #1 during evaluation of alternatives. All decommissioning alternatives eliminate important flood prevention and recreation benefits to the watershed.

Alternatives Considered but Not Analyzed in Detail

Multiple variations for structural rehabilitation to a high-hazard designation were considered. The least cost variation of the structural rehabilitation alternatives was selected to be carried forward for detailed analysis. Consideration was given to the effects of the alternatives on PR&G and NEPA concerns, however no differing impacts between structural alternatives were identified (other than the grass lined earthen spillway alternative, which was determined to be impractical due to cost and space). Potential alternatives that would reduce the hazard classification associated with Larimore Dam to

a significant-hazard classification were evaluated. These included buyouts of habitable structures and floodproofing. These alternatives were eliminated from detailed analysis due to high costs.

INTERDISCIPLINARY PROPOSAL SCREENING

Given the nature of the proposal, the responsible official is requesting documentation to demonstrate compliance with the following legal and regulatory considerations in addition to NEPA:

☒ Endangered Species Act (ESA)

☒ National Historic Preservation Act (NHPA)

☒ Tribal Consultation (EO 13175)

☒ Clean Air Act (CAA)

☒ Clean Water Act (CWA)

☒ Pertinent Executive Orders

Special Management Areas:

☐ Coastal Zone Management Areas

☒ Conservation Easements

☐ Coral Reefs

☐ Inventoried Roadless

☐ Marine Sanctuaries

☒ National Recreation Areas

☐ National Scenic & Historic Trails

☐ Research or Experimental Areas

☐ Wild & Scenic River Corridors

☐ Wilderness

☐ Other: specify area type

Scope of Analysis

This environmental assessment refers to three specific zones within the Area of Interest (AOI) (see Appendix 2: Area of Interest / Benefit Area).

- Upstream Assessment Area (U-AA), the zone near the reservoir where there are direct impacts of plan alternatives. The U-AA includes the dam site, the normal and flood pools upstream from the dam, and a short stretch of river immediately downstream from the dam, for a total of 748 acres (1.2 square miles) (see Appendix 3: Upstream Assessment Area (U-AA).
- Downstream Assessment Area (D-AA), the downstream zone where the environment may be indirectly affected by plan alternatives. The D-AA includes 0.5 miles of the South Branch of the Turtle River (historically called Upper Turtle River in SCS watershed planning documents), 14.4 miles of North Branch Turtle River, and 77.4 miles of the Turtle River, and the adjacent floodplains. The D-AA is 192,000 acres (300 square miles) (see Appendix 2: Area of Interest / Benefit Area Map).
- Area Upstream, the total drainage area to dam which is not expected to be affected by the project, is 43,206 acres (65.5 square miles) (including the U-AA) as shown in Appendix 2: Area of Interest / Benefit Area Map. This was not utilized for resource assessment descriptions but is noted to describe the context of the environmental conditions where appropriate (e.g., soils and erodibility potential).

Agencies and Persons Consulted

Given the nature of the proposal, the responsible official consulted the following agencies, organizations, tribes, and persons during development and analysis of the proposal:

Agencies/Organizations/Businesses/Landowners

Category of Consultee	Agency/Organization/Landowner
State/Local Organization	Grand Forks County Commission
State/Local Organization	Grand Forks County Emergency Management Office
State/Local Organization	Grand Forks County Floodplain Administrator
State/Local Organization	Grand Forks County Soil Conservation District
State/Local Organization	Grand Forks County Water Resource District
State/Local Organization	Grand Forks Highway Department
State/Local Organization	North Dakota Department of Emergency Services
State/Local Organization	North Dakota Department of Environmental Quality
State/Local Organization	North Dakota Department of Parks and Recreation
State/Local Organization	North Dakota Department of Transportation
State/Local Organization	North Dakota Department of Water Resources
State/Local Organization	North Dakota Game and Fish Department

State/Local Organization	Red River Retention Authority
State/Local Organization	State Historical Society of North Dakota
Cooperating Agency	US Army Corps of Engineers - ND Regulatory Office
Cooperating Agency	US Fish and Wildlife Service
Cooperating Agency	Federal Emergency Management Agency - Region 8
Cooperating Agency	Federal Emergency Management Agency - Region 8
Landowners	Landowners potentially impacted by construction or breach

Native American Tribes

Tribal Government Consulted	Tribal Government Consulted2
Apache Tribe of Oklahoma	Northern Cheyenne Tribe
Blackfeet Indian Reservation of MT	Oglala Sioux Tribe
Bois Forte Band of the MN Chippewa Tribe	Prairie Island Indian Community in MN
Cheyenne River Sioux Tribe	Red Lake Band of Chippewa Indians
Chippewa Cree Tribe of the Rocky Boy's Reservation	Rosebud Sioux Tribe of Indians
Confederated Salish and Kootenai Tribes	Shoshone Tribe of the Wind River Reservation
Crow Creek Sioux Tribe	Sisseton-Wahpeton Oyate
Flandreau Santee Sioux Tribe	Spirit Lake Tribe of Fort Totten
Fond du Lac Band of MN Chippewa Tribe	Standing Rock Sioux Tribe
Fort Belknap Indian Community	The Crow Tribe of Montana
Fort Peck Assiniboine and Sioux Tribes	The Three Affiliated Tribes
Grand Portage Band of MN Chippewa Tribe	Turtle Mountain Band of Chippewa
Leech Lake Band of Ojibwe	Upper Sioux Community
Lower Sioux Indian Community	White Earth Nation of Minnesota Chippewa
Mille Lacs Band of Ojibwe	Yankton Sioux Tribe
Northern Arapaho	

Documents

Table 1: Applicable proposal record documentation to support agencies consulted

Documentation Type	File Name (if applicable/needed)
State Assessment	ND Source Water Assessment Program (2018)
Land Use Plan	Grand Forks County Land Use Plan (2024)
TMDL Plan	ND Dept of Health/DEQ Nutrient TMDL Larimore Dam (2009)

Documentation Type	File Name (if applicable/needed)
Wildlife Action Plan	ND Dept of Game & Fish SWAP (2015)
Aquifer Report	ND DEQ Elk Valley Aquifer Report (2021)

Substantive Issues Considered for Analysis

Relevant and substantive issues considered for analysis include land cover and land use, surface geology and soil resources, water resources, air quality, biotic communities, and the human environment, which are summarized in Table 2.

Table 2: Relevant and Substantive Issues considered for analysis

Resource	Relevant	Substantive	Rationale
LAND COVER AND LAND USE			
Land Use	Yes	Yes	Breach scenario (No Action Alternative) would significantly impact downstream land use.
SURFACE GEOLOGY AND SOIL RESOURCES			
Surface Geology	Yes	No	Late Wisconsin glacial till mantled by glacial lake sediments.
Soil Resources, Erosion, and Deposition	Yes	Yes	Erosion occurs. Reservoir sediments contain nutrients and metals. Breach scenario (No Action Alternative) would result in significant downstream impacts of erosion and deposition.
Prime Farmland	Yes	Yes	Significant quantities of Prime Farmland would be negatively impacted by erosion and deposition from a breach scenario (No Action Alternative) .
WATER RESOURCES			
Groundwater Resources	Yes	Yes	Private drinking water wellheads exist downstream and may be contaminated by analytes during a breach scenario (No Action Alternative).
Surface Water Resources	Yes	Yes	River, tributary, lake, and wetland resources are present and would be significantly impacted by all scenarios.
Jurisdictional Waters of the US (Clean Water Act)	Yes	Yes	River, tributary, lake, and wetland resources that fall under CWA jurisdiction are present and negatively impacted by multiple scenarios.
Water Quality	Yes	Yes	Turtle River downstream of Larimore is on the ND DEQ 303d list of impaired water; Nutrient TMDL for Larimore Dam completed September 2009. Reservoir is eutrophic with impairment due to nutrient/eutrophication/biological indicators.
Water Management	Yes	Yes	The dam currently regulates peak flows downstream. Legal drains and private drainage infrastructure downstream were designed with consideration of the existing flood retention.
Floodplain Management (FEMA)	Yes	No	No FEMA detailed studies present within any AOI

Regional and International Water Resource Plans	Yes	Yes	Dam has an influence on the Boundary Waters Treaty (BWT), International Joint Council (IJC) adopted resolution of phosphorus and nitrogen concentration objectives at the international border crossing of the Red River and Red River Basin Commission goal of 20% peak flow reduction.
Sole Source Aquifers	No	No	None present
Wild and Scenic Rivers	No	No	No Wild and Scenic Rivers, no Nationwide Rivers Inventory segments
AIR QUALITY			
Air Quality – Dust and Emissions	Yes	No	No permanent air polluting infrastructure but potential for temporary effects during construction.
BIOTIC COMMUNITIES			
Plants, Communities, and Habitat Quality	Yes	Yes	River, tributary, lake, wetland, forest, grassland resources present, several species of state conservation concern could exist and be impacted by some alternatives. Significant Ecological Communities have been identified as present.
Riparian Woodlands	Yes	Yes	Riparian woodlands are present and would be impacted by some alternatives.
Coral Reefs	No	No	None present
Designated Natural Areas	No	No	No specifically designated areas present
Ecologically Critical Areas	Yes	Yes	NDGF Habitat Focus Areas are present. ND Park and Recreation significant ecological communities are present and would be negatively impacted by some alternatives. Dogwood-willow thicket and Bur Oak Upland Woodland are considered ecologically significant communities.
Essential Fish Habitat	No	No	None present
Parklands	Yes	Yes	Larimore Recreational Area and Turtle River State Park are present and would be negatively impacted by some alternatives.
Scientific Resources	No	No	No specifically designated areas present
Mammals, Amphibians, Reptiles, Invertebrates	Yes	Yes	Species present, several species of state conservation concern possible.
Fish	Yes	Yes	Fish present, several species of state conservation concern possible in the South Branch Turtle River and Turtle River
Birds, Migratory Birds, Eagles	Yes	Yes	Eagles and migratory birds of conservation concern possible. Potential impacts from all alternatives
Federal Threatened and Endangered Species	Yes	Yes	No designated critical habitat, two federally listed species possible. Potential impact from all alternatives
Undesirable Species (including Invasive Species)	Yes	No	State and county listed noxious/invasive species are present, prevalence of introduced species
HUMAN ENVIRONMENT			
Cultural Resources, Historic Properties	Yes	Yes	Historic properties present
Public Health and Safety	Yes	Yes	Public health and safety are currently jeopardized by the dam

Transportation and Infrastructure	Yes	Yes	Downstream roads, bridges, and drainage infrastructure are currently protected from damage by the dam but also at risk from a dam breach
Recreation Resources	Yes	Yes	The dam reservoir currently provides limited and highly desired opportunities for camping and open water recreational activities
Visual Resources (Scenic Beauty)	Yes	No	No designated scenic sites, but scenic beauty relevant. Potential impacts from some alternatives
Local and Regional Economy	Yes	Yes	Dam provides benefits to the economy through reduced flood damages downstream
Noise	Yes	No	No permanent effects anticipated. Temporary noise during construction project

ENVIRONMENTAL REVIEW & CONSULTATION

The following documents compliance with the National Environmental Policy Act (NEPA) and other relevant environmental laws, executive orders, and regulations.

NEPA: Consideration of Reasonably Foreseeable Impacts

Potentially Affected Environment

Land Use

Land use in the drainage area upstream of the dam (43,206 acres including the U-AA) consists of 68% cropland, 18.5% grass/hayland, 8.5% natural areas and 5% developed areas. Land use in the U-AA (745 acres) consists of 25% cropland, 27% grass/hayland, 46% natural areas (including 71.8 acres of open water largely from the reservoir), and 2% developed areas. In the D-AA (191,300 acres) land use consists of 58.5% cropland, 29.5% grass/hayland, 6.3% natural areas and 5.7% developed areas. Cropping is limited in the D-AA due to the high-water table and high saline content of the groundwater. A significant portion of the D-AA grassland area is enrolled in the Conservation Reserve Program. This area also includes Kelly's Slough National Wildlife Refuge (1,207 acres).

Soil Resources, Erosion and Deposition

The dominant soils in the upper portion of the upstream watershed are dominated by fine-loamy till formed by ground moraines on glacial till plains. Moving east, the Upper Turtle River crosses into the interbeach area where parent material changes to loamy glaciolacustrine deposits. Both the river channel sections upstream and downstream of the dam are stable with a slight tendency toward being vertically incised and channel enlargement (Appendix D-8 Stream Classification and Riparian Assessment Memorandum). Wave action and recreation activities directly and indirectly increase the incidence of erosion in the U-AA. Soils in the U-AA are dominated by sandy loams with severe cropping limitations due to the high erodibility of the sandy loam soils. The parent material consists of course-loamy alluvium. Also significant in the U-AA are frequently flooded silty clay loams formed in fine-silty alluvium.

Sediment accumulation in the reservoir is discussed in Plan Section 1.4.4 and Appendix D-7 Accumulated Sediment Memorandum. Sediments contain carbon, nutrients (nitrogen and phosphorus), and metals. Generally, concentrations are higher in the pool sediment,

compared to inlet sediment. None of the analyte concentrations exceeded the USEPA thresholds.

Soils in the D-AA vary as the Turtle River descends through the interbeach soils into the lacustrine soils of the bottom of glacial Lake Agassiz. The river crosses through soils formed on beaches of the lake plain which have loamy alluvium over sandy and gravelly glaciofluvial parent materials. The D-AA is dominated by saline affected soils formed on the lake plains. Further east, the saline lense subsides, greatly improving the cropability of the soil.

Prime Farmland

Protection for important farmland is established in the Farmland Protection Policy Act (FPPA), US Department of Agriculture regulations implementing the FPPA (7 CFR Part 658), and USDA DR No. 9500-3, Land Use Policy.

The U-AA is located primarily in MLRA 56, where soils are primarily designated as prime farmland. Just below the dam, areas of prime farmland are common throughout the interbeach area and in the far eastern area closest to the Red River. The largest portion of the D-AA (over 67%) is designated as Not Prime Farmland due to the high salinity of the soil.

Groundwater Resources

There are no Wellhead Protection areas within the U-AA or D-AA. The U-AA and D-AA are within the Elk Valley Aquifer extents. The Elk Valley Aquifer is unconfined surficial with area of 178.9 mi^2. Depth to water ranges from 0.5 to 50 feet. Maximum thickness is 61 feet and average is 34 feet. The city of Larimore, Grand Forks-Traill Water District, Tri-County Water District rural water systems, irrigation wells, and a few domestic wells draw water from the aquifer. In 2019, 2.9 billion gallons of permitted water were drawn from the aquifer. In the D-AA, there are three wellheads within the no action breach extents and one wellhead within the current 500-year floodplain, excluding plugged or test wells, see Watershed Plan Figure C-29 for details. There are no wellheads within the U-AA or D-AA located within the aquifer extents.

Surface Water Resources

Aquatic resources in the area consist of wetlands, open water (lakes), and a network of rivers. There are no Wild and Scenic Rivers and there are no Nationwide Rivers Inventory segments within the AOI watershed. Water resources are protected to varying degrees under the Clean Water Act and other legislation. When federal funding is used for construction and improvement projects, Executive Order 11990 requires federal agencies to preserve, enhance, or minimize degradation and losses to wetlands regardless of Clean Water Act status. NRCS policy for implementing the executive order can be found at 190-GM, Part 410, Subpart B, Section 410.26. The Clean Water Act Section 404 requires permitting from the US Army Corps of Engineers (USACE) for activities that impact Waters of the US. The NRCS floodplain management policy reviews activities in wetlands that occur within the 50-year floodplain (190-GM Section 510.25). The Red River of the North is a navigable river therefore by definition, the Turtle River and tributaries would be considered Waters of the US and under the jurisdiction of USACE. Aquatic resources within the U-AA may be jurisdictional, but this determination has not been completed by the USACE. USACE is a cooperating agency on this EA, however,

has limited resources and prefers to make final jurisdictional determinations after final design is complete and a 404-permit submitted, immediately prior to construction. Jurisdictional determinations would only be completed on identified wetlands that would be impacted by proposed alternative. Given Executive Order 11990, NRCS would address any wetland impacts through mitigation regardless of jurisdictional status.

The aquatic resources within the U-AA were surveyed in 2021 and documented in Appendix D-9 (Aquatic Resource Delineation and Fen Search Report, 2021), and NRCS Addendum to Aquatic Resource Delineation and Fen Report, 2024). These are categorized as wetland and potential Other Waters (OW). The four wetland classes identified include mineral soil flat, riverine, lacustrine fringe, and depressional. There are 76 wetland areas, totaling 161.66 acres, of which 129.08 acres are considered naturally present on the landscape and of which 32.58 acres are identified as artificial wetlands formed from construction of the dam and reservoir. There are 32 acres of artificial wetlands in the U-AA which could lacustrine fringe class wetlands. Therefore, these were the focus of existing condition functional assessments. Natural wetlands would not be affected by plan alternatives due to their independent hydrology from the reservoir and topography.

The D-AA has 15,486 acres of wetlands, as determined from NWI data. The South Branch Turtle River extending from Larimore Dam to the confluence with North Branch Turtle River, the start of main stem Turtle River, is 0.6 miles. The main stem Turtle River to outlet at Red River of the North is 77.4 miles. Individual wetlands were not delineated in the D-AA, however it can be assumed that wetlands have similar characteristics to those described in the U-AA and nearby streams. NWI wetland areas include riverine, lacustrine, and palustrine systems; classes include semi-permanent, emergent, temporary, forested, shrub, excavated, and streambed.

Water Quality

Surface water quality is discussed in more detail below in the Clean Water Act and Reginal and International Water Resource Plan sections.

One aquifer is located within the U-AA and D-AA and is known as the Elk Valley Aquifer, an unconfined surficial aquifer, Watershed Plan Appendix C-29. The aquifer has been sampled for water quality six times from 1993 to 2018, which is on a 5-year rotation. Other important findings from North Dakota Department of Environmental Quality Groundwater Monitoring Program Elk Valley Aquifer Fact Sheet, relate to water chemistry and pesticides. Water chemistry analytes considered high include Arsenic, Iron, and Manganese. Water hardness is considered “Very Hard”. Percentage of wells exceeding Nitrate Maximum Contamination Level (MCL) range in test years from about 2-5%. Percentage of wells with detections of each pesticide detected in the aquifer range in test years from about 0 to 18%. The total unique wells with pesticide detections since 1993 include 35 of 105. Pesticides listed include Picloram (13 wells), Bentazon (4 wells), Dicamba (3 wells), 2,4-D (1 well), and Metribuzine (1 well). Statewide aquifer monitoring and scoring ranked the Elk Valley Aquifer as “High” in all categories evaluated, including Vulnerability (Pesticide DRASTIC Model), Sensitivity (Agricultural Sales per Farmed Acre), Risk (Aquifer Appropriations per Square Mile), and Total Monitoring Score.

Water Management

Historically, this watershed had extensive natural flood retention capacity with wide distribution of Prairie Pothole wetlands and a large population of beavers that facilitate dynamic water retention. Since the 1800s, humans have drastically altered the landscape and a significant amount of natural flood retention has been lost via beaver trapping, extensive conversion of tall grass prairie to cropland, and widespread wetland drainage. Natural flood retention is still being lost through stream channelization and tile drainage development. After the highly damaging floods that occurred during the 1940s and 1950s, many dams, including Larimore Dam, were constructed in the region during the 1960s and 1970s. These dams replaced much of the natural flood retention, although not the ecological value of mosaic of wetlands, prairie, meandering streams, and beaver dam complexes. It is important to note the flood attenuation provided by Larimore Dam is more concentrated than the historically distributed water retention on the landscape, however the dams do serve to restore more natural (lower) peak flows to the downstream river reaches.

Flows within the Upper Turtle River Watershed (at confluence of North Branch and South Branch Turtle River) are regulated by eight flood control dams. These dams are located primarily in the upper portions of the Turtle River Watershed, and none are located downstream of Larimore Dam on the South Branch Turtle River or Turtle River. These seven other dams are within a 20-mile radius of Larimore Dam. See Watershed Plan Appendix B-1 for flood control dam locations.

Regional and International Water Resource Plans

Flooding along the Red River and its tributaries is a prolonged issue for the region and since 1997 severe flooding has occurred more frequently. The Red River Basin Commission recommends acceptable levels of flood risk within the Red River Basin, which would include protection of rural residences for a 100-year flood event and protection of cities for a 200-year flood event. The Red River Basin Commission has adopted a strategy to achieve the acceptable levels of flood risk with a goal of a 20% reduction of peak flow in the Red River through construction new flood water retention projects in the US portion of the Basin. The Red River Basin Commission and Red River Retention Authority are strongly in support of dam rehabilitation efforts to ensure that existing flood water retention is preserved into the future.

Water quality is also an important consideration because the Turtle River discharges to the Red River, where nutrient loading is an international concern due to the eutrophication of Lake Winnipeg in Manitoba, the world's tenth largest freshwater lake. While the Red River contributes only 10-15% of runoff water by volume to Lake Winnipeg, it is estimated to contribute 60% of the total phosphorus load. Continual expansion of cyanobacteria populations is linked to increased phosphorus loadings from fertilization and more frequent and intense spring floods in the Red River Basin. The Boundary Waters Treaty of 1909 was signed to prevent and resolve disputes over the use of the waters shared by Canada and the United States and to settle other transboundary issues. The treaty specifies "waters flowing across the boundary shall not be polluted on either side to the injury of health or property on the other." Through the International Joint Commission, in 2020 the government of the United States committed to water quality objectives which include a reduction in annual phosphorus loading at the international border by more than

50%. Flood control dams in this region provide a critical water quality function in reducing the frequency and duration of cropland inundation, thereby limiting the transport of dissolved phosphorus (which is the dominant form in this watershed) to the Red River.

Plants, Communities, and Habitat Quality

The U-AA is within two EPA Level IV sub-ecoregions - Beach Ridges and Sand Deltas to the west and Glacial Lake Agassiz Basin to the east. The U-AA has a variety of habitats and plant communities with a quality range of fair to good. The U-AA is partially within an NDGF habitat focus area: *Sand Deltas and Beach Ridges*. Plant communities include tame grassland (i.e., tilled, or other disturbed land returned to grassland), wetland, upland deciduous forest, river and stream, lake, and prairie. PL-566 Section 12 consultation with the USFWS and ND Parks and Recreation Department resulted in identification of two vegetative communities they deem "Significant Ecological Communities" present in the U-AA: Dogwood-willow Thicket (Cornus sericea-salix (bebbiana, discolor, petiolaris) thicket) and Bur Oak Upland Woodland (Quercus macrocarpa/prunis virginiana northern ravine woodland). They also had identified a rare plant - Small Yellow Lady's Slipper Orchid (Cyprpedium parviflorum) within the U-AA.

Refer to Section 4.2.3.2, Appendix D-9 (Aquatic Resource Delineation and Fen Search Report, 2021 with addendum (2024)) for more information on wetland classification and location. Refer to Appendix D-10: Biological Inventory Report for additional information on the habitats and plant communities identified at the project site.

Three NDGF habitat focus areas are within the D-AA: *Sand Deltas and Beach Ridges*, *Saline Area and the Turtle River*. Immediately downstream of the dam, some areas of the native riparian woodlands have been cleared for cropland and negatively impacted by grazing. However, a more robust corridor of riparian vegetation picks up about 4 miles downstream and continues to just north of the Grand Forks Air Force Base (GFAFB). This area includes native riparian mature woodlands in the Turtle River State Park. Riparian woodlands in the Red River valley are typically dominated by green ash (Fraxinus pennsylvanica), boxelder (Acer negundo), bur oak (Quercus macrocarpa) basswood (Tilia americana). Downstream of the GFAFB, in the Saline Area Sub-ecoregion, the riparian woodland is more sporadic, and the cover is more commonly in grass or cropland all the way to the confluence with the Red River of the North. The D-AA contains vast expanses of tall grass prairie, including a NDGF designated *saline focus area* (NDGF, 2015). The salty groundwater flowing to the surface is most suitable for salt tolerant species such as Salicornia rubra (red saltwort), Pascopyrum smithii (Western wheatgrass) and Spartina pectinata (prairie cordgrass). Other introduced species such as Kentucky Bluegrass, Smooth Brome, and Reed Canarygrass are also common in the D-AA. The saline area is also where wetlands are most concentrated. The USFWS Kellys Slough National Wildlife Refuge is largely within the D-AA. The refuge was established to develop and manage a system of wetlands and grasslands unique to the Red River Valley of North Dakota. It contains an intermittent stream and pools of water that flow into the Turtle River. The refuge serves as an important migration stopover and staging area for shorebirds and waterfowl in an area where there are few options for waterbirds (USFWS, 2025). Several USFWS Waterfowl Production Areas (WPAs) are contiguous

with Kellys Slough. The WPAs are open to public hunting, fishing and bird watching recreation.

Riparian Areas

The riparian zone in the U-AA is 553 acres (this does not include the area of the reservoir at normal pool elevation) and includes riparian woodlands, wetlands, and riverine communities, in addition to some grasslands located within the floodplain (Appendix D-10 Biological Inventory Report). This zone has experienced minor changes in community structure, and the community type is largely intact. When the dam was built and the reservoir pool filled, a large area of riparian woodland was lost.

The riparian area in the D-AA is approximately 17,818 acres and consists mainly of the corridor of riparian woodland and herbaceous vegetation along the Turtle River, including the confluence of the North Branch with the South Branch, portions of the North Branch, and several unnamed tributaries. The area continues to the confluence with the Red River of the North just southwest of the city of Oslo, MN. Approximately 29% of the vegetation is woodland; forest vegetation is largely confined to the upper reaches of the D-AA. A large block of native forestland is maintained in the Turtle River State Park. The upper-story native riparian trees are dominated by Burr Oak, Green Ash and Basswood, while understory species typically include chokecherry, hazel and snowberry. Significant areas of riparian herbaceous wetland are present in the middle region of the D-AA due to the high-water tables and salinity. Forest vegetation was largely removed in the reaches closest to the Red River, these areas are cropped when possible. The flatter slopes were tilled land and/or drained via channelization to facilitate cropping.

Mammals, Amphibians, Reptiles, Invertebrates

The NDGFD has listed species of concern for the state's wildlife conservation strategy, which are considered "species of conservation priority" and are included in the 2015 State Wildlife Action Plan (NDGF, 2015). These species are ranked in priority from level I to level III, with I being the highest priority. In the U-AA and D-AA there are 2 reptiles, 9 mammals, 5 freshwater mussels, and 4 insects species of conservation priority that may be present in this ecoregion. Level I species potentially present include: Plains Hog-nosed Snake (Heterodon naicus), Big Brown Bat (Eptesicus fuscus), Little Brown Bat (Myotis lucifugus), Northern Long-eared Bat (Myotis spetrentrionalis), Creek Heelsplitter (Lasmingona compressa) and Monarch Butterfly (Danaus Plexippus). This butterfly species requires milkweeds. Preferred habitat may be present in the project area. Refer to Appendix D-10: Biological Inventory Report for additional information.

Fish

Larimore Dam has been classified as a Class 2 cool-water fishery, which is considered capable of supporting natural reproduction and growth of cool-water fishes (i.e. walleye and northern pike). A Class 2 fishery is also considered to be capable of supporting associated aquatic biota for marginal growth of fish. The reservoir is stocked by the North Dakota Game and Fish Department (NDGFD) since 2014. Stocking included Pure Muskellunge, Walleye, and Northern Pike. The 2023 NDGFD Survey Report indicates sport fish include Common Carp (44.9%), Black Crappie (14.3%), Black Bullhead (12.2%), White Sucker (10.2%), Northern Pike (8.2%), Yellow Perch (8.2%), and Largemouth Bass (2.0%). The fishery status also indicates Walleyes are present, but low

in number, and a few Bluegills with some up to 8-inches. The reservoir relies primarily on stocking efforts made by NDGFD; natural reproduction is limited.

The Turtle River in Grand Forks County is also listed as a fishery by NDGFD. The Turtle River is one of only 15 rivers in the state the department manages and stocks. The next closest rivers are Sheyenne and Red River, which have only been stocked two years in the last 10 and only for one species (Walleye). The Turtle River within the Turtle River State Park has been stocked annually since 2014 with catchable Rainbow Trout. The Turtle River is a very rare trout stream in the region; the only other river in North Dakota stocked with Trout is Missouri River.

The NDGFD has listed eleven fish species of conservation priority potentially present in the U-AA and D-AA, including the level I species: Northern Pearl Dace (Margariscus nachtriebi). The ND Parks and Recreation Department identified a rare fish species – Northern Redbelly Dace (Chrosomus eos) as present within the U-AA.

Twenty-three native fish species were present in the Turtle River during a USGS survey in 1995. Of these, two are listed as Level II Species of Conservation Priority in the 2015 SWAP: Silver chub and Trout-perch. More recent native species found in the reservoir include: Black Bullhead, Northern Pike, Walleye, White Sucker and Yellow Perch.

Birds, Migratory Birds and Eagles

According to NDGFD, the bald eagle population and the number of eagle nests are increasing in North Dakota; however, there are no documented bald eagle nests or large stick nests near the dam.

North Dakota is located within the Central Flyway, one of the major migration paths in North America. Migratory birds can occur within the U-AA or in the vicinity during spring and fall migration or even use the area for breeding or nesting during summer months. In the D-AA, there are many migratory bird species of concern. Migratory birds occur in the D-AA during spring and fall migration as well as use the area as breeding and nesting grounds through the summer.

The USFWS IPaC Migratory Bird list for the U-AA was generated in June 2025 and included 13 bird species. All the birds listed are considered Birds of Conservation Concern (BCC), except for the Bald Eagle, which is not considered a BCC, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from development activities. The list provides a bird's relative probability of presence during a year in the U-AA. The list included 6 land birds, 3 shorebirds, 2 waterbirds and 2 raptors (See Table 5 Appendix D-10 Biological Survey).

Cultural Resources, Historic Properties

In the U-AA, Larimore Dam was determined to not be eligible for the NRHP but was listed as an architectural site with the ND State Historic Preservation Office. A Class III survey was completed by NRCS on 7/30/2025. A culturally significant site was found within the U-AA and indicates the area may have been an encampment – artifacts may lie below the plow zone. Other sites within a 1-mile radius of the U-AA include culturally significant burial mound sites. No sites in the D-AA have been listed in the NRHP,

however there are 20 culturally significant sites including 15 wood and stone structures constructed by the Civilian Conservation Corp in the Turtle River State Park (TRSP).

Public Health and Safety

In the dam's current condition, a breach during a major flooding event would pose a significant risk to public safety. The design standard breach analysis is described in Appendix D-1: Existing Conditions Assessment Report, and No Action breach analysis is described in Appendix D-3: Alternatives Evaluation Report. Both breach analyses indicate that loss of life is likely given a dam failure under the evaluated conditions. For No Action breach, 14 homes, 16 local roads, and 1 federal highway would have flow depths and velocities place them in the high danger potential category where loss of life would likely occur. An estimated 82 lives would be at risk at the residences, roads, and highway. The dam currently provides water quality protection to one downstream wellheads.

Transportation and Infrastructure

Federal Highway 2, Federal Highway 81, and Federal Interstate 29 are the only roads within the D-AA or U-AA with an average daily traffic load of over 400 vehicles. State Highway 18 is within the U-AA as it crosses the South Branch Turtle River within the flood storage pool; the lowest spot of road crest is elevation 1091.6, which is 1.1 feet higher than auxiliary spillway crest invert. Larimore Dam reservoir levels overtop State Highway 18 at approximately the 300-year flood event. Federal Highway 2 is within D-AA and crosses the Turtle River ~9 river miles downstream of Larimore dam. This highway has four lanes, with two eastbound lanes separate from two westbound lanes, and separate bridges are used for lanes. Federal Highway 81 and Federal Interstate 29 are within D-AA and ~60 river miles downstream of Larimore Dam. These highways are not affected by breach event as river flows return within banks by this point.

Recreational Resources

The population (2020 Census) within the project area is approximately 8,119 individuals. The demographics within the U-AA and D-AA include the communities of Larimore, Mekinock, Arvilla, Manvel, Ardoch and the Grand Forks Air Force Base. The project area is adjacent to the large community of Grand Forks, ND (population 59,166, 2020 US Census) and is nearby or adjacent to other small cities including Petersburg, Gilby, Johnstown, Emerado, and Niagara. The reservoir provides recreation opportunities generally not common in the area, consisting of camping, swimming, water recreating, fishing, and boating. The dam and reservoir are part of the Larimore Dam Recreation Area. Amenities include a campground, boat ramp, fishing pier, picnic areas, swimming beach, and arboretum, see Watershed Plan Appendix C-27 for a facility map. The campground has 144 camp sites, including water and electrical hookups, plus comfort stations with showers and flush toilets. Other facilities include softball diamond, horseshoe pits, volleyball nets, frisbee golf, playgrounds, and hiking trails, both paved and rustic. The Myra Arboretum has 500 varieties of trees and shrubs. Fishing is a popular activity here, and the lake is stocked annually by the NDGFD. Ice fishing occurs during the winter that creates a village of ice houses. Alternate fishing opportunities exist at four other locations in the area (within 16 miles). However, other fishing waters have limited sport fish species, stocking frequency, and deep-water habitat, compared to

Larimore Dam. The Larimore Dam flood pool is closed to hunting. Larimore Dam has an annual recreation value of $487,849 (2024 dollars). Adjacent to the recreation area is the Larimore Golf Course.

The D-AA includes large blocks of land open to public hunting, fishing and birdwatching within the USFWS Kellys Slough Wildlife Refuge and several USFWS Waterfowl Production Areas (WPAs). The city of Manvel has a golf course, and the other smaller communities typically offer playgrounds and picnicking at city parks. The Turtle River State Park (TRSP) provides many recreational services including fishing, swimming, camping and picnicking. The cold-water trout fishery around TRSP is stocked annually by North Dakota Game and Fish Department, which is a very popular and unique trout fishery not otherwise common in the region.

Local and Regional Economy

Roughly 83% of the land in Grand Forks County is farmland; the 2022 Census of Agriculture county factsheet that the county is home to 956 farms (National Agricultural Statistics Service, 2022). The county ranked 1st in ND for production of dry edible beans, 9th for corn and 10th in the state for soybeans for 2023 crop production (National Agricultural Statistics Service, 2024). Walsh county was a top-10 producer in the state for dry edible beans (2) and for production of spring wheat (7). Together, Grand Forks and Walsh Counties harvested just over one-quarter of the total dry bean acreage in North Dakota during the 2023 crop season and accounted for 26.93% of our state's dry bean production. The pair accounted for 4.9% of soybean acres and 6.37% of spring wheat production in the state. The unemployment rate in Grand Forks County has remained notably below the U.S. average for the last ten years. The 2024 county unemployment rate was 2.1%, compared to a national rate of approximately 4% (Bureau of Labor Statistics, 2026a, b).

Environmental Impacts of Action Alternatives

Environmental impacts of Future Without Federal Investment (FWOFI) and structural rehabilitation are summarized in following subsections. FWOFI was considered Alternative 1 during alternative comparisons, which included minimal decommissioning of the dam, without stabilization of reservoir sediments or downstream flood control features. Structural rehabilitation was considered Alterative 2 during alternative comparisons, which includes replacing principal spillway, armoring auxiliary spillway, flattening downstream embankment slope, and new chimney filter and foundation drain. The environmental impacts were considered for Upstream Assessment Area (U-AA) and Downstream Assessment Area (D-AA), which with more detail in Scope of Analysis section.

Land Use

Alternative No. 1 – FWOFI

- U-AA: Conversion of the 66-ac normal pool from open water and lacustrine fringe wetland to a riparian grassland and wetland complex used primarily for long-term grazing would occur. Loss of flood storage would reduce ability to grow crops on

the immediate downstream floodplain, which could result in conversion from cropland to pasture or natural lands.

- D-AA: Removal of the dam and increased flooding downstream may prompt land use changes. There may also be land use changes where agricultural land reverts to "natural" land use if flooding makes farming difficult and former cropland is enrolled in conservation programs.

Alternative No. 2 – Structural Rehabilitation

- U-AA: During reservoir drawdown for the 2-year construction period, the outcomes would be similar to the FWOFI. Once completed, the natural land use of the reservoir would resume (open water), along with lacustrine fringe wetlands.
- D-AA: There would be no effects during construction. Once completed, the current level of flood attenuation and flood protection would be maintained for an additional 100-yr lifespan, likely retaining the crop production land use. Rural residential land use would also be protected from flooding

Soil Resources, Erosion and Deposition

Alternative No. 1 – FWOFI

- U-AA: During construction there would be temporary erosion from earthwork (dam excavation, possible bypass channel). Drawdown of the surface water would expose unvegetated valley slopes (referred to as exposed slopes) and highly erodible sediments that have accumulated behind the dam (referred to as accumulated sediments) to wind erosion. A full channel restoration would not be completed. Meaning no soils would be reseeded to standard NRCS grass seed mixes. The floodplain and exposed slopes would be left to revegetate naturally. This would leave the unconsolidated floodplain sediments and exposed slopes vulnerable to significant wind and water erosion for several years until vegetation establishes. A braided stream would form in the accumulated sediments, inhibiting vegetation establishment and sediment stabilization for some time.
- D-AA: Lack of flood attenuation would result in increased flooding incidence downstream. These events could result in some cropland scouring. Inundation would lead to crop damage, then wind-driven erosion, and then further soil loss, thus reducing the productivity of the land. Uncontrolled sediment transport would increase sediment loading downstream. Sediments deposited in the downstream floodplain could be deposited on farmland and riparian communities. A supply of sediment flowing downstream may alleviate channel incision issues. Also, this sediment supply could benefit soil health in perennial plant communities including riparian woodlands.

Alternative No. 2 – Structural Rehabilitation

- U-AA: Construction activities and impacts would be similar to those of the FWOFI at the dam site. After the construction is complete, the soils on the dam embankment and the auxiliary spillway would be stabilized by ACB and grass seeding. Once the water level returns to the normal pool elevation, stabilization of

the accumulated sediments and exposed slopes would return to pre-project conditions. The low-level drawdown elevation should be set no lower than 1050.0 based on current sedimentation rate and dredging operations may be possible in the future. Regular maintenance and operation of the low-level drawdown conduit may help to flush some sediment through the principal spillway structure throughout the life of the dam. However, all analysis and calculations for sediment deposition in the reservoir were completed assuming that historical sediment deposition rates continue.

- D-AA: During construction, temporary increases in sediment transport would be possible, but best management practices (BMPs) would be implemented to minimize erosion. Once the project is complete, the reservoir would once again protect downstream lands from scouring and erosion and would prevent the accumulated sediments from eroding and moving downstream, thus preventing sediment loading downstream. This would protect agricultural land, but riparian communities would not receive a natural replenishing sediment supply and thus could continue to be of poor quality. By limiting the sediment supply moving downstream, channel incision and bank erosion would continue at current rates.

Prime Farmland

Alternative No. 1 – FWOFI

U-AA: Through review of pre-construction aerial imagery, the area of impact for this alternative has no history of agricultural commodity production. According to form NECH 610.33, because no farmland is being converted to non-farmland, it is not necessary to complete forms AD-1006 or CPA-106.
D-AA: During construction there would be no impacts. After the controlled dam breach, downstream flooding would inundate approximately 11,530 acres of prime farmland during 100-year flood events. These events could result in some cropland scouring. This would lead to crop damage, then wind-driven erosion, and then further soil loss, thus greatly reducing the productivity of the land. If the flood events occur during the summer months, the crop damages would be greater than during spring flooding events.

Alternative No. 2 – Structural Rehabilitation

- U-AA: Through review of pre-construction aerial imagery, the area of impact for this alternative has no history of agricultural commodity production. The project features impact soils largely designated as Not Prime. A small area of Prime Farmland in the existing auxiliary spillway will be shaped and filled, however, this area will still remain viable for haying, therefore because no prime farmland is being converted to non-farmland, it is not necessary to complete forms AD-1006 or CPA-106.
- D-AA: During construction there would be no impacts. Once the project is complete, downstream flooding would inundate the same 11,285 acres of prime farmland at the 100-year flood event. In total, 245 acres of prime farmland would continue to be protected by this alternative during 100-year flood event.

Groundwater Resources

Alternative No. 1 – FWOFI

- U-AA: No public wellheads or other groundwater resources are located within this area.
- D-AA: There would be no effects during construction. Once completed, current flood protection would be removed. Three wells (one production, one stock and one irrigation well) downstream of the existing dam would be inundated and potentially contaminated during a 500-year event. One rural water well adjacent to the inundated area would be susceptible to potential contamination during a 500 year event.

Alternative No. 2 – Structural Rehabilitation

- U-AA: No public wellheads or other groundwater resources are located in this area.
- D-AA: There would be no effects during construction. Once the project is complete, only the one stock well would remain unprotected during a 500-year rainfall event.

Surface Water Resources

Alternative No. 1 – FWOFI

- U-AA: Expected permanent impacts include elimination of 32 acres of wetlands, and 45.99 acres of Other Waters (OW). This drawdown alternative includes removal of artificial deepwater system which is numbered OW-8 (45.99 acres). Consequently, the artificial lacustrine fringe wetlands adjacent to deepwater (W-75 & W-76) totaling 28.17 acres would also be lost. The depressional wetlands (W4 – W12) within auxiliary spillway and at toe of embankment would be lost due to auxiliary spillway fill, dam excavation, and altered hydrology; the sum of these wetland areas is 3.83 acres. Alternative grading extents results in ~0.4 acres of fill in OW-2, which is artificial section of South Branch Turtle River including dam principal spillway plunge pool and short stretch of downstream channel. For more details regarding functional losses see **Error! Reference source not found.** 3, and map of impacted areas see Watershed Plan Appendix C-23.

Table 3: FWOFI Wetland Functional Losses in the U-AA.

Wetland Classes	Depressional	Lacustrine Fringe
Affected Area in U-AA by Alternatives	3.83 acres	28.17 acres
Function	**FCU**	**FCU**
Static	0.85	17.25
Dynamic	0.00	0.00
Cycling	2.44	21.91
Removal	0.35	20.23
Retention	2.25	20.83
Plants	1.64	21.13

Structure	1.75	17.77
Habitat	0.68	6.80
Shoreline Integrity	-	9.10

If USACE determined that these were jurisdictional wetlands, the WRD would be required to purchase credits for up to 32 acres. Given this would not be a federal project, if wetlands were determined to be non-jurisdictional then no mitigation would occur.

Within the reservoir area multiple shallow channels (braided stream) would form and migrate across the unconsolidated sediments with each flood event. Beaver dams and vegetation would establish over time, although larger floods would cause new erosion and channels to form. Over the course of decades, the valley would stabilize, and grasses may start to grow on higher elevation sediments along the margins. It is possible a single thread channel could form over the long term, or the area could remain in a multiple-thread channel condition. Both riparian and depressional wetlands could form over the very long term. Tributary stream channels down the valley side slopes would lengthen and resume pre-reservoir conditions.

D-AA: During the construction period, reservoir drawdown would result in greater volumes of water (less or more depending upon construction techniques) flowing downstream. This could temporarily cause minor flooding conditions. Removal of Larimore Dam would result in an increase in flooding downstream, but the stream would remain a perennial stream. Appendix D-4 (Concept Design Report) and D-5 (Economics Report) summarize flood probability event site performance, and downstream flood affects without dam. Increased flooding could support more wetlands, develop new meanders in the river channel, and form new oxbow wetlands. It is possible that some agricultural land use could revert to natural wetland areas. Downstream riparian wetlands would benefit over time from this alternative by restoring riparian floodplain function.

Alternative No. 2 – Structural Rehabilitation

- U-AA: Expected temporary impacts include loss of hydrology to 28.17 acres of lacustrine fringe wetlands, and 45.99 acres of Other Waters (OW). Temporary impacts would consist of reservoir drawdown to the point that deepwater is no longer present. There would also be inundation of wetlands (~0.5 acres) around the reservoir when the 2-year, 24-hour storm events temporarily increased the pool elevation.

  Expected permanent impacts include loss of 0.95 acres of wetlands. Permanent impacts would consist of filling W-8 through W-11 with ACB spanning the auxiliary spillway. W-12 would also be lost due to two-stage filter system properly conveying any potential seepage away from dam toe. No losses are expected to lacustrine fringe wetlands and OW as dam embankment and principal spillway will be replaced with the same ground dimensions and locations as existing features.

For more details regarding functional losses see Table 4, and map of impacted areas see Appendix 4.

Mitigation would be required under EO 11990 for permanent wetland impacts, regardless of whether USACE determined they were jurisdictional or not.

Table 4: Proposed Action Wetland Functional Losses in U-AA

Wetland Classes	Depressional
Affected Area in U-AA by Alternatives	0.95 acres
Function	**FCU**
Static	0.85
Dynamic	0.00
Cycling	2.44
Removal	0.35
Retention	2.25
Plants	1.64
Structure	1.75
Habitat	0.68

Temporary construction impacts would occur to a ~0.1 acres of OW-2 due to principal spillway outlet construction. Temporary reservoir drawdown for construction would remove 45.99 acres of deep water habitat and 28.17 acres lacustrine fringe wetlands, and would occur from early-summer to the time the reservoir refills (1-3 years dependent on precipitation). Alternative No. 2 retains the pool behind Larimore Dam as well as the fringing wetlands for 100-years from when construction is complete and reservoir refills.

D-AA: During construction the reservoir would be drawn down at a rate that would minimize potential for increased downstream flooding. No wetland impacts are anticipated in the D-AA from Alternative 2.

Water Quality

Alternative No. 1 – FWOFI

- U-AA: After the drawdown, the eutrophic reservoir water associated with Larimore Dam would be absent. Water temperatures downstream of the dam would be reduced. The accumulated sediments, previously held under anoxic conditions and now exposed to air, would become oxidized and begin to release mobile metals and bioavailable phosphorus into the porewater. Contaminated porewater has potential to migrate to the underlying groundwater aquifer over time. Of the contaminants documented in reservoir sediments, the ones with the potential to migrate into underlying groundwater include arsenic, chromium, copper, nickel, and zinc. Risks of exceeding water quality thresholds are less than Alternative 3 (No Action) and more than Alternative 2 (Structural).

D-AA: As the multi-thread channel system forms and migrates back and forth across the reservoir sediments upstream of the grade control structure constructed at the former dam site, the eroded sediments would be transported downstream. Increased levels of nitrogen, phosphorus, carbon, arsenic, cadmium, chromium, copper, lead, nickel, and zinc would be expected as a result. Erosion quantity would be substantially less than outlined for Alternative 3 (No Action). The process would take place over several decades but occur at higher rates during major flood events. Risks of exceeding water quality thresholds are less than Alternative 3 and more than Alternative 2 in the short term. After decades, water quality could improve as wetlands and vegetation provide chemical sequestration, sediment stabilization, filtration, and phytoremediation benefits. Due to increased frequency, extents, and duration of cropland flooding dissolved phosphorus transport to the Turtle River downstream of the dam would increase over the long term.

Alternative No. 2 – Structural Rehabilitation

- U-AA: During construction, the reservoir drawdown would result in temporary water quality degradation, similar to the FWOFI. The sediment would become oxidized and mobile metals and bioavailable phosphorus would be released into the porewater. Once the project is complete, the sediments transported from the contributing watershed would be again contained by the dam. Potentially mobile metals and bioavailable phosphorus would be sequestered in the anoxic sediments at the reservoir bottom (Larimore Dam is stratified with an approximately four-meter anoxic zone). The low-level drawdown elevation should be set no lower than 1050.0 based on current sedimentation rate, which would provide 100+ years of sediment storage. The reservoir would refill and would again become eutrophic. Increased rainfall intensity would exacerbate sediment transport from the contributing watershed and predicted warmer temperatures would increase growth of algae in the reservoir, both factors likely causing HABs to increase more in frequency.
- D-AA: As the reservoir waters are drawn down, there would be potential for temporary increased sediment and nutrient loading downstream, the intensity of this depending on the construction techniques used. Temporary BMPs would be implemented to minimize adverse impacts (from e.g., total suspended solids) to water quality. Once the construction is complete, the reservoir would again reduce nutrient, metals, and sediment transport downstream, thus improving the quality of the water flowing downstream.

Water Management

Alternative No. 1 - FWOFI

- U-AA: The reservoir would no longer temporarily store flood water and attenuate the inflow hydrograph.
- D-AA: The public safety risk due to a dam breach would be eliminated. During construction, the reservoir drawdown may cause slight increases to discharge downstream. No flooding would result, however, because allowable discharges to

drawdown the reservoir would be regulated based on downstream flow conditions. Thus, all drawdown discharge would be contained within the stream channel. After the project is completed, flood attenuation would be eliminated, increasing the incidence of flooding downstream. During a 100-year flood event, approximately 25,450 acres of cropland would be inundated, including 10 residential dwelling structures, 71 agricultural structures 32 commercial structures, and 1 industrial structures. Flooding impacts at other recurrence intervals are provided in Appendix D-5 Economics Evaluation.

Alternative No. 2 – Structural Rehabilitation

- U-AA: During construction, the reservoir would no longer temporarily store water and attenuate the inflow hydrograph. Post-construction, the reservoir will continue to temporarily store flood water and attenuate the inflow hydrograph.
- D-AA: Flood risk associated with an uncontrolled breach would be reduced by meeting dam safety and design requirements for a high hazard dam. During construction, the reservoir drawdown may cause slight increases to discharge downstream. No flooding would result, however, because allowable discharges to drawdown the reservoir would be regulated based on downstream flow conditions. Thus, all drawdown discharge would be contained within the stream channel. During construction of the principal spillway riser tower there would be a temporary interruption in flood attenuation. Once the construction is complete, the alternative would result in compliance with dam safety design requirements for a high hazard designation dam. Flood protection would be provided to cropland, residential structures, non-residential structures, and roads. Flood protection for the 2-year through 500-year events would remain unchanged from the current condition. During a 100-year flood event, approximately 26,050 acres of cropland would be inundated, including 7 residential structures, 55 agricultural structures, 27 commercial structures, and 1 industrial structure. Flooding impacts at other recurrence intervals are provided in Appendix D-5 Economics Evaluation.

Regional and International Water Resource Plans

Alternative No. 1 – FWOFI

- U-AA and D-AA: Increased phosphorus and nitrogen transport out of the Turtle River watershed, from both sediment mobilization from upstream of the dam and increased extents, duration, and frequency of cropland flooding, conflicts with U.S. government commitment to reducing phosphorus and nitrogen concentrations at the international border crossing of the Red River through the International Joint Commission's implementation of the Boundary Waters Treaty.

  Removal of flood storage through the decommissioning of Larimore Dam would work against flood damage reduction objectives defined in the Red River Basin Commission's Long Term Flood Solutions report. Additional storage elsewhere in the Red River Basin would be required to offset flood storage lost through this alternative to meet the 20% flow reduction goal on the Red River mainstem.

Alternative No. 2 – Structural Rehabilitation

- U-AA and D-AA: Bringing the dam into compliance for state and federal dam safety requirements would ensure downstream nutrient reduction benefits provided by the dam would continue into the future, thus meeting the U.S. government commitment to reducing phosphorus and nitrogen concentrations at the international border crossing of the Red River through the International Joint Commission's implementation of the Boundary Waters Treaty.
- Rehabilitation to current state and federal dam safety requirements would also ensure flood storage currently provided by the current condition would remain into the future. This aligns with the Red River Basin Commission's Long Term Flood Solutions objective to reduce peak flows on the Red River Mainstem by 20% by not requiring resources to be invested into identifying and implementing flood storage projects to offset storage lost under the FWOFI.

Plants, Communities, and Habitat Quality

Alternative No. 1 – FWOFI

U-AA: Removal of the reservoir would eliminate a large area of artificial deep-water habitat (45.99 acres). Subsurface aquatic plant species found in the reservoir would be recolonized by the remaining stream channel. The reservoir would be replaced by an exposed floodplain where eventually rehabilitated grasslands and floodplain wetlands would develop. Existing upland woody habitat would not be affected by the construction. The ND Park and Recreation deemed ecologically significant community of Dogwood-willow thicket may be reduced by the removal of the fringe hydrology of the reservoir. The Bur Oak Upland Woodland significant community existed prior to the dam construction and could potentially increase with the reduced hydrology around the perimeter of the reservoir.

Most of the newly exposed soils on the valley slopes and floodplain would not be deliberately seeded nor rehabilitated to a natural plant community and no maintenance for non-native species control would be conducted. Therefore, natural plant succession typically associated with shallow braided stream and flood plains that are interspersed with small beaver dams would occur. For a short period, annual grasses and broadleaf plants such Echinochloa crus-galli (Barnyardgrass), and Polygonum pensylvanicum (Pennsylvania smartweed), will likely temporarily establish along with other early succession perennial plants like Hordeum jubatum (Foxtail barley), some of which would also be noxious weeds like Cirsium arvense (Canada thistle) and Sonchus arvensis (Field sowthistle). Perennial grasses, composed of both native and non-native wet meadow (FAC wet) species such as Phalaris arundinacea (Reed canarygrass),and Spartina pectinata (Prairie cordgrass); and wetland (obligate) plants such as Typha X glauca (hybrid cattail) and Polygonum amphibium (water smartweed) would make up the majority of the plant community. Woody plant species would primarily be composed of early successional species such as Salix petiolaris (meadow willow) and Cornus sericea (Redosier dogwood). Establishment of willows and dogwoods would provide necessary woody material to support a beaver population and would

help create the floodplain wetlands mentioned above. Other upland non-native invasive grasses like Bromus inerimis (Smooth brome), and Poa pratensis (Kentucky bluegrass) would also establish on the upper floodplain. After herbaceous vegetation has established, and the reservoir sediments are stabilized, it is likely livestock would graze the flatter and higher floodplain areas. Woody vegetation is expected in steeper and wetter floodplain areas. The natural development of the riparian area primarily provides habitat for grassland nesting birds, amphibians, deer, and other small mammals.

These conditions would likely remain in place for several decades, or until a major flood event occurs. After what would likely be several decades, the braided stream/beaver pond complex may become more channelized. The once shallow braided system could become a single channel, effectively eliminating the floodplain. Due to the drier condition brought on by the elimination of the flood plain, a shift in plant community would occur. Plant species would transition from predominantly wet meadow and hydrophytic species to a scenario dominated by upland plant species on the former floodplain with hydrophytes remaining only in the channel.

- D-AA: Generation of a "flashier" hydrologic regime compared to both current and historic conditions in the watershed, with unnaturally high peak flows, suspended sediment, and erosion downstream would increase habitat complexity but would also adversely affect some species and provide ample areas for invasive species establishment. Predictions of long-term increased precipitation in this area has the potential to further increase peak flows. Increased frequency and extents of downstream flooding on cropland could encourage land use conversion from agriculture to either pasture or rehabilitated natural plant communities associated with the Glacial Lake Agassiz Basin sub-ecoregions, through which the D-AA runs. This would improve habitat connectivity and would indirectly benefit other organisms and contribute to ecosystem resiliency and biodiversity. On the other hand, increased flooding could encourage construction of additional cropland drainage systems in the downstream floodplain, which would result in loss of depressional and riverine wetlands and contribute to wildlife habitat loss and decreased ecosystem resiliency and biodiversity. Increased peak flows would damage some of the riparian areas and sediments and associated contaminants transported downstream from the dam accumulated sediments would degrade habitat and impair ecological functions for some time.

Alternative No. 2 – Structural Rehabilitation

U-AA: Rehabilitation of the dam would mean retaining the open water habitat, enlarging the herbaceous cover of construction sites, wetland loss in the long-term (absence of floodplain wetlands versus poor-quality lacustrine fringe wetlands), and absence of riparian woodlands. The ND Parks and Recreation deemed ecologically significant communities of Dogwood-willow thicket, and Bur Oak Upland Woodland would remain intact. Habitat favorable to the rare species: Small Yellow Lady's Slipper, would not be impacted by temporary construction impacts.

Temporary impacts during construction to wetlands, grasslands, and forested areas would be mitigated to the extent possible with the use of BMPs. Grassland beyond the footprint of the embankment and auxiliary spillway footprint would likely be affected by the operation of construction equipment. Any areas outside of the construction footprint that are damaged in a way that does not allow existing grasses to grow back would be reseeded.

Approximately 2.6 acres of trees are present in the estimated work area of Alternative 2. Approximately 0.1 acres of woodland near the existing embankment toe would be removed entirely to ensure flow paths through the embankment are not created via tree roots. The remaining 2.5 acres would only be removed if necessary for construction access or safety. This woodland habitat is peripheral and not significant compared with the adjacent undisturbed woodland habitat. Over a very long time, sediments would continue to accumulate behind the dam, causing the reservoir to become shallower and eventually become deep-water wetland habitat.

Approximately 13.7 acres of tame grass in the auxiliary spillway and embankment will be disturbed for construction and would be reseeded to a native grass/forb suitable for critical use areas. Any other tame grass areas disturbed for roads or staging would be seeded to a superior mix of native grasses and forbs suitable for pollinators. Existing tame grass in the ACB area (5.66 ac.) would be permanently lost as grassland habitat, however the quality of the reseeded grasslands will improve in vigor and diversity. The seed mix on the dam itself needs to exclude legume species that attract rodents. The stand will be mowed and monitored to ensure that tree growth does not occur. Root depths should be shallow enough so that flow paths are not created through the embankment, but deep enough to ensure stability of the embankment. Control over the types of grasses growing on the embankment are crucial for monitoring and inspection purposes. The seed mixes selected for this purpose would likely be NRCS approved critical area grass mixes or something similar.

- D-AA: Once construction is complete, downstream biotic communities would function similar to their present condition.

Riparian Areas

Alternative No. 1 – FWOFI

- U-AA: The removal of the dam would eliminate the reservoir which would be replaced by a new braided stream channel and floodplain area on the accumulated sediments. Initially the reclaimed floodplain would be vulnerable to significant erosion, but over time (decades) riparian habitat would develop, however, riparian woodlands would likely be limited to shrub species such as Salix petiolaris (meadow willow) and Cornus sericea (Red osier dogwood) that would be found along the stream channel(s) and in or around newly formed floodplain wetlands. The riparian area would be mixed woodlands and herbaceous plants based on

competition; nearby river corridors illustrate a likely ratio. Existing woodland habitat in the river valley would remain unchanged.

- D-AA: Restored sediment transport downstream would increase the quality of riparian woodlands. In addition, increased peak flows could increase natural propagation of historically native tree species such as Bur Oak, Green Ash and Basswood. Increased erosion from unnaturally high peak flows would cause loss of mature trees, as well, however.

Alternative No. 2 – Structural Rehabilitation

- U-AA: Temporary impacts during construction to riparian areas would be mitigated to the extent possible with the use of BMPs, i.e. silt fences, sediment basins, and riparian buffers. A temporary loss of up to 2.6 acres is expected for construction access. 0.1 acres of permanent riparian woodland loss is expected.
- D-AA: Rehabilitation of the dam would maintain riparian woodland conditions downstream, including incision effects from interrupted sediment transport.

Mammals, Amphibians, Reptiles, Invertebrates

Alternative No. 1 – FWOFI

- U-AA: During construction, movements and foraging patterns of mammals would be temporarily disrupted due to human presence and noise. The plan to complete construction and vegetation reestablishment in construction zone within a year minimizes direct disturbance impacts to local animals. There would be no significant effect on terrestrial animals because they would avoid human activity and there would be no suitable bat roosting trees removed. For animals dependent on the 32 acres of wetland habitat and 45.99 acres of open water, the reservoir drawdown and auxiliary spillway fill would cause displacement or death. An expanded stream corridor would benefit many riverine and riparian species, particularly mussels (Level I *Lasmigona compressa*, creek heelsplitter) and amphibians. The system of braided, shallow channels, beaver dams, and successional vegetation processes that follow the controlled breach would provide habitat for amphibians, reptiles, deer, beaver, and other small mammals.
- D-AA: Generation of a “flashier” hydrologic regime compared to both current and historic conditions in the watershed, with unnaturally high peak flows, suspended sediment, and erosion downstream would increase habitat complexity but would also adversely affect some species and provide ample areas for invasive species establishment. Predictions of increased precipitation in this area have the potential to further increase peak flows. Increased frequency and extents of downstream flooding on cropland could encourage land use conversion from agriculture to either pasture or rehabilitated natural plant communities associated with the Glacial Lake Agassiz Basin sub-ecoregion, through which the D-AA runs. These habitats support a wide range of animals and invertebrates. They also provide increased habitat connectivity. These corridors are particularly important to many species in this region where trees are relatively uncommon on the landscape. On the other hand, increased flooding could encourage construction of additional

cropland drainage systems in the downstream floodplain, which would result in loss of depressional and riverine wetlands and contribute to wildlife habitat loss and decreased ecosystem resiliency and biodiversity. Increased peak flows would damage some of the riparian areas and sediments and associated contaminants transported downstream from the dam accumulated sediments would degrade habitat and impair ecological functions for some time.

Alternative No. 2 – Structural Rehabilitation

- U-AA: During construction, temporary effects would be similar to the FWOFI. Rehabilitating the dam and refilling the reservoir would retain the artificial lake, precluding historical, suitable habitat for many riparian and riverine species. The ACB used for part of the auxiliary spillway would reduce grass cover and prevent some animal species from browsing or burrowing in this area. The reseeding of staging and incidental areas to native pollinator mixes would increase the quality of the grass habitat potentially benefiting bumblebees and *Danaus plexippus* (monarch butterfly). Mature tree losses are minimal, but some trees may be suited for NFGFD Level I species including the Big Brown Bat (Eptesicus fuscus), Little Brown Bat (Myotis lucifugus), and Northern Long-Eared Bat (Myotis spetrentrionalis).
- D-AA: Current habitat conditions would persist into the future.

Fish

Alternative No. 1 – FWOFI

- U-AA: During construction, drawdown of the reservoir would leave a small area of shallow water over the winter but not enough to support the fish species currently in the dam. North Dakota Game and Fish Department (NDGFD) has no plans to capture and move fish in Larimore reservoir during lake drawdown. There is a greater chance of oxygen depletion in the winter or freezing to the reservoir bottom, both potentially resulting in winter fish kill. After construction, absence of the lake habitat would eliminate lake species at this location. A new stream channel would develop in the accumulated sediments, and this could become suitable habitat for riverine fish in the long-term if water quality improves. However, there would be no fish passage from the downstream channel over the weir. Lessening downstream channel incision processes could benefit several species, including the Level I *Margariscus nachterbi* (northern pearl dace).
- D-AA: Impacts during construction would be mitigated through implementation of the required stormwater pollution prevention plan and 404 permit. In the long-term, high sediment loading would continue until the stream channel stabilizes and vegetation becomes established in the rehabilitated floodplain. Increased sediment loading could continue depending on agricultural practices in the contributing watershed. Generation of a “flashier” hydrologic regime compared to both current and historic conditions in the watershed, with unnaturally high peak flows, suspended sediment, and erosion downstream would increase habitat complexity but cause degradation of habitat for fish species such as *Margariscus nachterbi* (northern pearl dace) which require clear water. Water temperatures

downstream of the dam will be lower, which could improve conditions for stocked trout in Turtle River State Park section.

Alternative No. 2 – Structural Rehabilitation

- U-AA: Temporary reservoir drawdown during construction will result loss of fish species in the lake, which NDGF indicated would provide opportunities to improve species composition for the fishery. Once the construction is complete and the lake water levels return, NDGF would restock fish populations with locally desirable game fish such as perch, walleye and northern pike enjoyed for sport and human consumption. Other native species found in the reservoir would also benefit including black bullhead, and white sucker. An operational drawdown gate would enable the NDGFD to collect more reliable inventories of fish populations in the lake and would improve the efficiency of large catches used to transport them to other locations if necessary (i.e., prior to sediment dredging or for controlling invasive species). As in the recent past, fish could experience winter kills and algal bloom impacts. Sediment will continue to accumulate in the reservoir. Majority of the reservoir sediment thickness is <1 foot over the past 41 years; this rate will continue over the next 100 years. Therefore, the average depth (11 feet) will still be above 9 feet, and max depth (28 feet) will still be at least 26 feet. The reservoir will remain habitable by fish species within the 100-year planning timeframe, however composition of sport fish will be dependent on management and use.
- D-AA: Impacts during construction would be mitigated through implementation of the required stormwater pollution prevention plan and 404 permit. In the long-term, fish species that require clear water (e.g., *Margariscus nachterbi,* northern pearl dace) would benefit from the presence of the dam and continued retention of the large volume of accumulated sediments. Species that require cold water (stocked trout in Turtle River State Park reach) will retain current stream temperatures, which are raised from natural conditions due to dam impoundment and warmer surface water flowing over principal spillway weir.

Birds, Migratory Birds and Eagles

Alternative No. 1 – FWOFI

- U-AA: During construction, noise and reservoir drawdown would displace some bird species but be an attractant for fish-eating birds such as *Haliaeetus leucocephalus* (bald eagle), *Lophodytes cucullatus* (hooded merganser), *Phalacrocorax auratus* (double-crested cormorant), *Podiceps nigricollis* (eared grebe), and *Pelecanus erythrorhynchos* (American white pelican) who would feast on fish within the shrinking pool area. Once the project is complete, fish-eating birds and those that depend on open water habitat and lacustrine fringe wetlands would be permanently displaced. These include four NDGFD Level I species of conservation concern: *Leucophaeus pipixcan* (Franklin's gull), Botaurus lentiginosus (American Bittern), Coturnicops noveboracensis (Yellow Rail), Limosa fedoa (Marbled Godwit) and USFWS listed migratory birds including the aforementioned Franklin's Gull and Marbled Godwit as well as Tringa flavipes (Lesser Yellowlegs), Aechmophorus occidentalis (Western Grebe) and Tringa

semiplmata (Willet). For several years following the controlled dam breach, the exposed sediments would continue to provide habitat for most of the aforementioned birds with reduced habitat for those requiring open water such as the Western Grebe and Marbled Godwit. After several decades, a system of braided, shallow channels, beaver dams would develop. The vegetation successional processes that follow would provide habitat for grassland nesting birds like *Agelaius phoeniceas* (Red winged blackbird), *Xanthocephalus xanthocephalus* (Yellow headed blackbird), and many species of duck. The development of riparian woodlands would be mixed due to landscape position and competition from herbaceous plants. Therefore, benefits to woodland nesting birds would be minimal.

D-AA: There would be no effect during the construction period. Long term, generation of a "flashier" hydrologic regime compared to both current and historic conditions in the watershed, with unnaturally high peak flows, suspended sediment, and erosion downstream would increase habitat complexity, which could benefit some bird species. Restored sediment transport could improve riparian woodlands, which could benefit woodland nesting species such as Level I/USFWS listed Coccyzus erythropthalmus (Black-billed Cuckoo) and Melanerpes erythrocephalus (Red-headed Woodpecker). These riparian corridors are particularly important to many species in highly agricultural areas where trees are relatively uncommon on the landscape.

Alternative No. 2 – Structural Rehabilitation

- U-AA: Construction and reservoir drawdown activities would be similar to the FWOFI in terms of temporary benefits to fish-eating birds but negative impacts others due to disturbance and drawdown. Once the project is complete, no effect is expected compared to the current condition.
- D-AA: Once the project is complete, no effect is expected compared to the current condition.

Cultural Resources, Historic Properties

Alternative No. 1 – FWOFI

- U-AA: The FWOFI alternative would be the most destructive to the existing dam as the structure would be significantly altered by the planned breach. Ground-disturbing activities associated with the proposed project include excavation, grading, or other disturbance that could damage or destroy undiscovered subsurface features comprising archaeological resources. This alternative would also disturb the greatest amount of land not previously disturbed by the initial dam construction, because the new road alignment requires work outside of the original footprint of the dam
- D-AA: Under the FWOFI alternative, hydraulic modeling indicates increased flood inundation extents. The 15 originally constructed CCC structures in Turtle River State Park and historic bridges along Turtle River would have minimal increased damages for floods smaller than the 100-year event, but more significant increased

damages for the 100-year and 500-year flood events, compared to existing conditions.

Alternative No. 2 – Structural Rehabilitation

- U-AA: The ND SHPO concurred with the NRCS recommendation of "No Historic Properties Affected" for Alternative 2. An adjacent area will require "avoidance area" signage to prevent incidental impacts during construction. Alternative 2 will not significantly alter the position or function of the dam or its impoundment zone and, thus, does not pose an adverse effect to the integrity or eligibility status of surrounding cultural resource sites.
- D-AA: This area was not surveyed; however, NRHP eligible sites downstream, including 15 CCC structures within the Turtle River State Park and other potentially eligible bridges, would be inundated only during the 100-year and 500-year event (as it is currently unless the dam were to fail).

Public Health and Safety

Alternative No. 1 – FWOFI

- U-AA: Once the project is complete, absence of the dam would eliminate risk of a breach.
- D-AA: After construction, the 100-year flood event would affect 114 structures, 10 of these being residential (See Watershed Plan Figures C-15 through C-21 for more information). No lives would be at risk (based on depth-velocity requirements used for the breach hazard classification). The 500-year flood event would impact two wellheads.

Alternative No. 2 – Structural Rehabilitation

- U-AA: The project would bring the dam up to current performance, design, and safety standards to protect public safety. Incidence of HABs would continue and become exacerbated by climate change and intensified agriculture in the contributing watershed.
- D-AA: The 100-year flood event would affect 15 structures, one of these being residential (See Watershed Plan Figures C-15 through C-21 for more information). No lives would be at risk (based on depth-velocity requirements used for the breach hazard classification). All wellheads within the wellhead protection area in the D-AA would maintain existing protection through a 500-year flood event.

Transportation and Infrastructure

Alternative No. 1 – FWOFI

- U-AA: State Highway 18 would no longer be affected by Larimore Dam reservoir impoundment, which currently would overtop the road at ~300-year flood recurrence.
- D-AA: Lack of flood attenuation upstream would result in downstream road overtopping, road damages, and decreased residential and community access.

Adverse impacts would likely need to be addressed and costs of adapting to flood protection assessed. Without flood attenuation and downstream flood reductions, three bridges would no longer meet North Dakota Century Code Chapter 24-3 stream crossing standards. The standards require sufficient capacity for variable frequency flows to permit the water flow freely and unimpeded under the bridge based on use volume. The three bridges are crossing at 28th St. NE, 21st Ave. NE, and 23rd Ave. NE (CR11), see Plan Document Table D-3-6 for more details

Alternative No. 2 – Structural Rehabilitation

- U-AA: State Highway 18 would continue to be affected by Larimore Dam reservoir impoundment, which currently would overtop the road at ~300-year flood recurrence.
- D-AA: The project would result in decreased risk of failure of the dam would reduce the potential for downstream road overtopping, road damages, and residential and community access problems. Existing conditions bridge hydraulic design standards would remain, as documented in Table D-3-6.

Recreational Resources

Alternative No. 1 - FWOFI

- U-AA: Decommissioning of the dam would eliminate boating, fishing, and water based recreational opportunities currently provided by the reservoir. The recreation area would remain open as some recreational opportunities will be present in upland areas. However, lack of a reservoir would severely limit recreation use volume. Additional opportunities for new users are limited, rather would provide additional huntable acres for those holding one of the limited whitetail deer hunting permits. Increased opportunities for upland game birds would be present, however Larimore Dam is not located in primary range for North Dakota's popular upland gamebirds (pheasant, sharptailed grouse, and Hungarian partridge), therefore additional users of those resources are limited.
- D-AA: A more naturally functioning floodplain and sediment transport would increase quality of riparian habitat that may enhance hunting and fishing opportunities for floodplain areas downstream. During the 500-year event, the Turtle River State Park would experience significant losses in their recreational facilities (lodge, fishery, camping and picnicking). Some of these would be rebuilt over time. Most land downstream of the dam is in private ownership with access regulated by landowners. While this would enhance recreational opportunities for those with access, it would not increase the number of recreation users to the area.

Alternative No. 2 – Structural Rehabilitation

- U-AA: During construction, all water-based recreation activities would be restricted. However, upland based activities would remain. After completion, the project would provide all recreation activities including fishing, boating, and camping through the remainder of the dam's extended design life (at least 100 years from construction). Fishing and boating activities are not expected to diminish over the design life due to insignificant sedimentation in the reservoir.

Though fishing opportunities may diminish over time, a fish population in the reservoir would be maintained through the design life of the dam.

- D-AA: Recreational opportunities downstream of the dam would remain unchanged.

Local and Regional Economy

Alternative No. 1 – FWOFI

The FWOFI outcome, similar to the Preferred Alternative, eliminates the risk of loss of life. Under the FWOFI, though, this comes with the trade-off of increasing the expected annual damages from flooding because of the removal of the flood control structure. The expected annual benefit of the FWOFI, compared to the NAA, is (-$311,543). See Appendix D (section III.A.4) for more details.

- U-AA: Recreation is the main economic aspect in the U-AA. The owner would likely install a stockwater pipeline and water tanks off the rural water system to replace the reservoir as a livestock water source under this alternative.
- D-AA: Dam removal and subsequent lack of flood attenuation downstream would result in property damage to structures, contents, and vehicles ranging from $157,793 for the 5-year flood event to over $24.2 million for the 500-year flood event. The expected annual flood damages to structures, contents, and vehicles are estimated at $419,940. The expected annual flood damages to crops are estimated at $1.2 million. The expected annual damages to roadways are estimated at $200,601. It was determined that without the dam, three additional properties would need to participate in the National Flood Insurance Program, resulting in an estimated $1,164 more per year for administrative costs.

Alternative No. 2 – Structural Rehabilitation

The benefit to cost ratio (BCR) is 0.1. This is based on total annual costs of $522,523 and annual benefits of $39,406. The total cost for rehabilitation, including engineering, non-engineering, and construction is $14.1 million.

- U-AA: Once the construction is complete, recreation activities would resume, resulting in an annual estimated recreation value of $487,849.
- D-AA: Once the project is complete, there would be numerous benefits to the local and regional economy. The rehabilitation would reduce the expected annual damages to structures and vehicles by $20,955 compared to the No Action Alternative ($336,227 compared to $357,182 under the NAA). After the project is complete, flooding would impact fewer acres of cropland. The expected annual flood damages to crops are estimated at 1,135,306, which is a reduction of $17,009 compared to the NAA. The expected annual damages to roadways are estimated $171,489, an annual reduction of $822 compared to the NAA. The structural rehabilitation would also protect an additional $620 in expected annual recreation value, compared to the NAA.

Environmental Impacts of No Action Alternative

Land Use

Alternative No. 3 - No Action

- U-AA: This alternative includes no reservoir drawdown; thus, the land uses for natural land and built land would not be affected until the uncontrolled breach occurs. During a breach, the reservoir would be eliminated, but the sum of natural land use would not change. The basin which currently services as public recreational land use would likely change to contracted grazing land use. Long-term, eventual rehabilitation of vegetation in the valley floodplain may enable grazing land expansion if livestock can use the new stream channel as a water supply.
- D-AA: The flood attenuation capacity upstream is not changed until the uncontrolled breach occurs. During the breach, the flood wave moving downstream would permanently damage some agricultural land via major scouring and sediment deposition. Long-term, there would be increased flooding over some agricultural land and many areas suitable for building. The loss of 325 acres of mature riparian trees with the flood wave may lead to the conversion of forest to grazing land. Some portions of the scoured cropland may not be possible to farm in the future, so would be converted to grazing lands.

Soil Resources, Erosion and Deposition

Alternative No. 3 – No Action

- U-AA: Prior to the uncontrolled breach, this alternative would provide flood attenuation and would maintain the water cover above the accumulated sediments and on the slopes. Also, because there would be no drawdown nor construction activity, this alternative precludes associated erosion. During a breach, the dam auxiliary spillway would drastically erode, and the subsequent sudden drawdown of the reservoir would expose the accumulated sediments and the sideslopes and cause uncontrolled release of sediments to flow downstream. In the short-term, a new braided stream channel or channels would develop in the accumulated sediments. In the long term, a headcut would likely develop as a result of multiple flood events and would continue to erode an incised channel moving upstream, and all flood attenuation would have been lost.
- D-AA: This alternative would continue to reduce flood erosion and prevent uncontrolled sediment transport downstream prior to the uncontrolled breach. During the breach, the flood wave would travel downstream causing scouring and depositing massive amounts of sediments in areas downstream. 523,200 cubic yards of earthen material would be eroded from the downstream floodplain, and deposition of 682,000 cubic yards would occur, resulting in nearly $12.6 million in clean-up costs on cropland. Long-term, erosion from the reservoir site would continue to deposit sediments downstream. Increased flooding incidence would cause cropland erosion and soil loss. This would lead to wind-driven erosion and

further soil loss, thus greatly reducing the productivity of the land. Downstream riparian communities may expand with a more dynamic erosion/deposition system.

Prime Farmland

Alternative No. 3 – No Action

- U-AA: Through review of pre-construction aerial imagery, the area of impact for this alternative has no history of agricultural commodity production. After the uncontrolled breach, residual sediment flats on either side of the incised channel could provide a very small amount of land suitable for farming.
- D-AA: The 500-yr event would inundate approximately 16,096 acres of prime farmland. During the breach, the initial flood wave moving downstream would inundate 4,050 acres of prime farmland, causing significant damage via scouring and/ deposition. In the long-term, 100-year flood events would inundate approximately 11,285 acres of prime farmland. The lack of vegetation would lead to wind-driven erosion and further soil loss, thus reducing the productivity of the land.

Groundwater Resources

Alternative No. 3 – No Action

- U-AA: No public wellheads or other groundwater resources are located within this area.

  D-AA: Prior to the uncontrolled breach, this alternative maintains the current level of flood attenuation and downstream flood protection which includes three wells (1 production, 1 irrigation, and 1 stock well). During a breach, the flood wave moving downstream would inundate these wells. The inundation water is also adjacent to a rural water well used for consumption where leaching may reach the wellhead drawdown area. A portion of the Elk River Aquifer lies within the breach area, just downstream and to the north of the dam along the North Branch of the Turtle River. The 751,100 cubic yards of contaminant-laden sediment behind the dam and auxiliary spillway sediment would be transported downstream; some of these analytes would deposit over the wellheads, which have a direct connection to the local groundwater. EPA surface water quality aquatic life standards would be exceeded for cadmium and zinc; regional standards would be exceeded for nitrogen and phosphorus. Water flowing downstream for years after the breach will pose risks to human health and aquatic species. A dam breach would not likely change the presence or lack thereof, of pesticides in the local groundwater.

Surface Water Resources

Alternative No. 3 – No Action

- U-AA: Prior to the uncontrolled breach, no effects compared to the current condition are expected. During and after the breach the expected permanent impacts include elimination of 32 acres of wetlands and 45.99 acres of Other Waters (OW). The loss of reservoir would result in loss of deepwater (45.99

acres) and adjacent lacustrine fringe wetlands 75 & 76 (28.17 acres), plus dam toe seepage wetland (W-12, 0.03 acres). Since the breach is through the auxiliary spillway, Wetlands 4 - 11 (3.8 acres) would also be lost. For more details regarding functional losses see Table 5, and map of impacted areas see Watershed Plan Appendix C-25.

Table 5: Alternative 3 Wetland Functional Losses in U-AA

Wetland Classes	Depressional	Lacustrine Fringe
Affected Area in U-AA by Alternatives (acres)	3.83	28.17
Function	**FCU**	**FCU**
Static	0.85	17.25
Dynamic	0.00	0.00
Cycling	2.44	21.91
Removal	0.35	20.23
Retention	2.25	20.83
Plants	1.64	21.13
Structure	1.75	17.77
Habitat	0.68	6.80
Shoreline Integrity	-	9.10

As the headcut progressed through the sediment deposits behind the dam in years following the breach, it would likely form multiple branches and side channels. Beaver dams and vegetation would establish over time, although larger floods would cause new erosion and channels to form. It is possible a single thread channel could form over the long term, or the area could remain in a multiple-thread channel condition. Both riparian and depressional wetlands could form over the very long term. The new floodplain would be more limited than the FWOFI alternative. Tributary stream channels down the valley side slopes would lengthen and resume pre-reservoir conditions.

D-AA: Prior to the uncontrolled breach, no effects compared to the current condition are expected. During the breach, the flood wave has potential affect over 50 miles of Turtle River, and approximately 7,129 wetlands, accounting for 15,486 acres, to varying degrees ranging from minimal disturbance to complete removal of the channel or basin. Some wetlands would experience erosion from the high erosive currents during peak, others by deposition during receding limb of breach hydrograph, and some both erosion and subsequent deposition. Where the breach wave breaks out of the flood plain and moves overland, a large zone of low-lying areas would be inundated, leaving sediment deposits throughout the zone.

Maximum velocities from hydraulic model breach event are compared to allowable velocity to estimate potential erosion of stream channels and wetlands. Allowable velocities are exceeded, resulting in erosion potential, of 15.9 miles of streams and

5.1 acres of wetlands. Sediment deposition is determined spatially based on typical sediment particles (silt), hydraulic model shear stresses, and Stokes's Law for settling velocity. Approximately 1,323 wetlands, accounting for 999.2 acres, would fill with sediment ranging in depths from 0 to 2 feet of fill. Additionally, rivers and creeks categorized as "other waters" would fill with varying degrees of sediment ranging in depth from 0 to 4 feet of deposition. 14,482 acres of wetland may have affects from breach, but are expected to be much less severe than 1,004 acres that are predicted to erode or deposit significant amounts of sediment based on breach hydraulic modeling. Long-term, increased flooding would supply more water to remaining wetlands which would increase wetland function. In low-lying areas, conversion from agricultural land use to restored wetlands could occur as a result of recurring flooding impacts.

Water Quality

Alternative No. 3 – No Action

- U-AA: No effects on water quality would occur prior to the uncontrolled breach. During the breach, the reservoir water would be eliminated and exposed sediments would begin leaching metals and phosphorus. The suddenly exposed sideslopes would erode, contributing additional unconsolidated sediments to the valley floor. In the long term, this leaching would continue indefinitely. The presence of pesticide compounds has been detected in nearly all streams throughout much of the year across the country. The fact that the south branch of the Turtle River is located within an agricultural setting makes the likelihood that pesticide compounds are present, and would continue to be present, quite high.

  D-AA: No effects on water quality would occur prior to the uncontrolled breach. During the breach, massive amounts of sediment would be transported downstream in addition to the drained reservoir water. Water quality downstream would be immediately impacted by excess nutrients, metals, and suspended sediments over a large area.

  Analyte constituents in reservoir sediments were determined by lab testing sediment samples (Table 6, Appendix D-7 Accumulated Sediment). These results were applied to flood volumes to gauge effects of their release during a dam breach. During a breach flood wave, constituents would travel variable distances; dissolved constituents would likely travel farther than those bound to sediment. The breach event is based on Probable Maximum Flood (PMF) for hazard classification. Because the PMF is an extremely rare event with extreme flood volume, it was considered inappropriate for calculating the potential concentration of analytes. Therefore, the constituent masses were applied to the existing conditions 100-year flood volume from hydrologic modeling. The 100-year event analysis was assumed to be appropriate because during the PMF event there is a high likelihood that large amounts of all constituents would remain in the Turtle River watershed, either attached to deposited sediment, stored in depressional areas, i.e. lakes and wetlands, or infiltrated into groundwater paths. As a result,

however, concentrations could be substantially higher at lower peak flows in the downstream river in years following the breach.

The average analyte concentration within 100-year flood hydrograph is at, near, or above all Environmental Protection Agency (EPA) criteria, as shown in table below. Pollutant criteria are based on National Recommended Aquatic Life acute values for freshwater (National Recommended Water Quality Criteria - Aquatic Life Criteria Table | US EPA). Nutrient reference standards are adopted from Ambient Water Quality Criteria Recommendations for rivers and streams in Great Plains Region (Ecoregion IV: Great Plains Grass and Shrublands (epa.gov)). Pollutants above EPA aquatic life criteria include cadmium and zinc. The nutrient flood concentrations (Nitrogen and Phosphorus) are greater than two orders of magnitude above regional reference standard. Therefore, flood concentration is compared to, and greater than one order of magnitude above 90th percentile concentration for agricultural watersheds (Nitrogen and Phosphorus in Streams in Agricultural Watersheds (epa.gov)). The 90th percentile represents the value, Nitrogen = 10 mg/L that 90% of streams in agricultural watersheds are below. In summary, release of the pollutants and nutrients due to dam breach would have significant effects on downstream watershed, notably to streams and rivers but also could affect wetlands, lakes, and groundwater.

Table 6: Estimated Breach Floodwater Contaminant Analysis

EPA Nutrient & Metal Conditions					
Analyte	Concentration (100-yr flood)	EPA Water Quality Criteria	Reference Regionally	Ag Watersheds 90 Percentile	100-year> EPA limit?
	mg/l	mg/l	mg/l	mg/l	
Arsenic	0.04	0.34			No
Cadmium	0.004	0.002			Yes
Chromium	0.09	0.57			No
Lead	0.03	0.07			No
Nickel	0.10	0.47			No
Zinc	0.33	0.12			Yes
N(Total)	14.03		0.56	10	Yes
Phosphorus	0.14		0.02	0.5	Yes

Nitrogen and Phosphorus in Streams in Agricultural Watersheds (epa.gov)

Long-term, there would likely be ongoing erosion upstream and sediment loading downstream. The contaminants would continue to cause water quality problems indefinitely, particularly with increased turbidity disrupting river and lake ecosystems and with increased incidence of HABs in waterbodies. After decades, water quality could improve as wetlands and vegetation provide chemical sequestration, sediment stabilization, filtration, and phytoremediation benefits. Due to increased frequency, extents, and duration of cropland flooding dissolved phosphorus transport to the Turtle River downstream of the dam would increase significantly over the long term.

Water Management

Alternative No. 3 – No Action

- U-AA: Water storage would be provided up to the uncontrolled breach of Larimore Dam. Following breach no storage would be provided.
- D-AA: Flood prevention would be provided up to the uncontrolled breach of Larimore Dam. The flood wave resulting from the breach would place 82 human lives and 14 residential structures at risk. Contaminants would deposit on 3,284 acres of cropland. After the breach, the downstream floodplain would function as described in the FWOFI alternative.

  Without this dam a "flashier" hydrologic regime compared to both current and historic conditions would occur in the watershed, causing unnaturally high peak flows. Predictions of increased precipitation in this area have the potential to further increase peak flows.

Regional and International Water Resources

Alternative No. 3 – No Action

- U-AA and D-AA: Prior to the uncontrolled breach, no effects are anticipated. During the breach, the sudden release of over 2 tons of phosphorus and 173 tons of nitrogen will impact water quality in the Red River in the short term. Long term impacts of increased frequency, extent, and duration of cropland flooding will be increased nutrient phosphorus transport to the Red River, conflicting with the U.S. government's commitment the International Joint Commission's phosphorus reduction goal.

  Flood storage provided by the current condition would continue until the uncontrolled breach. During the breach, significant flooding would occur downstream. Long term, flood storage would be lost, and increased flooding would be expected downstream. Both the devastated consequences to public safety during the breach, and increased flood levels after the breach make this alternative counterproductive to the goals outlined in the Red River Basin Commission's Long Term Flood Solutions objective to reduce peak flows on the Red River Mainstem by 20%.

Plants, Communities, and Habitat Quality

Alternative No. 3 – No Action

U-AA: Prior to the uncontrolled breach, the current open water habitat, lacustrine fringe wetlands, and poor quality of the various plant communities would prevail. Maintenance of the dam embankment would result in some tree removal. During a breach, the open water habitat would suddenly be eliminated, the unvegetated valley slopes would be exposed. The flood wave would erode ~6 acres of tame upland grasses and ~4 wetland acres of the auxiliary spillway. It would also damage a riparian woodland area immediately downstream of the dam. In the long-

term, the exposed sideslopes would eventually become revegetated, likely by non-native upland grasses like Poa pratensis (Kentucky bluegrass) and Bromus inerimis (Smooth brome), broadleaves like Thlaspi arvense (Field pennycress), and noxious weed species such as Cirsium arvense (Canada thistle) and Euphorbia esula (Leafy spurge).

In the exposed unconsolidated sediments at the valley floor, the drainage would form a braided stream and vegetative succession would be similar to what is described in the FWOFI alternative.

These conditions would likely remain in place for several decades, or until a major flood event occurs. At that time, the braided stream/beaver pond complex may become more channelized. The once shallow braided system could become a single channel, effectively eliminating the floodplain. Due to the drier condition brought on by the elimination of the flood plain, a shift in plant community would occur. Plant species would transition from predominantly wet meadow and hydrophytic species to a scenario dominated by upland plant species on the former floodplain with hydrophytes remaining only in the channel.

Existing upland woody habitat would not be affected by the breach event in the U-AA.

- D-AA: Prior to the uncontrolled breach, downstream biotic communities would continue to function consistent with present conditions. During the breach, the flood wave would cause damage to mature trees on 325 acres of riparian woodlands and scour or deposition on 1,004 acres of riverine and depressional wetlands. Scour would occur over 15.9 miles of the Turtle River during the breach. Riparian woodlands could be replanted to trees or allowed to naturally re-establish, or in flatter topography may be converted to grazed pasture. Depressional wetlands where hydric soils were entirely scoured would be unlikely to re-form over the time period of this watershed plan, however wetlands lost to sediment deposition with intact hydric soils below could re-establish over time. Riverine wetlands could form in newly scoured areas in the floodplain over many decades, unless they are filled and leveled for cropland. Increased sediment transport downstream would improve remaining riparian woodlands and floodplain wetlands in a manner similar to the FWOFI. Inundation, scouring and sediment deposition would not impact Kelly's Slough Wildlife Refuge, however ten USFWS Waterfowl Production Area leases would experience varying degrees of disturbance. The USFWS service would be responsible for decisions regarding reseeding or allowing natural regeneration of these areas. Impacts from the contaminants in the sediment such as heavy metals would be a concern for safe waterfowl habitat.

  Increased frequency and extents of downstream flooding on cropland could encourage land use conversion from agriculture to either pasture or rehabilitated natural plant communities associated with the Glacial Lake Agassiz Basin sub-ecoregion, through which the D-AA runs. This would improve habitat connectivity

and would indirectly benefit other organisms and contribute to ecosystem resiliency and biodiversity. On the other hand, increased flooding could encourage construction of additional cropland drainage systems in the downstream floodplain, which would result in loss of depressional and riverine wetlands and contribute to wildlife habitat loss and decreased ecosystem resiliency and biodiversity. Increased peak flows would damage some of the riparian areas and sediments and associated contaminants transported downstream from the dam accumulated sediments would degrade habitat and impair ecological functions for some time.

Riparian Areas

- *Alternative No. 3 – No Action*

  U-AA: Prior to the uncontrolled breach, no effect from the current condition would occur. During the breach, scour from flood wave would damage a riparian woodland area just below the dam. The reservoir would be replaced by a new braided stream channel and floodplain area on the accumulated sediments. Initially the reclaimed floodplain would be vulnerable to significant erosion, but over time (decades) riparian habitat would develop, however, riparian woodlands would likely be limited to shrub species such as Salix petiolaris (meadow willow) and Cornus sericea (Redosier dogwood) that would be found along the stream channel(s) and in or around newly formed floodplain wetlands. The riparian area would be mixed woodlands and herbaceous plants based on competition; nearby river corridors are an example of a likely ratio. Climate change may reduce the hydrologic regime, also retarding the natural regeneration of riparian woody species. The geographic position of the floodplain is not conducive to developing a riparian woodland corridor that is the same as what is present downstream of the current dam site. Existing woodland habitat in the river valley would remain unchanged.

- D-AA: No effects would occur prior to the uncontrolled breach. The flood wave from the breach would cause deep inundation to 6787 acres of riparian area downstream of the dam and cause the loss of 325 acres of mature trees. Over decades, this community may redevelop into a natural riparian corridor that would likely contain many of the same species of trees found today, or those lands may be converted to pasture. Increased sediment transport and flooding could improve the quality of remaining riparian woodlands in a manner much like the FWOFI.

Mammals, Amphibians, Reptiles, Invertebrates

Alternative No. 3 – No Action

- U-AA: Prior to the uncontrolled breach, no effect from the current condition is expected. During a breach, the reservoir would suddenly drain, removing the 66 acres of open water habitat and also damaging some riparian woodlands nearby downstream. For species dependent on the 28.17 acres of lacustrine fringe wetlands and 3.83 acres of depressional wetlands, the dam failure would cause displacement or death. For several years the exposed sediments over 66 acres would provide shorebird habitat in the former reservoir area. The system of

braided, shallow channels, beaver dams, and vegetation successional processes that follow the dam failure would provide habitat for amphibians, reptiles, deer, beaver, and other small mammals, particularly mussels (Level I *Lasmigona compressa*, creek heelsplitter) and amphibians.

- D-AA: Prior to the uncontrolled breach, no change from the current condition is expected. During the breach, the flood wave would cause damage to mature trees on 325 acres of riparian woodlands and scour or deposition on 1,004 acres of riverine and depressional wetlands. Scour would occur over 15.9 miles of the Turtle River. Impacts from the contaminants in the sediment such as heavy metals would be a concern for safe mammal, amphibian, reptile and invertebrate habitat. Loss of mature woodland may impact NFGFD Level I species including the Big Brown Bat (Eptesicus fuscus), Little Brown Bat (Myotis lucifugus), Northern Long-Eared Bat (Myotis spetrentrionalis) and monarch butterfly. Deposition would occur over 3,284 acres of cropland and 1,480 acres of natural lands and pasture. Riparian woodlands could be replanted to trees or allowed to naturally re-establish, or in flatter topography may be converted to grazed pasture. Depressional wetlands where hydric soils were entirely scoured would be unlikely to re-form over the time period of this watershed plan, however wetlands lost to sediment deposition with intact hydric soils below could re-establish over time. Riverine wetlands could form in newly scoured areas in the floodplain over many decades, unless they are filled and leveled for cropland. Increased sediment transport downstream would improve remaining riparian woodlands and floodplain wetlands in a manner similar to the FWOFI.

  Increased frequency and extents of downstream flooding on cropland could encourage land use conversion from agriculture to either pasture or rehabilitated natural plant communities associated with the Glacial Lake Agassiz Basin sub-ecoregions, through which the D-AA runs. This would improve habitat connectivity and would indirectly benefit other organisms and contribute to ecosystem resiliency and biodiversity. On the other hand, increased flooding could encourage construction of additional cropland drainage systems in the downstream floodplain, which would result in loss of depressional and riverine wetlands and contribute to wildlife habitat loss and decreased ecosystem resiliency and biodiversity. Increased peak flows would damage some of the riparian areas and sediments and associated contaminants transported downstream from the dam accumulated sediments would degrade habitat and impair ecological functions for some time.

Fish

Alternative No. 3 – No Action

- U-AA: Until the uncontrolled breach occurs, conditions would be as described for Alternative 2. During an uncontrolled breach, erosion of the dam structures and drainage of the reservoir would result in fish death. In the long term, conditions in the channel and floodplain ecosystem would improve, potentially benefitting fish species currently present in the Turtle River that are adaptable to small, shallow,

warm channels. Suitable conditions for fish species dependent on deep water habitat would be absent.

- D-AA: No effects would occur prior to the uncontrolled breach. During the breach, scour from the flood wave and sediment loading would harm downstream fish populations. Long-term, water quality would be poor for many years but would eventually improve once the erosion/deposition regime equilibrates and riparian woodlands and floodplain wetlands redevelop to some level. However, the habitat quality would still be impaired by continued erosion in the upstream accumulated sediments and contaminants moving downstream. Water temperatures downstream of the dam will be lower, which could improve conditions for stocked trout in Turtle River State Park section.

Birds, Migratory Birds and Eagles

Alternative No. 3 – No Action

- U-AA: No effect would occur prior to the uncontrolled breach. During the breach, the open water habitat would be eliminated suddenly, resulting in a change in the type of migratory birds that would use the habitat. Effects to birds would be similar to those mentioned in the FWOFI alternative.
- D-AA: No effect would occur prior to the uncontrolled breach. During the breach, the flood wave would cause damage to mature trees on 325 acres of riparian woodlands, which would negatively impact woodland nesting species such as Coccyzus erythropthalmus (Black-billed Cuckoo) and Melanerpes erythrocephalus (Red-headed Woodpecker). These riparian corridors are particularly important to many species in highly agricultural areas where trees are relatively uncommon on the landscape. Contaminants from the sediments would be a concern for health of the migratory birds in the downstream USFWS waterfowl production areas. The potential for raptor habitat/nesting would also be greatly reduced potentially affecting the USFWS listed Circus hudsonius (Northern Harrier) and Bald Eagles. Migratory bird and eagle habitat loss would be greater than the FWOFI. Deposition would occur over 3,284 acres of cropland and 1,480 acres of natural lands and pasture. In the years immediately following the dam breach, shorebirds would benefit from the exposed sediment flats left behind by the flood event. The damage caused by the dam breach and restored natural flooding regime downstream may result in conversion of land use from agriculture to reestablishment of naturalized habitats supporting both grassland and woodland nesting bird populations. Grassland nesting bird species would be similar to that listed under the FWOFI.

Cultural Resources, Historic Properties

Alternative No. 3 - No Action

- U-AA: No effect would occur to existing Larimore Dam (considered by ND SHPO to be an architecturally significant site) prior to the uncontrolled breach. During the breach, disturbance to existing Larimore Dam would be severe. Massive erosion of the auxiliary spillway would occur which would negatively affect the architectural value of Larimore Dam. Failure of the embankment itself is also possible with this

alternative. This massive erosion would also likely erode the archeological site within the U-AA, potentially destroying culturally significant material.

- D-AA: No effect would occur prior to the uncontrolled breach. During the breach, hydraulic modeling indicates that approximately 20 cultural resource sites would be inundated and potentially damaged or destroyed. Eight existing sites have been deemed eligible for the NRHP, including CCC stone and wood structures at Turtle River State Park, the other seven sites maybe deemed eligible with further analysis. A CCC constructed lodge in the park was severely damaged during the 2020 flood which eroded the Larimore dam auxiliary spillway. The integrity of the lodge was compromised, however many of the lodge features were salvageable and it remains eligible for NRHP listing. The remaining inundated sites are historic bridges which would be vulnerable to an uncontrolled event. There are no properties downstream listed on the National Register of Historic Places that would be impacted by this alternative

Public Heath and Safety

Alternative No. 3 – No Action

- U-AA: Prior to the uncontrolled breach, there would be continued risk of dam failure. During the breach, there would be erosion of the dam and the road, and rapid drawdown of the reservoir. Safety would be a concern if the breach occurred when people were present. Long-term, the risk of dam failure would no longer be of concern.
- D-AA: Prior to the uncontrolled breach, there would be continued risk of dam failure. During the breach, 82 human lives would be at risk due to hazardous conditions at 14 residential structures, 16 local roads and 1 Federal Highway (Hwy 2). The loss of life potential from structures is 40, while roads is 42. There are 28 residential structures potentially impacted by the dam breach, which 14 are high hazard classification. There are 27 roads potentially impacted by the dam breach, which 17 are high hazard classification. No Action Dam Breach Zone Depth-Velocity-Danger Level Relationships for Houses and Passenger Vehicles is summarized in Appendix 7. The impacted structures and roads are discussed in more detail in Appendix D3 – Alternatives Evaluation Report, Section 5.5.3. The flood wave moving downstream would inundate two wells within a wellhead protection area and may contaminate drinking water resources.

  Long term, after the dam breached, the 100-year flood event would affect 21 structures, four of these being residential (See Watershed Plan Figures C-13 through C-19 for more information). No lives would be at risk (based on depth-velocity requirements used for the breach hazard classification). The 500-year flood event would also impact one public wellhead within a wellhead protection area downstream of the dam.

Transportation and Infrastructure

Alternative No. 3 – No Action

- U-AA: No effect would occur prior to the uncontrolled breach. After the breach, State Highway 18 would no longer be affected by Larimore Dam reservoir impoundment, which currently would overtop the road at ~300-year flood recurrence.
- D-AA: No effect would occur prior to the uncontrolled breach. During a breach, the flood wave traveling downstream would result in 26 downstream roads overtopped and bridges being potentially permanently impacted. There would also be more than 964 feet of gravel road embankment that would be washed out, plus approximately 52 feet of paved road embankment washed out. See Appendix D-5 Economic Evaluation Report for more information. In the long-term, lack of flood attenuation would result in continued downstream road overtopping, road damages, and decreased residential and community access. Adverse impacts would likely need to be addressed and costs of adapting to flood protection assessed.

Recreational Resources

Alternative No. 3 – No Action

- U-AA: The current recreation activities, including fishing, boating, and camping, would be provided until the dam has an uncontrolled breach through the failure of the auxiliary spillway (1,844-year rainfall event). After the uncontrolled breach of the dam, the upland recreational opportunities will still be present; however, with loss of the reservoir visitors will reduce significantly. Additional opportunities for new users are limited, rather would provide additional huntable acres for those holding one of the limited whitetail deer hunting permits. Increased opportunities for upland game birds would be present; however Larimore Dam is not located in primary range for North Dakota's popular upland gamebirds (pheasant, sharptailed grouse, and Hungarian partridge), therefore additional users of those resources are limited.
- D-AA: Recreational opportunities downstream of the dam would remain unchanged until the uncontrolled breach occurred. The breach would result in sediment erosion and deposition within channel and natural riparian areas downstream. The Turtle River State Park would experience drastic losses in their recreational facilities (lodge, fishery, camping and picnicking). Some of these would be rebuilt overtime. The stream and riparian area would see degrading available habitat for game species that are recreationally hunted. Over time as the breach begins to stabilize, a more naturally functioning floodplain and sediment transport would increase quality of riparian habitat that may enhance hunting and fishing opportunities for floodplain areas downstream. Most land downstream of the dam is in private ownership with access regulated by landowners. While this would enhance recreational opportunities for those with access, it would not increase the number of recreation users to the area.

Local and Regional Economy

Alternative No. 3 – No Action

- U-AA: No effect would occur prior to the uncontrolled breach. The breach would eliminate the current recreation value provided by the normal pool. Recreation revenue would be eliminated until good hunting opportunities return.

  D-AA: No effect would occur prior to the uncontrolled breach. During the breach event, damages to structures, vehicles, and infrastructure would occur. Damages to structures and vehicles are estimated at $39.4 million. Damages to infrastructure (roadways) are estimated at $3.6 million. Estimated crop damages during a breach are $31.1 million.

Environmental Impacts Summary

Environmental impacts of proposed action (Structural Rehabilitation), FOWFI, and No Action are summarized in Table 7.

Irreversible or irretrievable commitment of Federal resources

Implementation of proposed action (Alternative 2) would include the financial costs associated with planning, design, and construction of watershed structures and conservation measures, which once expended cannot be recovered. The proposed action would have a permanent impact on 0.1 acres of woodland and 5.66 acres of tame grassland.

The proposed action would have irreversible impacts on the small area of tree removal as well as conversion of the auxiliary spillway from tame grass to articulated concrete block. The proposed action would maintain the value of the original federal investment in the dam and all the benefits it currently provides.

Table 7: Summary of Environmental Impacts

Resource	FWOFI	Structural Rehabilitation	No Action
		Land Cover and Land Use	
Land Use	Conversion of the 66 acres normal pool from open water and fringe wetland to a riparian grassland and wetland complex used primarily for grazing. Loss of flood storage would reduce ability to grow crops on the downstream floodplain, which could result in conversion from cropland to pasture or natural lands.	No change from existing condition.	Preserve current use in the 66-acre normal pool and downstream floodplain until dam breach . After breach, the former pool area would convert to channels, beaver dams, wetlands, and pasture. Downstream, scour and deposition from the breach wave could take some cropland permanently out of production and increase damages on remaining.
		Surface Geology and Soil Resources	
Soil Resources, Erosion, and Deposition	The floodplain and exposed slopes would be left to revegetate naturally. This would leave the unconsolidated floodplain sediments and exposed slopes vulnerable to significant wind and water erosion for several years until vegetation establishes.	After construction, soils on the dam embankment and the auxiliary spillway would be stabilized by ACB and grass seeding. With normal pool elevation, stabilization of the accumulated sediments and exposed slopes would return to pre-project conditions.	No change to existing conditions prior to dam failure. The breach will erode 751,100 cubic yards of dam and reservoir sediments both initially and in the several years following. An additional 523,200 cubic yards of earthen material would be eroded in the downstream floodplain.
	Immediately erosion could increase downstream. Over time, sediments would be stabilized as trees, weeds and herbaceous vegetation colonize the sediment.	No change expected to downstream conditions.	Deposition of eroded sediments would occur over 3,284 acres of cropland and 1,480 acres of natural lands and pastures, which will be subject to wind and water erosion until stabilized by vegetation.
Prime Farmland	Increase in flooding, for example 11,530 acres inundated during the 100-year rainfall event. Flooding could result in some cropland erosion, crop damage, then wind-driven erosion.	No change to existing flood impacts, for example 11,285 acres inundated during the 100-year rainfall event.	Prior to breach, no change. The breach would inundate 4,050 acres of prime farmland causing significant damage from erosion and deposition. After breach increased flooding, similar to FWOFI.

Resource	FWOFI	Structural Rehabilitation	No Action
		Water Resources	
Groundwater Resources	The 500-year flood event would temporarily pond water over 1 stockwater wellhead, potentially contaminating the source directly. Leaching of nitrates and pesticides into the Elk River Aquifer and local groundwater area is a concern.	Wellheads are protected from inundation to the 500-year event, with the exception of one stock well.	Prior to the breach, one stockwater wellhead is impacted from inundation up to the 500-year event. The dam breach would inundate 2 additional wellheads with risk of leaching nitrogen, cadmium, chromium, copper, lead, nickel, and zinc to the Elk River Aquifer.
Surface Water Resources	Loss of 28.17 acres of lacustrine wetlands (FCU 0 to 21.91) and 45.99 acres of lacustrine other waters.	Loss of 0.95 acres of depressional wetlands Temporary impacts to 45.99 acres of lacustrine other waters and 28.17 acres of lacustrine fringe wetland due to reservoir drawdown during construction.	Prior to breach, no change. Within U-AA, the breach would result in loss of 32 ac of wetlands, and 45.99 ac. of lacustrine other waters. Within D-AA, the flood wave would scour at least 15.9 miles of Turtle River, and 5.1 ac of wetlands; sediment deposition would impact 999.2 ac of wetlands.
	Peak flows would be higher with removal of the dam. This could generate bank erosion in the South Branch Turtle River.	Downstream sediment transport would continue to be regulated by the dam, creating minor channel incision in the natural meandering portion of the river between Larimore and Hwy 2.	Over many decades the river channel and tributaries would stabilize, wetlands could form within scoured areas, and water quality would improve.
Jurisdictional Waters of the US (Clean Water Act)	Under this alternative, the Sponsor would submit a Section 404 Permit to USACE immediately prior to construction, who would determine CWA jurisdiction. The maximum CWA wetland acreage would be 32 acres.	The Sponsor would submit a Section 404 Permit to USACE immediately prior to construction, who would determine CWA jurisdiction. The maximum wetland acreage would be 0.95 ac, which would address CWA determination and EO 11990 requirements.	The dam breach would be an act of nature; therefore, no jurisdictional determination would be made. The maximum CWA wetland acreage impacted would 32 ac in the U-AA. Downstream, approximately 5.1 ac of wetlands impacted by scour and sediment deposition would impact 999.2 ac of wetlands.

Resource	FWOFI	Structural Rehabilitation	No Action
		Water Resources (Continued)	
Water Quality	Drawdown and erosion of accumulated sediments upstream of the dam would transport nutrients and contaminants downstream. Increased levels of nitrogen, phosphorus, carbon, arsenic, cadmium, chromium, copper, lead, nickel, and zinc would be expected downstream as a result.	Drawdown may temporarily increase nutrient loading to the downstream river. Accumulated sediments would remain in the normal pool. Erosion and nutrient loading consistent with the current condition would continue in the long term.	No impact prior to breach. With the breach, water quality would be impacted by mobilization of 751,100 cy of contaminant laden sediment behind the dam. EPA surface water quality aquatic life standards would be exceeded for cadmium and zinc; regional standards are exceeded for nitrogen and phosphorus. Water quality would also be impacted from the expected 523,200 cy of scour in the downstream channel and floodplains that would also release high nutrient loads.
Water Management	Public safety risk of an uncontrolled breach is removed. Increased frequency, extents, depth, and duration of downstream flooding because of lost retention at the dam. The 100-year flood would inundate 25,450 acres of cropland, 10 residential structures, 104 unoccupied structures, and inundate 19.15 miles of gravel and 3.10 miles of paved roads.	Public safety risk of an uncontrolled breach is significantly reduced by meeting current dam safety requirements. Flood protection would remain unchanged from existing conditions for the 2 to 500-year floods. The 100-year floodplain would inundate 26,050 acres of cropland, 7 residential structures, 83 unoccupied structures, and inundate 19.0 miles of gravel and 3.03 miles of paved roads.	The dam would function for flood protection as it does under the current condition until the uncontrolled breach occurs. The breach would release a sudden flood wave downstream, putting 82 human lives at risk. Contaminants would be deposited on 3,280 acres of cropland. After the failure, flood protection provided by the dam would be removed.
Regional and International Water Resource Plans	Increased phosphorus and nitrogen transport out of the Turtle River watershed, from both sediment mobilization from upstream of the dam and increased extents, duration, and frequency of cropland flooding, conflicts with U.S. government commitment to reducing phosphorus and nitrogen concentrations at the international border crossing of the Red River through the IJC's implementation of the BWT. Loss of flood retention is in direct conflict with the strategies laid out in the Red River Basin Commissions Long Term Flood Solutions Report.	Bringing the dam into compliance for state and federal dam safety requirements would ensure downstream nutrient reduction benefits provided by the dam would continue into the future, thus meeting the U.S. government commitment to reducing phosphorus and nitrogen concentrations at the international border crossing of the Red River through the IJC's implementation of the BWT. Implementation of this alternative is in keeping with the strategies laid out in the Red River Basin Commissions Long Term Flood Solutions Report.	With the breach, over 2 tons of phosphorus and 173 tons of nitrogen would be transported downstream in the Turtle River. This, combined with long term impacts of increased cropland flooding, would conflict with the U.S. government commitment to reducing phosphorus and nitrogen concentrations at the international border crossing of the Red River through the IJC's implementation of the BWT. Loss of flood retention is in direct conflict with the strategies laid out in the Red River Basin Commissions Long Term Flood Solutions Report.

Resource	FWOFI	Structural Rehabilitation	No Action
		Biotic Communities	
Plants, Communities, and Habitat Quality	Removal of the reservoir would eliminate a large area of artificial deep-water habitat (45.99 acres). Natural plant succession typically associated with shallow braided stream and flood plains that are interspersed with small beaver dams would occur. Including perennial grasses, wet meadow species, wetland plants, sedge and rush species, and minimally willows and dogwoods would make up the majority of the plant community.	Rehabilitation of the dam would mean retaining the open water habitat and enlarging the herbaceous cover of construction sites. Tame grass areas disturbed along embankment or for roads or staging would be seeded to a similar tame grass, or superior mix of native grasses and forbs suitable for pollinators. The seed mix on the dam itself needs to result in a grass stand that can be mowed and monitored to ensure that tree growth does not occur.	No change from the current condition until the breach occurs. Changes to plant communities at and upstream of the dam would be similar to FWOFI. During the breach, the flood wave would scour 15.9 miles of the Turtle River and cause damage to mature trees on 325 acres of riparian woodlands and scour or fill 89.9 acres of wetlands. The increased flooding incidence downstream would improve remaining riparian woodlands and floodplain wetlands in a manner similar to the FWOFI.
	Increased flooding downstream would continue to encourage land use conversion from agriculture to rehabilitated natural plant communities. However, sediment and contaminants transported downstream from the dam will degrade habitat and impair ecological functions for some time.	No change would be expected from current condition downstream of the dam.	Increased flooding downstream would continue to encourage land use conversion from agriculture to rehabilitated natural plant communities. However, sediment and contaminants transported downstream from the dam would degrade habitat and impair ecological functions for some time.
Riparian Woodlands	Over time, increased incidences of downstream flooding and restoration of sediment transport could improve existing riparian forest conditions.	During construction, up to 2.7 acres of woodland may need to be removed. Most of this would regenerate over time. 0.1 acres of permanent woodland loss is expected.	No change from the current condition until the breach occurs. The breach flood wave would damage mature trees on 325 acres of existing riparian forest.
Ecologically Critical Areas	Dogwood-willow thicket may be reduced by the removal of the fringe hydrology of the reservoir. The Bur Oak Upland Woodland community existed prior to the dam construction and could potentially increase with the reduced hydrology around the perimeter of the reservoir.	Dogwood-willow thicket and Bur Oak Upland Woodland would remain intact.	No change from the current condition until the breach occurs. Changes to plant communities at and upstream of the dam would be similar to FWOFI.
Parklands	The Larimore Recreation Area would likely close the campground due to loss of open water recreation activities. During the 500-year event, the Turtle River State Park would experience significant losses in their recreational facilities.	Recreation would temporarily be negatively impacted at Larimore Recreation Area; no change is expected for Turtle River State Park. After completion, the normal pool would refill and recreation opportunities would be consistent with the current conditions.	Recreation opportunities would remain until dam breach. During breach the Larimore Recreation Area would lose reservoir and Turtle River State Park would encounter severe flooding and erosion. Following breach, results would be similar to FWOFI.

Resource	FWOFI	Structural Rehabilitation	No Action
		Biotic Communities (Continued)	
Mammals, Amphibians, Reptiles, and Invertebrates	Temporary disruptions during construction include the presence of humans and noise. Species make-up and distribution would shift to those more suitable for riparian and grassland habitats instead of open water and lacustrine wetlands.	Temporary disruptions during construction due to the presence of humans, noise, and drawdown of the deep-water habitat. Long term, species makeup and distribution would be equivalent to the current condition.	Prior to breach, no change. The floodwave would cause the loss of mature trees. Scour would occur on over 15.9 miles of the Turtle River. Impacts from the contaminants in the sediment such as heavy metals would be a concern for safe habitat.
Fish	Species reliant on the deep-water habitat would no longer be present above the location of Larimore Dam. The grade control structure would not be fish passable, therefore the downstream and upstream channel would function independently.	Temporary impacts during construction; NDGF has indicated potential opportunities to improve species composition in the fishery. NDGF would restock fish populations with locally desirable game fish such as perch, walleye and northern pike enjoyed for sport and human consumption.	Prior to breach, no change. The rapid release of the reservoir during would result in fish death. Downstream scour, sedimentation, and contaminants would compromise fish habitat. This would be detrimental to cold water fishery in and around the Turtle River State Park where trout are stocked, which is a popular fishery.
Birds, Migratory Birds, Eagles	During construction, noise and reservoir drawdown would displace some bird species but be an attractant for fish-eating birds. Once the project is complete, fish-eating birds and those that depend on open water habitat and lacustrine fringe wetlands would be permanently displaced.	Temporary impacts during construction to habitat for species dependent on open water and fringing wetland habitats. Long term, species would remain unchanged from the current condition.	Prior to breach, no change. During the breach, the open water habitat would be eliminated suddenly. Shorebirds could benefit from 4,831 acres of exposed sediment flats in the short term. Migratory bird and eagle habitat loss would be greater than the FWOFI alternative.
Federal Threatened and Endangered Animal Species	During construction there would be no adverse direct or indirect effects on species – no trees would be removed and herbaceous habitat would not change in type or scope.	During construction, a few trees of suitable size for the nationally Endangered NLEB could be removed. This alternative was submitted for consultation through the USFWS IPaC site and received a determination of “May Affect - Not Likely to Adversely Affect” the NLEB. Long term, no change from existing conditions expected.	Prior to breach, no change. The breach flood wave would destroy mature trees on 325 acres of riparian woodlands suitable for NLEB habitat. Long term, the re-establishment of herbaceous habitat in the pool sediments and downstream deposition areas could increase monarch butterfly, Suckley’s Cuckoo bumble bee, and western regal fritillary habitat.

Resource	FWOFI	Structural Rehabilitation	No Action
		Human Environment	
Cultural Resources, Historic Properties	Massive disturbance to Larimore Dam – a ND SHPO designated architectural site. The FWOFI would be the most destructive to the dam compared with other alternatives. Several of the 15 CCC stone and brick structures been deemed eligible for the NRHP within the TRSP would be impacted by large flood events.	Alternative 2 will not significantly alter the position or function of the dam or its impoundment zone and, thus, does not pose an adverse effect to the integrity or eligibility status of surrounding cultural resource sites.	Prior to breach, no change. During the breach, there would be negative effect to the architectural value of Larimore Dam. Erosion would likely erode the archeological site within the U-AA, potentially destroying culturally significant material. ~20 cultural resource sites would be inundated and potentially damaged or destroyed.
Public Health and Safety	Lack of flood attenuation would result in downstream road overtopping and decreased residential and community access. Adverse impacts would likely need to be addressed in the future. Without flood attenuation and downstream flood reductions, three bridges would no longer meet ND stream crossing standards.	The project would bring the dam up to current performance, design, and safety standards to protect public safety.	Prior to breach, there would be continued risk of dam failure. During the breach, 82 human lives would be at risk due to hazardous conditions at 14 residential structures, 17 local roads and 1 Federal Highway (Hwy 2). Post dam failure, impacts would be similar to FWOFI.
Transportation infrastructure	Increased flooding downstream would cause more frequent damages. Increased costs for larger structure sizes would be realized as stream crossings are replaced. There would be three bridge crossings (28th St, 21st Ave, and 23rd Ave) that no longer meet ND Stream Crossing Standards.	Long term, no change from the current condition.	No change prior to breach. The breach would result overtopping of 18 roads, and overwhelm bridge openings causing potential damage and road washouts. There would be 19.0 miles of gravel and 3.03 miles of paved road overtopped during the 100-year event. This would require alternative routes that increase haul distance, reduce emergency services access, and increase commute times.
Recreational Resources	The Larimore Recreation Area (LRA) would likely close the campground due to loss of open water recreation activities.	During construction, negative impacts are expected at LRA. After completion, the normal pool would refill and recreation opportunities would be consistent with the current condition.	Recreation opportunities would remain unchanged until dam breach. During breach the Larimore Recreation Area would lose the reservoir. Following breach, results would be similar to FWOFI.
Local and Regional Economy	Expected annual damages of $1,823,252, include damages to structures, crop production, and roadways. This is an increase of $141,444 compared to the No Action baseline. Expected annual recreation benefits under this alternative are $168,935 less than the expected annual recreation benefit under the NAA	Expected annual damages of $1,643,022, include damages to structures, crop production, and roadways. This is a reduction of $38,786 compared to the No Action baseline. This alternative further protects $620 in expected annual recreation benefits. The project results in	No effect until the dam breach occurs. Expected annual damages under the No Action baseline are $1,681,808, including damages to structures, crop production, and roadways. Additional long-term impacts to crop production would result from erosion and deposition of sediments in the floodplain.

	baseline. This outcome also increases annual administrative costs to the NFIP by an estimated $1,164. The project results in negative net benefits (-$491,541) and a benefit to cost ratio that would be negative. See Appendix D (III.A.4).	negative net benefits (-$483,117) and a benefit to cost ratio less than one (0.1).	

Endangered Species Act

The USFWS IpaC (Information for Planning and Consultation) review process was utilized in 2020 and updated in 2026 for compliance with the ESA. Four species were included in the Official Species list for the U-AA on 2/26/2026. Myotis septentrionalis (Norther Long-eared Bat) status is *Endangered*, while the Danaus plexippus (monarch butterfly), Bobus suckleyi (Suckley's cuckoo bumble bee), and Argynnis idalia occidentalis (western regal fritillary) statuses are *Proposed*. No critical habitats were identified as present in the project area. However, suitable habitat is noted within the study area. In the U-AA, Danaus plexippus (monarch butterfly) was observed. There are no known hibernacula or maternity roost trees in North Dakota for NLEB, however there is the presence of preferred habitat (Appendix D-10: Biological Inventory Report). Common milkweed (Asclepias syriaca), a critical species for Monarch Butterfly, was identified in the U-AA.

During construction, trees of suitable size (> 3" diameter) for the nationally Endangered NLEB would be removed primarily for heavy equipment access to the stilling basin and ACB installation. A field inventory found 196 trees > 3 inch diameter (bur oak, basswood and green ash) in the potential removal zone. This alternative was submitted for consultation through the USFWS IPaC site on February 26, 2026 and received a determination of "May Affect - Not Likely to Adversely Affect" the Northern Long-eared Bat. USFWS recommends completing the IPaC at frequent intervals to stay current with the required protocols. If bats are observed near the construction site, construction would cease and USFWS would be consulted. Construction would cause a temporary and permanent loss of herbaceous vegetation suitable for Suckley's Cuckoo bumble bee, western regal fritillary, Monarch Butterflies and milkweed, necessary for their production. Loss of herbaceous habitat is minimal in the long term and limited to the conversion of the grassed auxiliary spillway to ACB's.

United States Fish and Wildlife Service (USFWS) indicates no designated critical habitat in the D-AA, but the bat may be present based on habitat preferences. NRCS will continue to consult with USFWS regarding Northern Long-eared Bat throughout design and construction phases.

National Historic Preservation Act – Section 106 Review

The North Dakota State Historic Preservation Office has reviewed the proposed action and made the following determination:

No historic properties affected. Section 106 Review has been completed for the project area and no National Register eligible cultural sites were found.

A Class III survey was completed by NRCS on 7/30/2025. A culturally significant site was found within the U-AA and indicates the area may have been an encampment – artifacts may lie below the plow zone. Other sites within a 1-mile radius of the U-AA include culturally significant burial mound sites.

The project agreement and the construction contract would specify that if there are any inadvertent or unanticipated discoveries of cultural resources during construction or operation, work shall immediately be stopped, the affected site secured, and the state

archaeologist notified. The contract would also specifically address the procedure required upon the discovery of human remains. In addition, the construction contract would prohibit project workers from collecting artifacts or intentionally disturbing cultural resources in any area under any circumstances. All borrow material is expected to come from onsite, however should the project require additional borrow material from an offsite or unevaluated location, the location would be evaluated by the NRCS Archeologist and Tribes, and the State Historic Preservation Office consulted to its utilization outlined in 36 CFR800.13B.

The downstream area (D-AA), which is not within the cultural resources area of potential direct effect from the proposed action, was not surveyed, however a Class I search was completed. There are no properties downstream listed on the National Register of Historic Places. However, there are a significant number of sites deemed *eligible* for the NRHP. These include 15 originally constructed Civilian Conservation Corps (CCC) stone and wood structures within the Turtle River State Park. Of the 15, 12 are recognized as buildings and three as structures. Eight structures were inventoried and analyzed in Plan Appendix D-1 and D-3. There are also several historic bridges eligible for the NRHP downstream of the dam.

Consultation with Federally Recognized Tribes

Consultation with federally recognized tribes was conducted as follows: The tribal consultation process was initiated on March 19, 2020. Thirty-one tribes and ND SHPO were sent invitations to participate in the planning process for Larimore Dam Rehabilitation. One response was received from a tribe requesting to be included on all correspondence.

The ND State Historic Preservation Office (SHPO) was provided with the Class III Survey in May 2025; they requested some edits to the document. On July 30, 2025, ND SHPO concurred with the NRCS recommendation of “No Historic Properties Affected”, provided a cultural site be fenced and avoided during construction. Language for the signage will be limited to “avoidance area”. Any modifications or additional borrow areas would need to come from an approved source. On September 4th, 2025, 31 tribes and ND SHPO were sent the Class III Cultural Resources Survey. One response was received by a tribe indicating they would defer to local tribes. Section 106 consultation on the Class III survey was completed on December 19, 2025. The following list is inclusive of all 31 tribes consulted on the project:

- Apache Tribe of Oklahoma
- The Blackfeet Nation
- Chippewa Cree Tribe of the Rocky Boy's Reservation
- Confederated Salish and Kootenai Tribes
- The Crow Tribe of Montana
- Fort Belknap Indian Community
- Fort Peck Assiniboine and Sioux Tribes
- Northern Cheyenne Tribe
- Shoshone Tribe of the Wind River Reservation
- Northern Arapaho Tribe
- Mandan, Hidatsa & Arikara Nation
- Spirit Lake Tribe of Fort Totten
- Standing Rock Sioux Tribe
- Turtle Mountain Band of Chippewa
- Bois Forte Band of Chippewa Indians
- Fond du Lac Band of Lake Superior Chippewa
- Santee Sioux Nation
- Grand Portage Band of Lake Superior Chippewa
- Leech Lake Band of Ojibwe
- Prairie Island Indian Community of Minnesota
- Lower Sioux Indian Community
- Mille Lacs Band of Ojibwe
- Upper Sioux Community
- Red Lake Band of Chippewa Indians
- Cheyenne River Sioux Tribe
- Crow Creek Sioux Tribe
- Flandreau Santee Sioux Tribe
- Oglala Sioux Tribe
- Rosebud Sioux Tribe of Indians
- Sisseton-Wahpeton Oyate
- White Earth Nation of Minnesota Chippewa
- Yankton Sioux Tribe

Table 8: Applicable proposal record documentation to support tribal consultation

Documentation Type	File Name (if applicable/needed)
Initial Consultation Letter (3/19/2020)	Watershed Plan Appendix A
Section 106 Consultation Correspondence on Class III Survey (9/4/2025)	Watershed Plan Appendix A
Multiple correspondence with ND SHPO on Draft Class III Survey (2025)	Watershed Plan Appendix A

Clean Water Act

The pertinent subject matter expert has reviewed the proposed action (and action alternatives, if any) and made the following determination:

Project will affect waters, including wetlands. Modifications/design criteria will be included to ensure compliance with CWA is met. The USACE regulates the deposition of fill into Waters of the US under Section 404 of the Clean Water Act. While a jurisdictional determination can be requested to provide a greater level of certainty regarding the need for an authorization under this authority, it is likely that the proposed project would require a permit under Section 404.

The proposed project requires wetland mitigation of 0.95 acres and functions documented in Table 6-2. Mitigation would be required under EO 11990 for permanent wetland impacts, regardless of whether USACE determined they were jurisdictional or not. Mitigation credit purchases could be approximately $60,000 (e.g., Ducks Unlimited

charges $57,000 per acre in the appropriate Bank Service Area as of 2022). No mitigation is expected for temporary impacts during construction.

Clean Air Act

The project will not result in permanent air emissions and no modifications or further coordination needs to occur to ensure compliance.

Special Management Area Considerations

The USFWS has reviewed the proposed action through their IPaC site and made the following determinations based on special management area presence, proximity, or lack of:

No activities are proposed within or in the vicinity of Special Management Areas.

While no direct impacts from the Proposed Action (Alternative 2) were identified by the USFWS, downstream impacts of the No Action Alternative to USFWS properties were included in the analysis and rationale of Alt 2:

Table 9: Special management area compliance determinations

Management Area Type	Applicable Law / Regulation to Demonstrate Compliance With	Rationale for Compliance
Kellys Slough National Wildlife Refuge	National Wildlife Refuge System Administration Act of 1966	Avoiding negative impacts to the downstream refuge were included in the rationale for the Preferred alternative (i.e. avoiding the No Action alternative).
USFWS Waterfowl Production Areas (10 total)	Migratory Bird Act (1929)	Avoiding negative impacts to the downstream WPA's were included in the rationale for the Preferred alternative (i.e. avoiding the No Action alternative).

Pertinent Executive Orders

EO 11988, Floodplain Management – Not Applicable

Requires determination of action occurring in a floodplain, using HUD floodplain map or more detailed map if available.

EO 11990, Protection of Wetlands – avoid actions within wetlands unless there are no practical alternatives, and the action includes all practicable means to minimize harm to wetlands.

Executive Order 11990 requires all federal agencies to avoid, to the extent possible, short- or long-term adverse impacts to wetlands through avoidance, minimizing impacts, or mitigation. EO 11990 applies to both natural and artificially formed wetlands. An evaluation of existing wetland functions was completed via the NRCS Hydrogeomorphic Functional Assessment Prairie Pothole (Depressional) Model to score and summarize existing wetland functions for Depressional. There are no expected losses to mineral soil flat, riverine, and lacustrine fringe wetlands, therefore functions for these wetland classes were not completed. Measurements are completed for multiple variables and result in

Functional Capacity Indices (FCI). The FCI is a measure of functional capacity of a wetland compared to reference standard; score of 1.0 is the reference standard and represents pristine condition function, where lower values indicate the wetland is functioning below reference standard. Functional Capacity Units (FCU) are computed from product of each wetland area and FCI and are summarized in Table 4 for wetlands within the U-AA, which could be affected by some plan alternatives.

During the construction period, reservoir drawdown would result in greater volumes of water (less or more depending upon construction techniques) flowing downstream. This could temporarily cause minor flooding conditions. Removal of Larimore Dam would result in an increase in flooding downstream, but the stream would remain a perennial stream. Increased flooding could support more wetlands, develop new meanders in the river channel, and form new oxbow wetlands. It is possible that some agricultural land use could revert to natural wetland areas. Downstream riparian wetlands would benefit over time from this alternative by restoring riparian floodplain function.

Temporary construction impacts for Alternative 2 would occur to a ~0.1 acres of OW-2 due to principal spillway outlet construction. Temporary reservoir drawdown for construction would remove 45.99 acres of deep water habitat and 28.17 acres lacustrine fringe wetlands, and would occur from early-summer to the time the reservoir refills (1-3 years dependent on precipitation). Alternative No. 2 retains the pool behind Larimore Dam as well as the fringing wetlands for 100 years from when construction is complete and reservoir refills.

Expected permanent impacts include loss of 0.95 acres of wetlands. Permanent impacts would consist of filling W-8 through W-11 with ACB spanning the auxiliary spillway. W-12 would also be lost due to two-stage filter system properly conveying any potential seepage away from dam toe. No losses are expected to lacustrine fringe wetlands and other waters as dam embankment and principal spillway will be replaced with the same dimensions and locations as existing features. For more details regarding functional losses see Table 4, and map of impacted areas see Appendix 4.

EO 13007, Indian Sacred Sites – Not Applicable

EO 13112, Invasive Species – prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause.

Eight invasive and troublesome weeds listed in the state identification document (NDSU Extension, 2023) were observed during the wetland delineation. One county-listed noxious weed species - kochia (Bassia scoparia) and three state-listed (NDDA, 2025) noxious weeds - absinth wormwood (Artemisia absinthium), leafy spurge (Euphorbia esula) and Canada thistle (Cirsium arvense) are present in the U-AA. Other invasive plants found in the U-AA include Kentucky bluegrass (Poa pratensis), smooth bromegrass (Bromus inermis), reed canary grass (Phalaris arundinacea), Russian olive (Elaeagnus angustifolia) and common buckthorn (Rhamnus cathartica).

There were no invasive animal species observed during the biological inventory survey. Zebra mussels have not been identified in Larimore Reservoir, but they are present in North Dakota and as close as Red River in Grand Forks. There is the possibility this species could be introduced to the reservoir by users of recreational boating opportunities.

In accordance with North Dakota Century Code 4.1-47-030, it is illegal to willfully transport any material, or equipment in a manner that allows for the dissemination of noxious weeds. Furthermore, materials containing noxious weed seeds or propagating parts may not be disposed of. To reduce the spread of aquatic nuisance species, North Dakota Administrative Code 30-03-06-01 states that upon entering or leaving any water body, construction equipment must be free of prohibited or regulated aquatic nuisance species, as defined in the state's aquatic nuisance species list. All construction related equipment traveling into the state or for which the vessel's last exit was from a class 1 infested water body must be certified free of aquatic nuisance species by the North Dakota Game & Fish Department before entering into any water of the state. Inspection criteria include but are not limited to: Last known location, and water body equipment was at, the last known time the equipment was in the water, date of last cleaning, cleaning procedures.

Downstream, the river can transport vegetative propagules of non-native/noxious species, and this can exacerbate the spread of these populations of undesirable and invasive species downstream. Unnaturally high peak flows, post breach, could increase the extent of non-native/noxious species spread

For proposed action, during construction, the incidence of undesirable species is similar to the FWOFI. Once the project is complete, presence of the reservoir precludes opportunistic plant species from colonizing exposed sediments in that area. The tame grassland area affected by the footprint of the construction currently contains a high proportion of non-native species. This area would be reseeded with a typical construction seed mix (with native grasses), and not a native prairie mix.

EO 13186, Migratory Birds – identify actions that may have a measurable negative effect on migratory bird populations.

The USFWS IPaC Migratory Bird list for the U-AA was generated in June 2025 and included 13 bird species. All the birds listed are considered Birds of Conservation Concern (BCC), except for the Bald Eagle, which is not considered a BCC, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from development activities. The list provides a bird's relative probability of presence during a year in the U-AA. The list included 6 land birds [Black-billed Cuckoo (Coccyzus erythropthalmus, Red-headed Woodpecker (Melanerpes erythrocephalus), Grasshopper Sparrow (Ammodramus bairdii), Le Conte's Sparrow (Ammodramus leconteii), Bobolink (Dolichonyx oryzivorus), and Chimney Swift (Chaetura pelagica)], 3 shorebirds [Marbled Godwit (Limosa fedoa), Willet (Tringa semiplmata), and Lesser Yellowlegs (Tringa flavipes)], 2 waterbirds [Franklin's gull (Leucophaeus pipixcan) and Western Grebe (Aechmophorus occidentalis)] and 2 raptors [Bald eagle (Haliaeetus leucocephalus) and Northern Harrier (Circus hudsonius)].

For proposed action, construction and reservoir drawdown activities would be similar to the FWOFI in terms of temporary benefits to fish-eating birds but negative impacts to others due to disturbance and drawdown. Once the project is complete, no effect is expected compared to the current condition.

EO 13443, Facilitation of Hunting Heritage and Wildlife Conservation – expand and enhance hunting opportunities.

In accordance with EO 13443, the North Dakota Game and Fish Department (NDGF) was consulted, and their advice was incorporated into the EA and plan. The Larimore Dam is classified as a Class 2 cool-water fishery, which is considered capable of supporting natural reproduction and growth of cool-water desirable game fishes (i.e. walleye and northern pike). A Class 2 fishery is also considered to be capable of supporting associated aquatic biota for marginal growth of fish. The reservoir is stocked by the North Dakota Game and Fish Department (NDGFD) since 2014. Stocking included Pure Muskellunge, Walleye, and Northern Pike. Compared with the FWOFI and No Action Alternatives, the proposed action is the only one that maintains the fishery for enhanced recreational opportunities. The FWOFI and No Action alternative would remove this resource.

Certifying Statement for EA Page Limit and Deadline

The Responsible Official certifies that this EA:

☐ Demonstrates the agency has thoroughly considered the factors mandated by NEPA;

☐ Represents the agency's good-faith effort to prioritize documentation of the substantive issues and most important considerations required by NEPA within the congressionally mandated page limits;

☐ Reflects the agency's expert judgment;

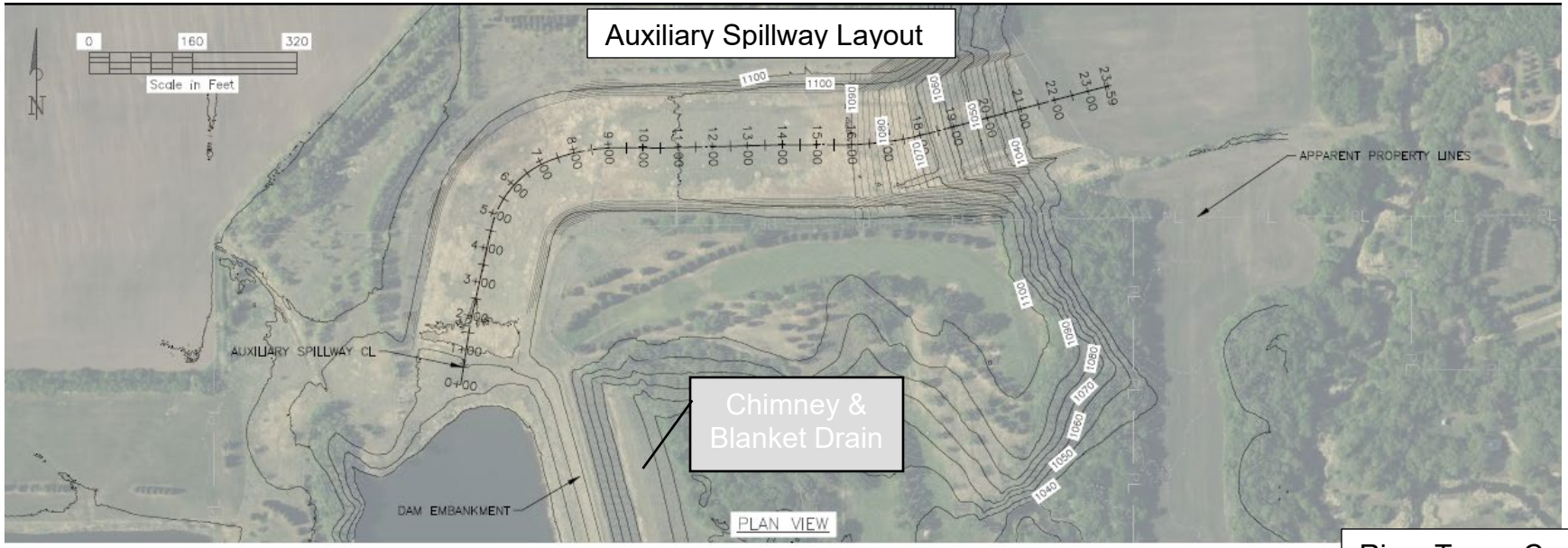
☐ Addressed briefly, or left unaddressed, any issues or considerations that were, in the agency's judgment, comparatively not of a substantive nature;

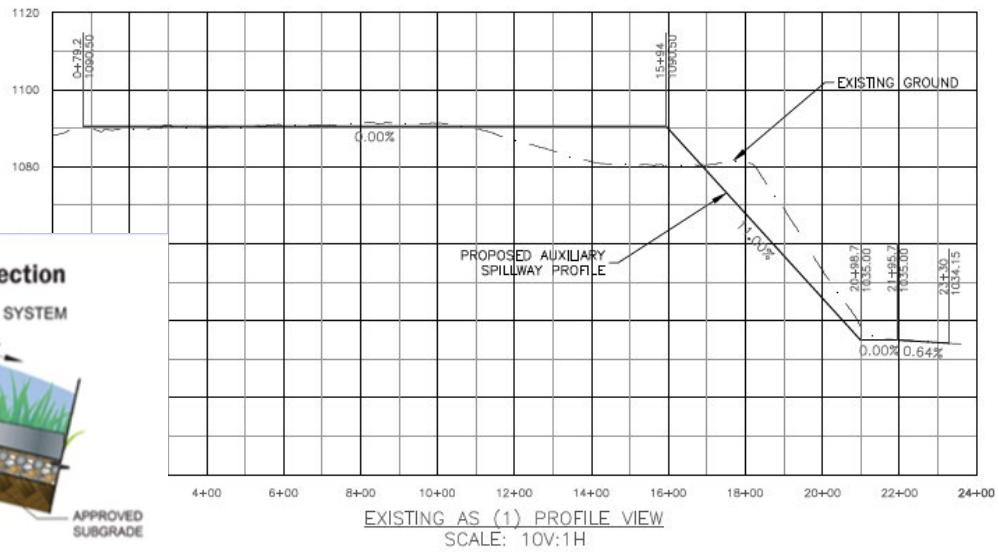
☐ Represents the agency's good-faith effort to fulfill NEPA's requirements within the Congressional timeline (or within the minimally extended timeline) and this effort is substantially complete; and

☐ Contains analysis that is adequate to inform and reasonably explain the responsible official's final decision regarding the proposed action or selected alternative.

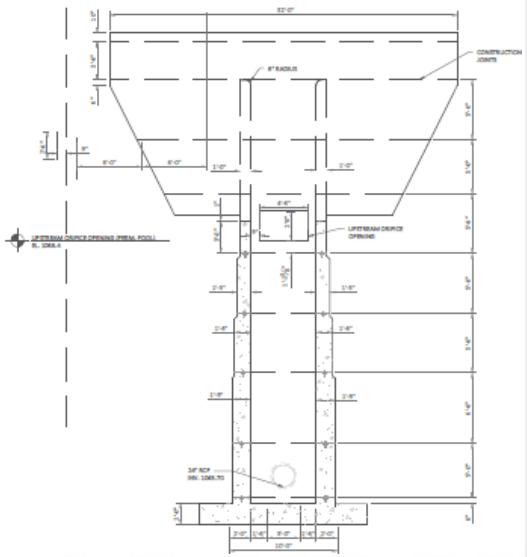
APPENDICES

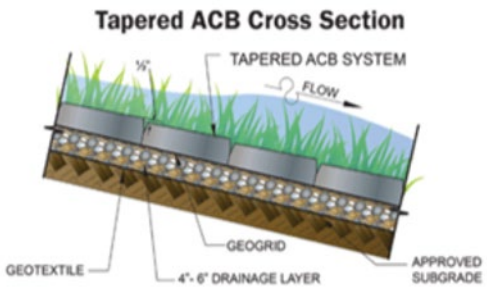
- Appendix 1: Proposed Action (Structural Rehabilitation – Armored ACB Auxiliary Spillway, Riser Tower, & Drain)
- Appendix 2: Area of Interest / Benefit Area
- Appendix 3: Upstream Assessment Area (U-AA)
- Appendix 4: Proposed Action/Structural Alternative – Aquatic Resource Impacts Map (Permanent Impacts)
- Appendix 5: No Action Dam Breach Event – Floodplain Erosion Depth
- Appendix 6: No Action Dam Breach Event – Floodplain Deposition Areas
- Appendix 7: No Action - Dam Breach Zone Depth-Velocity-Danger Level Relationships for Houses and Passenger Vehicles



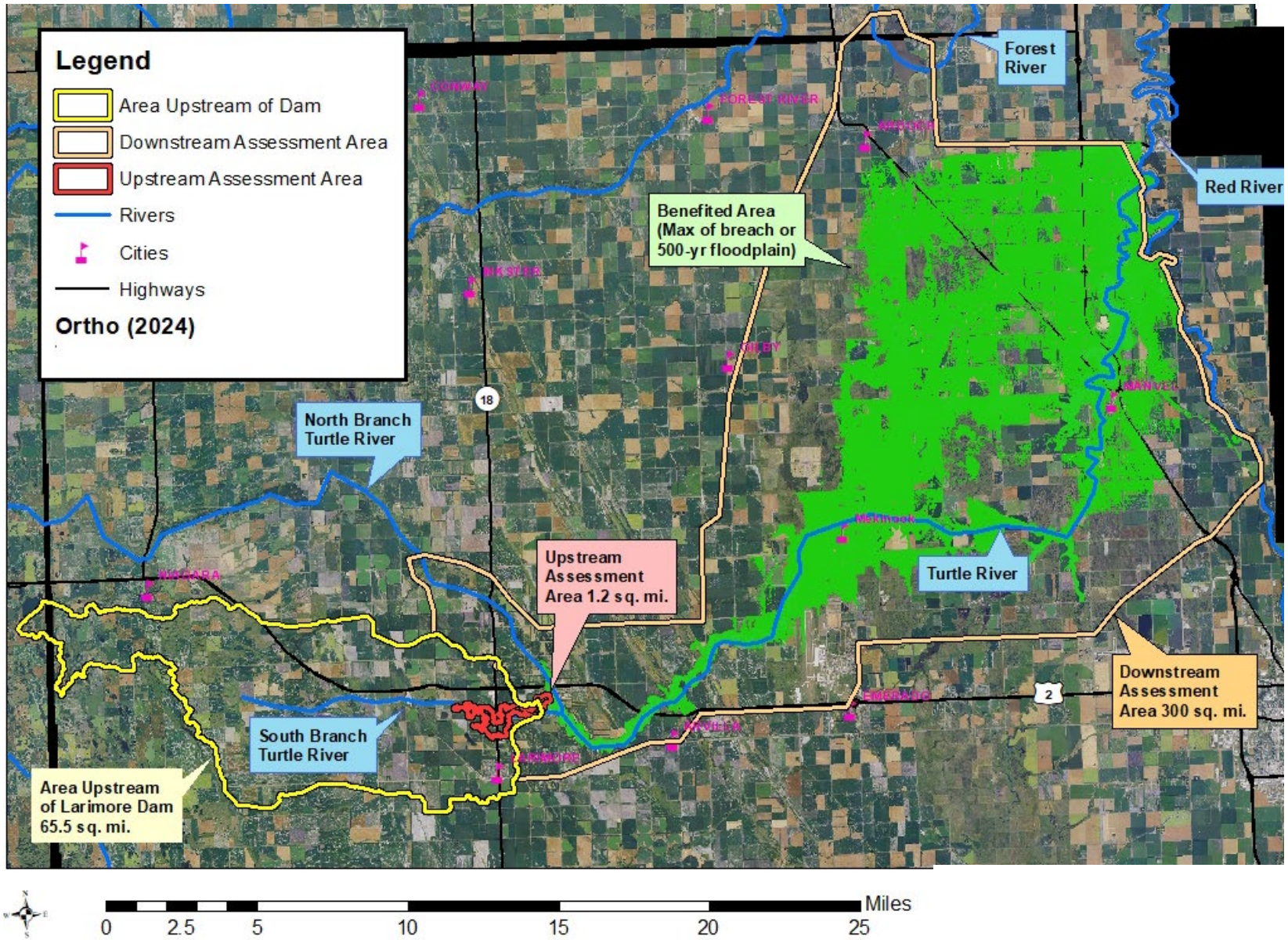


Riser Tower Cross Section

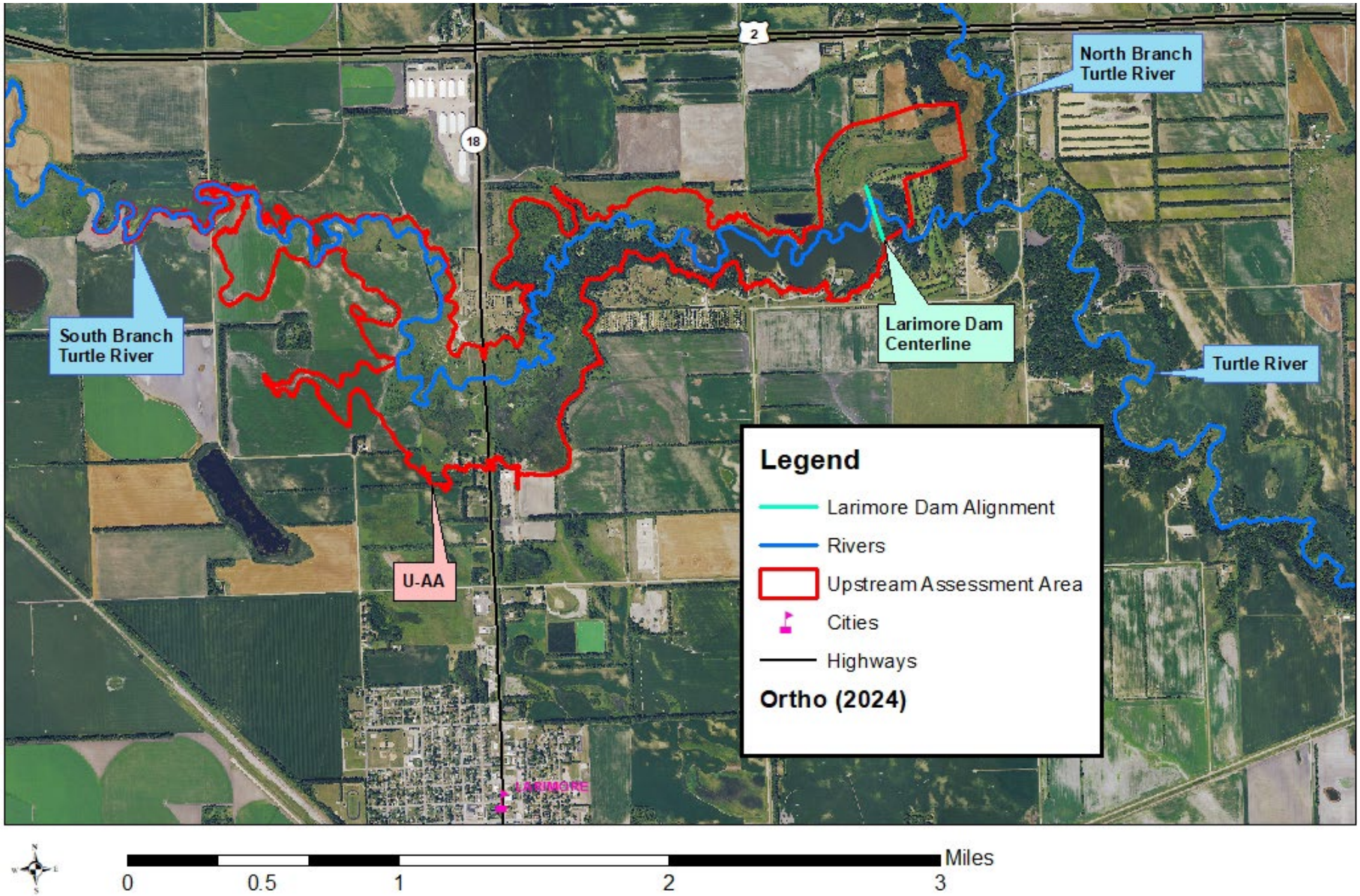




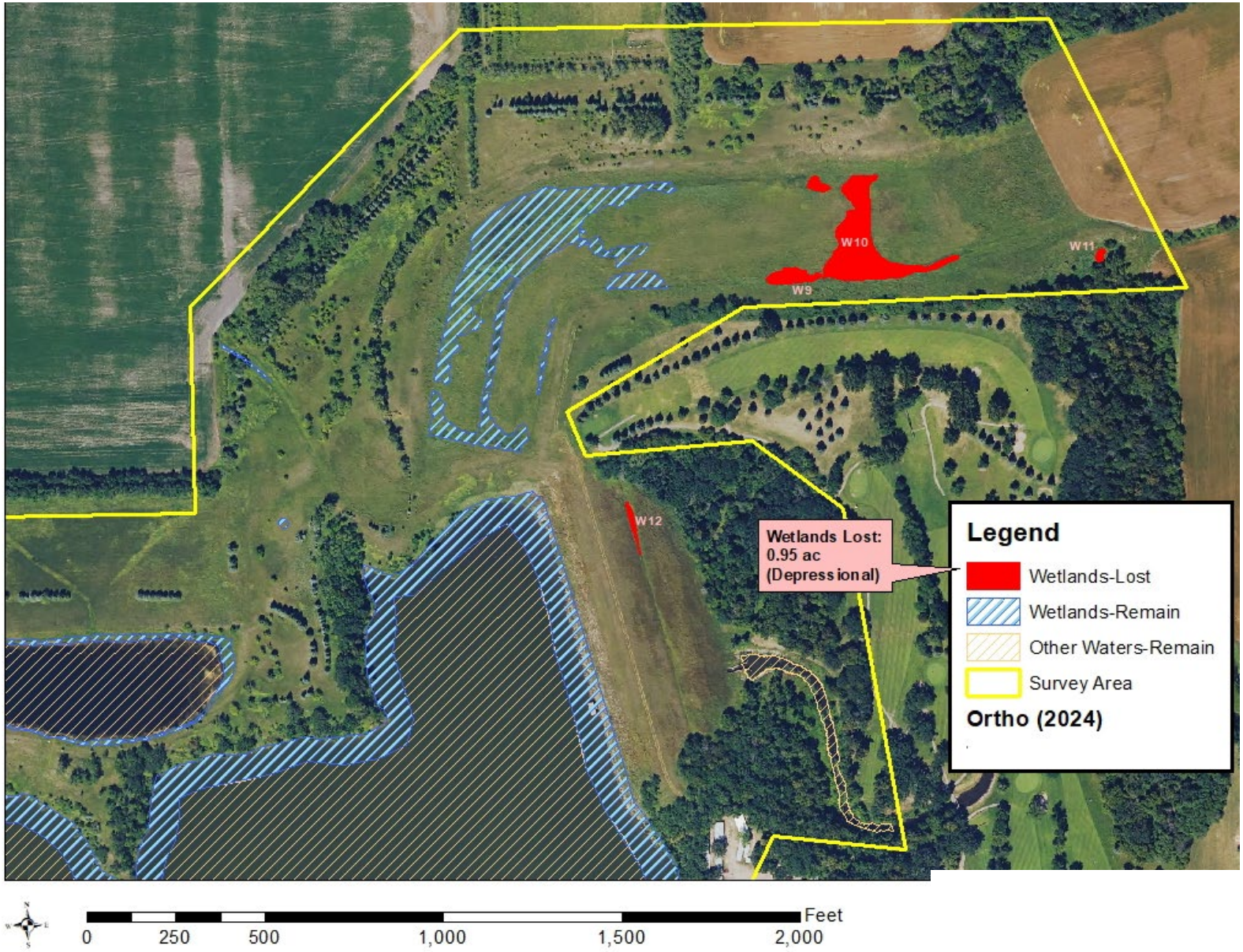
Appendix 1: Proposed Action (Structural Rehabilitation – Armored ACB Auxiliary Spillway, Riser Tower, & Drain)



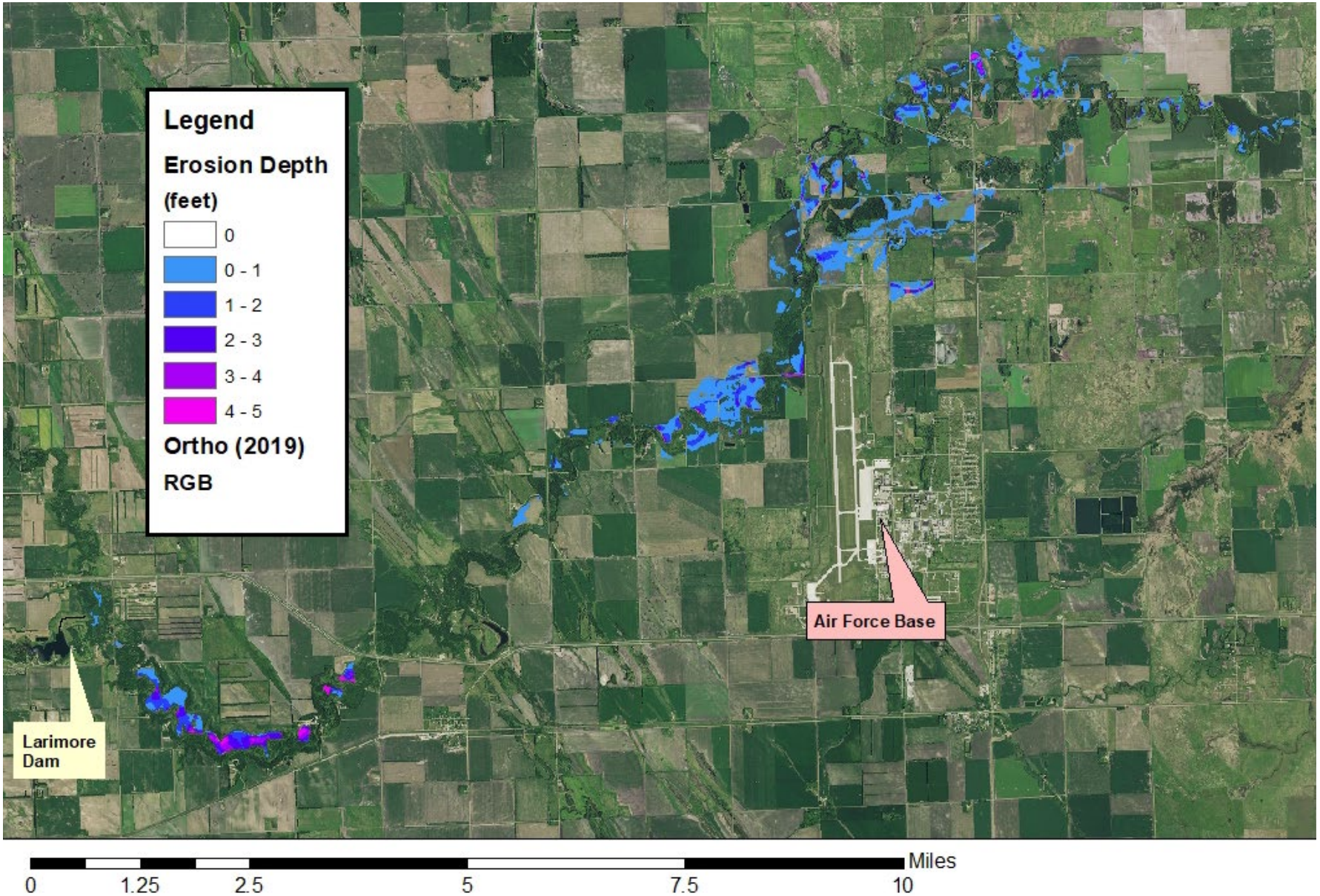
Appendix 2: Area of Interest / Benefit Area



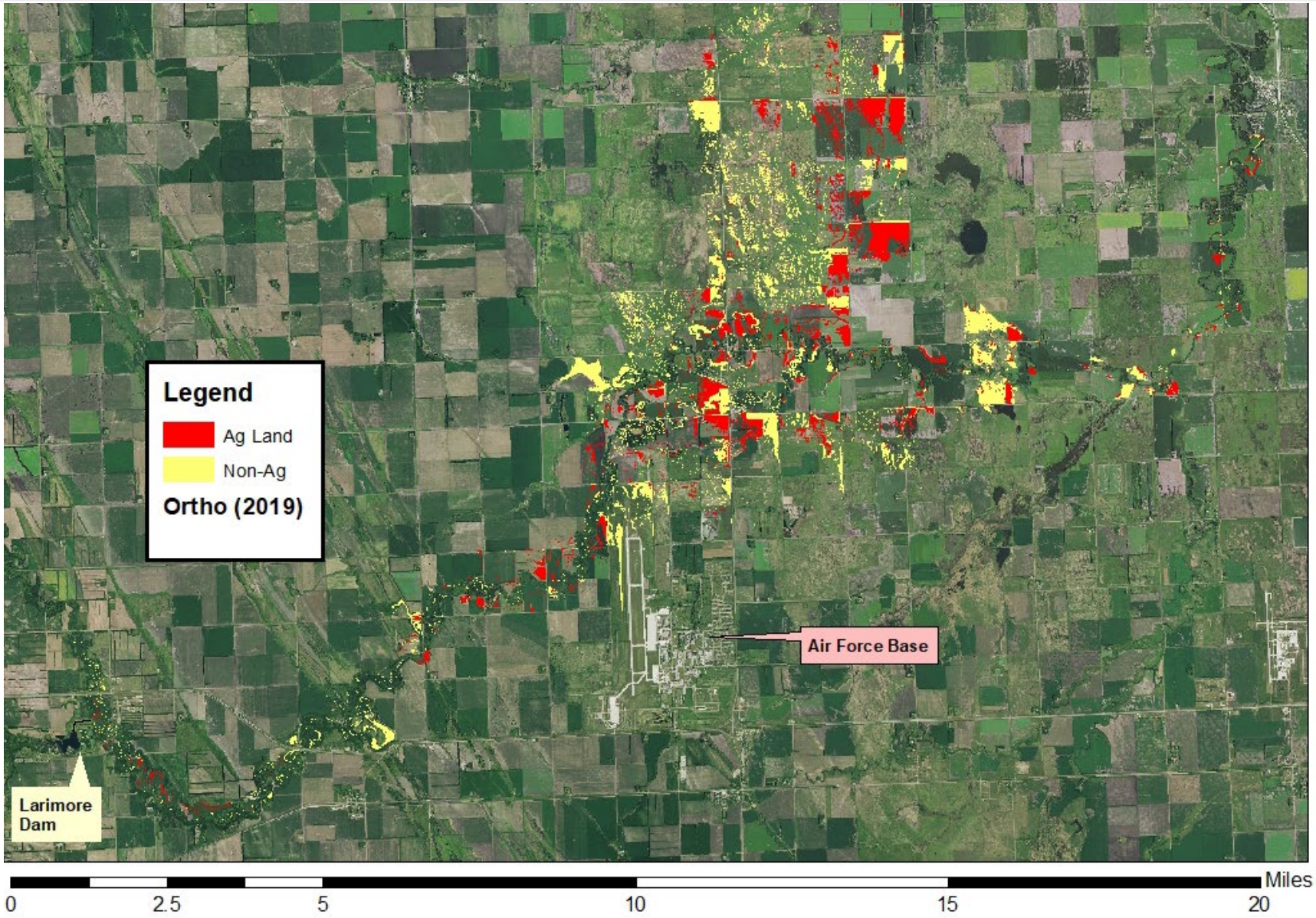
Appendix 3: Upstream Assessment Area (U-AA)



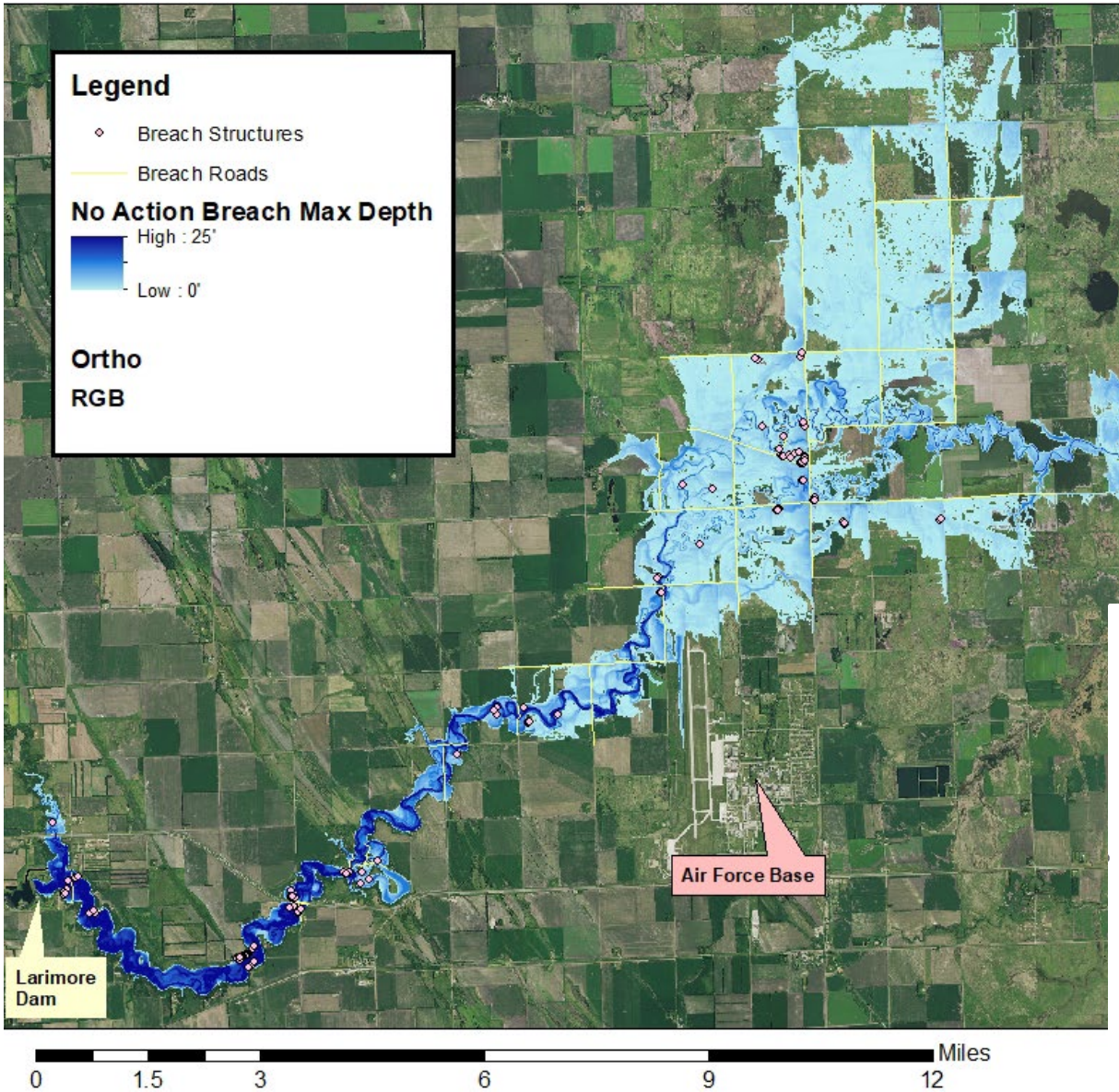
Appendix 4: Proposed Action/Structural Alternative – Aquatic Resource Impacts Map (Permanent Impacts)

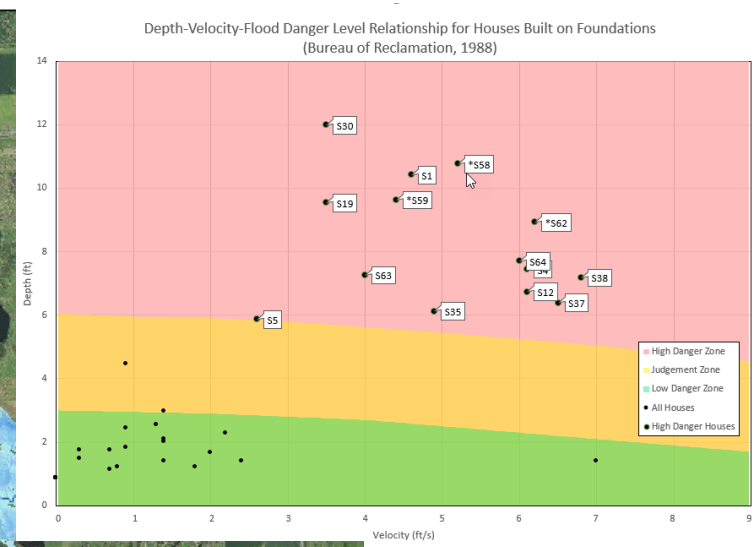


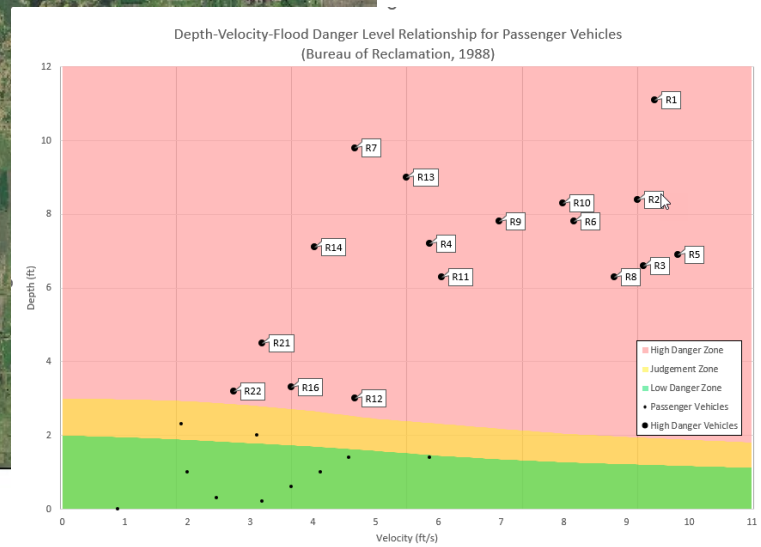
Appendix 5: No Action Dam Breach Event – Floodplain Erosion Depth



Appendix 6: No Action Dam Breach Event – Floodplain Deposition Areas







Appendix 7: No Action Dam Breach Zone Depth-Velocity-Danger Level Relationships for Houses and Passenger Vehicles

NRCS