3 Mile Lake
Watershed Assessment Plan

Project Agreement #: 17-01 **September 18, 2018**

Contact Person: Union SWCD
Dixie Baker
904 E. Taylor Street
Creston IA 50801

Phone #: 641-782-4218 Ext. 3
Email: Dixie.Baker@ia.nacenet.net

Section 1.

Water Resource Characteristics:

Three Mile Lake is a regional water resource in south central Iowa, located in Union and Adair Counties. The 880-acre reservoir provides a drinking water source, through the Southern Iowa Rural Water Association, to a seven-county area including 30 towns and more than 13,000 rural customers. Together with nearby Twelve Mile Lake, the water system provides more than three million gallons of potable water per day. In addition, Three Mile Lake is important to the local economy as a recreation area. The Three Mile Lake Recreation Area is the largest recreational facility in Union County. There are nearly 24 miles of shoreline to fish as well as excellent boating opportunities. Portions of the lake are open to sailing, power boats, and water skiing. No-wake boating is permitted on the remainder of the lake. Hundreds of acres of public hunting areas surround the lake. There is also a well-developed camp ground with cabins and a lodge available for events. A beach is available for swimming. There has been strong support for the development and protection of the lake in the local community.

Lake construction was completed in September 1995, when the gate was closed on Three Mile Lake dam. Hydrologists projected the lake would take 18 months to fill, but heavy spring rains led to lake overflow by May 1996. The lake is classified as a Class B (LW), Class HH, and Class C lake. The lake is 880-acres with a watershed of 22,730 acres for a watershed area ratio of 25.8.

The watershed is in Adair and Union counties with 41% of the area in Adair County and 59% in Union County. Land use in the 22,730-acre watershed above Three Mile Lake is agricultural. Like many other reservoirs in southern Iowa, the depth and quality of Three Mile is primarily threatened by agricultural nonpoint source pollution, including erosion, excess nutrients and pesticides, and bacteria from livestock operations. In a windshield survey conducted in spring of 2018, observed land use was approximately 60% corn and soybeans, about 30% in pasture, grassland, CRP, and hay, and the remainder was woodlands, CAFOs, feedlots, or building sites. There are no municipal areas in the watershed.

The predominant soil association is Sharpsburg-Shelby-Nira. These are gently sloping to moderately steep, moderately well drained and well drained upland soils that have a silty clay

loam or clay loam surface layer and were formed in glacial till or loess. Soils in this association have high available water capacity. Runoff is rapid, and erosion is moderate to severe. NRCS has determined these soils are 5T, so they can only erode 5 tons per year per acre or about 1/32" over an acre to retain productivity.

Most of the watershed is a C (5-9%) or D (9-14%) slope with B (2-5%) slopes on the uplands at the edge of the watershed and along the stream. Three-Mile Creek is just over 13 miles long from start to the lake and drains 22,730 acres.

A partnership of stakeholders consisting of Iowa DNR, Union County Conservation, Iowa Department of Agriculture and Land Stewardship, City of Creston, High Lakes Outdoor Alliance, Southern Iowa Rural Water Association (SIRWA), Union and Adair SWCDs, USDA-NRCS, and the Union County Board of Supervisors was developed to discuss concerns about the watershed.

Section 2.

Existing water quality problems:

History:

The Union Soil and Water Conservation District (SWCD) and an advisory committee composed of watershed landowners, with assistance from the USDA Natural Resources Conservation Service (NRCS) in Iowa began organizing a watershed initiative for Three Mile Creek in 1988. Four priority problems were identified that could impair Three Mile Lake in the future: soil erosion on cropland, gully erosion on non-cropland, fertilizer and chemical runoff from cropland, and animal manure runoff.

Recognizing the potential for agricultural nonpoint source pollution risks to Three Mile Lake, local sponsors and natural resource agency staff initiated the Three Mile Watershed Project in 1991 to assist watershed producers in implementing crop and livestock management practices that control agricultural nonpoint source pollution while protecting farm profitability. While earthen erosion control structures are the first line of defense in that effort, management practices related to soil and water conservation and integrated crop, livestock, and manure management are of equal importance. The project has provided information, educational programs and financial and technical assistance.

Project staff and landowners have put in a lot of effort to make sure there were adequate structures in the watershed to prevent soil from reaching the then-new lake. The project was unique in its proactive approach. Local sponsors planned to increase erosion control and improve crop nutrient and manure management in the watershed even before the lake was completed. The Three Mile Watershed Project was the first preemptive watershed protection project undertaken with USDA support.

Results of the project were apparent in the watershed. At the completion of the project in 1999, eighty percent of the watershed had soil erosion rates at or below the tolerable soil loss level. Since 1991, eighty-two producers put at least one soil and water conservation practice in place—

reducing soil erosion on 12,702 watershed acres by more than 16,000 tons annually. They built 83,436 feet of terraces and 85 ponds and sediment basins to reduce soil erosion and trap sediment. Crop residue cover on 11,700 acres of cropland has increased on average from 14% to over 27% on corn following soybeans, and from 22% to over 40% on soybeans following corn.

Recent Concerns:

However, in recent years, DNR fishery staff have noticed a decline in water quality resulting in a poorer fish population. Water quality monitoring data show that total suspended solids have increased 2 ½ times since the early 2000's. Secchi depths have decreased. The decrease in water quality, increased algae blooms, and increasing yellow bass population prompted the partners identified in section 1 to meet and discuss lake renovation. Along with a lake renovation to eliminate the yellow bass, a watershed assessment will be conducted in 2017 to investigate potential sources of sediment and nutrients entering the lake from the watershed. The DNR plans to perform in-lake improvements during the next 5-7 years, the shoreline will be deepened in areas and armored with riprap. In addition, the current sediment retention wetland needs to be modified or replaced. Fishing jetties will be repaired and modified. In-lake fish habitat will be improved. A breakwater in the main boat ramp cove is also planned to protect from wind and wave action.

Section 3.

Watershed Assessment & Planning:

Assessment:

During the fall of 2017 and spring of 2018, a RASCAL stream assessment and windshield land use survey were conducted by Union SWCD and the resulting data compiled by Andy Asell, GIS Analyst with Iowa DNR.

SOIL LOSS AND SEDIMENT LOADING:

Using the watershed land use information collected, RUSLE soil loss and Sediment Delivery models were processed to project the relative levels of loading throughout the watershed. To further enhance the sediment loading projections, the catchment areas for structural practices were also developed. Using this information, priority areas for upland treatment can be identified. Pre-project sediment delivery, sheet and rill erosion, and land use maps are included with this report.

STREAM ASSESSMENT:

A RASCAL Stream Assessment was conducted to identify conditions along the riparian corridor. A SWCD employee conducted this stream assessment by walking along Three Mile Creek and its major tributaries using a handheld GPS unit with ArcPad and data collection software. Riparian zone widths and cover, bank stability and height, and livestock access were some of the factors measured. Summary maps of livestock access, tile outlets, bank stability and bank height are included at the end of the report.

WATER QUALITY DATA:

Water quality data was accessed from the ABDNet online database through the Iowa DNR.

RIPARIAN SATURATED BUFFER SUITABILITY CLASS:

A map identifying suitable areas for saturated buffers was prepared using data from the Agriculture Conservation Planning Framework.

Analysis and Planning:

The data brought out several points. A map of catchment areas of existing BMP's and field inspections of these practices showed that much of the area surrounding the lake is protected from sediment delivery by still-functioning BMP's. However, much of the upper watershed either does not have these practices installed or they have exceeded their lifespan.

Another factor appearing in the land use assessment was that most of land around the lake and lower watershed is in grass-either pasture, hay, CRP or other grassland. The upper watershed has more crop acres in a traditional corn-bean rotation. This fact is reflected in the Sheet and Rill Erosion and the Sediment Delivery maps. The bulk of sediment delivery is potentially coming from the upper watershed which has fewer functioning BMPs.

The stream assessment revealed the majority of the thirteen miles of stream has bank heights ranging from 6 to 15' or more. Much of the bank was bare of vegetation or vegetation was overhanging. This makes the stream banks very susceptible to erosion. With more frequent major rain events in the spring in recent years, it seems reasonable to speculate that much of the sediment delivery to the lake comes from bank erosion.

Given the lack of existing grade stabilization structures, sediment basins, and terraces in the upper watershed, targeting locations for these practices is one area to address. There has also been some landowner turnover in the watershed during the 25 years since the initial project, so this may be another opportunity to investigate.

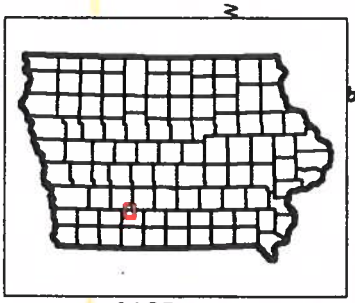
The most cost-effective method of addressing streambank erosion is to slow or stop runoff to the stream. Filter strips along the creek and saturated buffers where possible would help slow runoff. Promoting the use of cover crops, no-till, and managed grazing would help increase rainfall infiltration in fields which would reduce the amount of runoff. Improving soil organic matter would increase the water holding capacity of the soil.

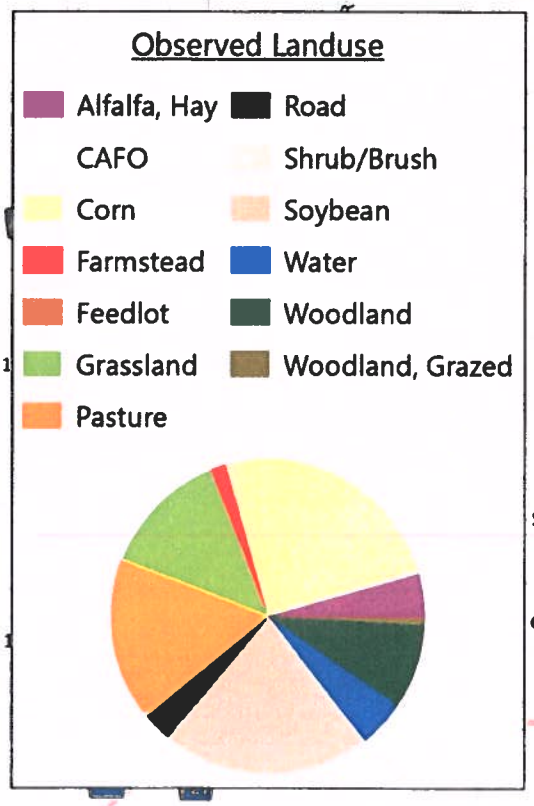
This plan has been reviewed and approved by a motion at the September 2018 meeting of the Union SWCD Commissioners. Actions taken appear in the official minutes of the District.

Prepared by: Jodi Hitz, Conservation Aide

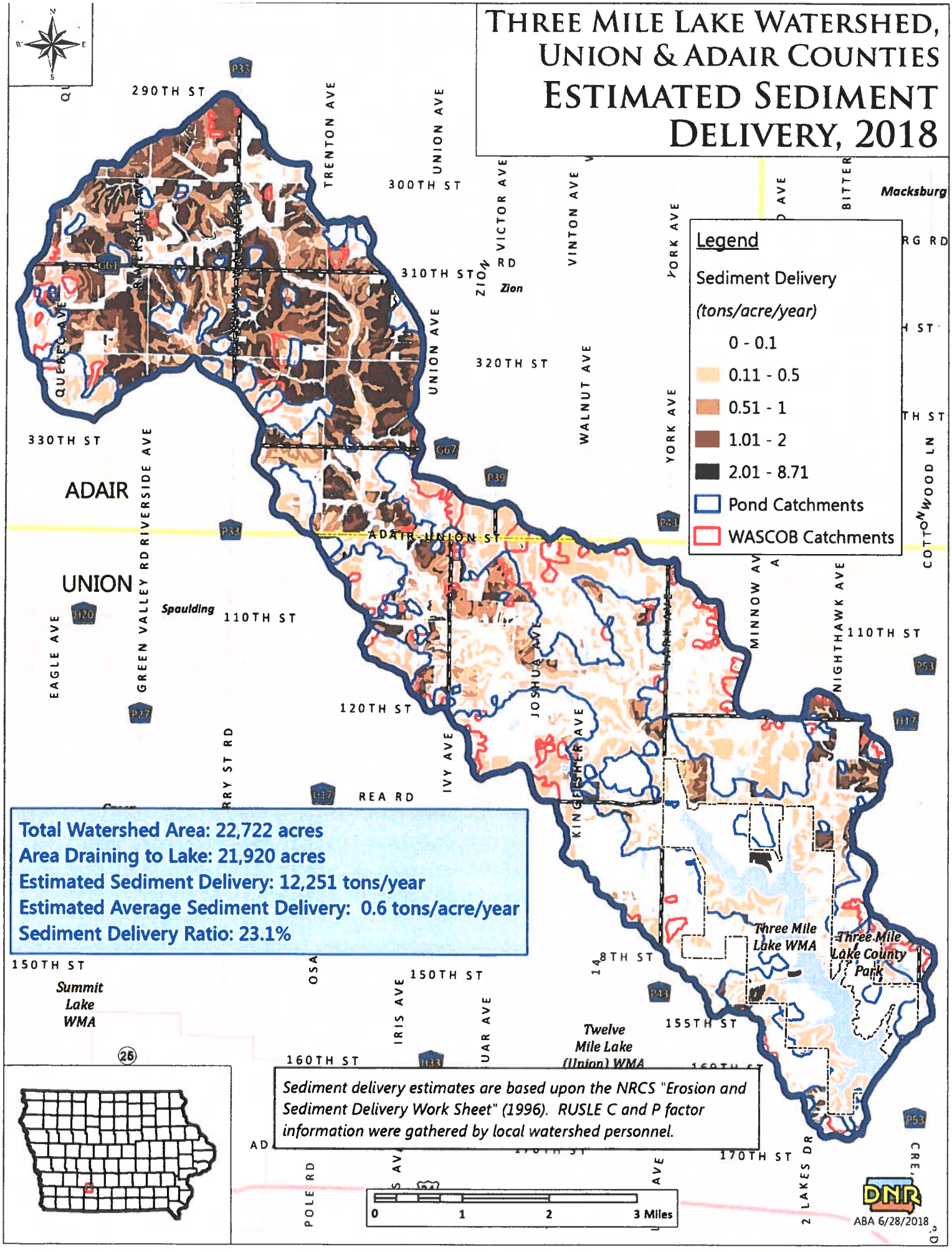
Mike Eblen, SWCD Chairperson

Three Mile Lake Watershed, Union & Adair Counties
Observed Landuse, 2018





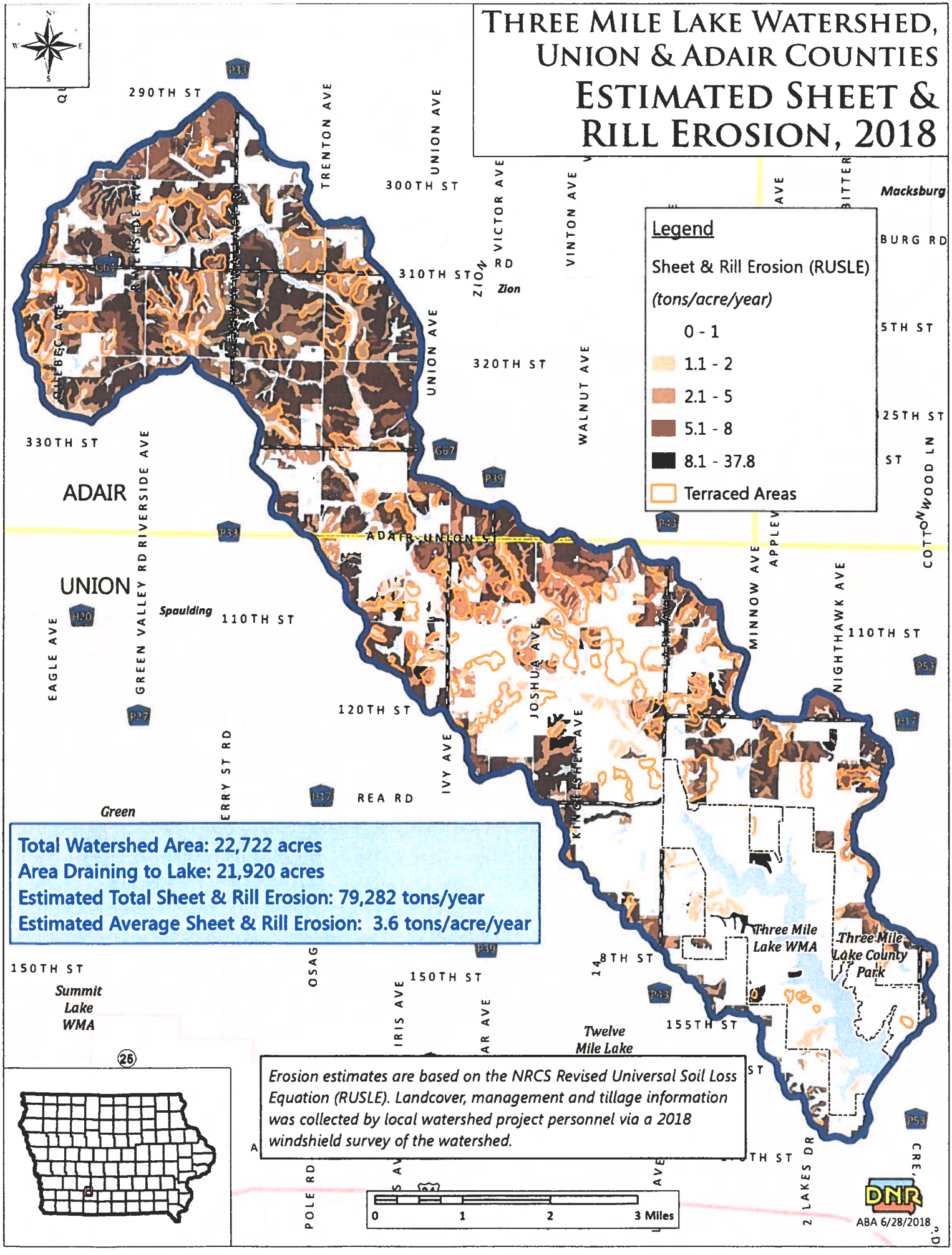
Three Mile Lake Watershed, Union & Adair Counties
Estimated Sediment Delivery, 2018



Total Watershed Area: 22,722 acres
Area Draining to Lake: 21,920 acres
Estimated Sediment Delivery: 12,251 tons/year
Estimated Average Sediment Delivery: 0.6 tons/acre/year
Sediment Delivery Ratio: 23.1%

Sediment delivery estimates are based upon the NRCS "Erosion and Sediment Delivery Work Sheet" (1996). RUSLE C and P factor information were gathered by local watershed personnel.

Three Mile Lake Watershed, Union & Adair Counties
Estimated Sheet & Rill Erosion, 2018



Total Watershed Area: 22,722 acres
Area Draining to Lake: 21,920 acres
Estimated Total Sheet & Rill Erosion: 79,282 tons/year
Estimated Average Sheet & Rill Erosion: 3.6 tons/acre/year

Erosion estimates are based on the NRCS Revised Universal Soil Loss Equation (RUSLE). Landcover, management and tillage information was collected by local watershed project personnel via a 2018 windshield survey of the watershed.

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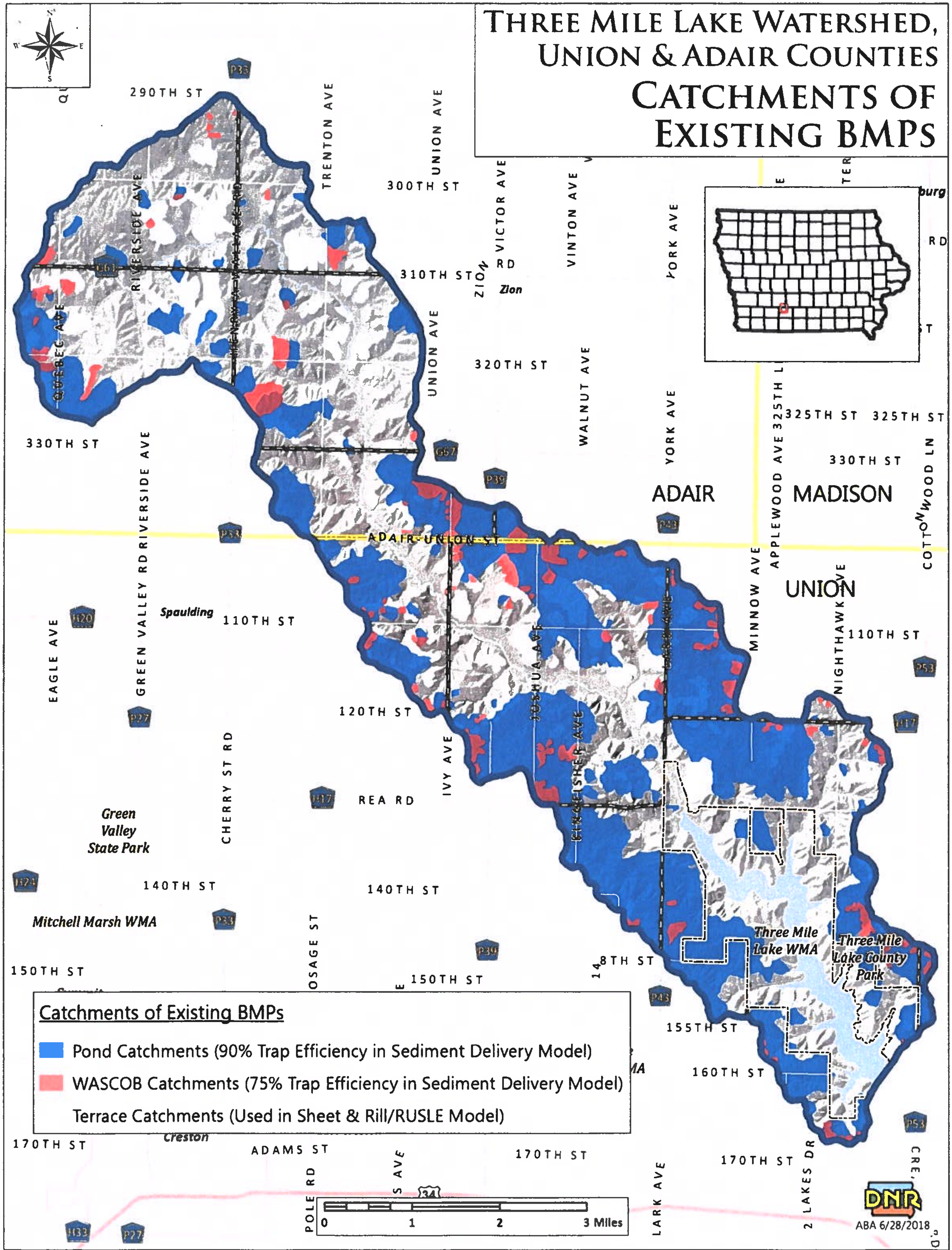
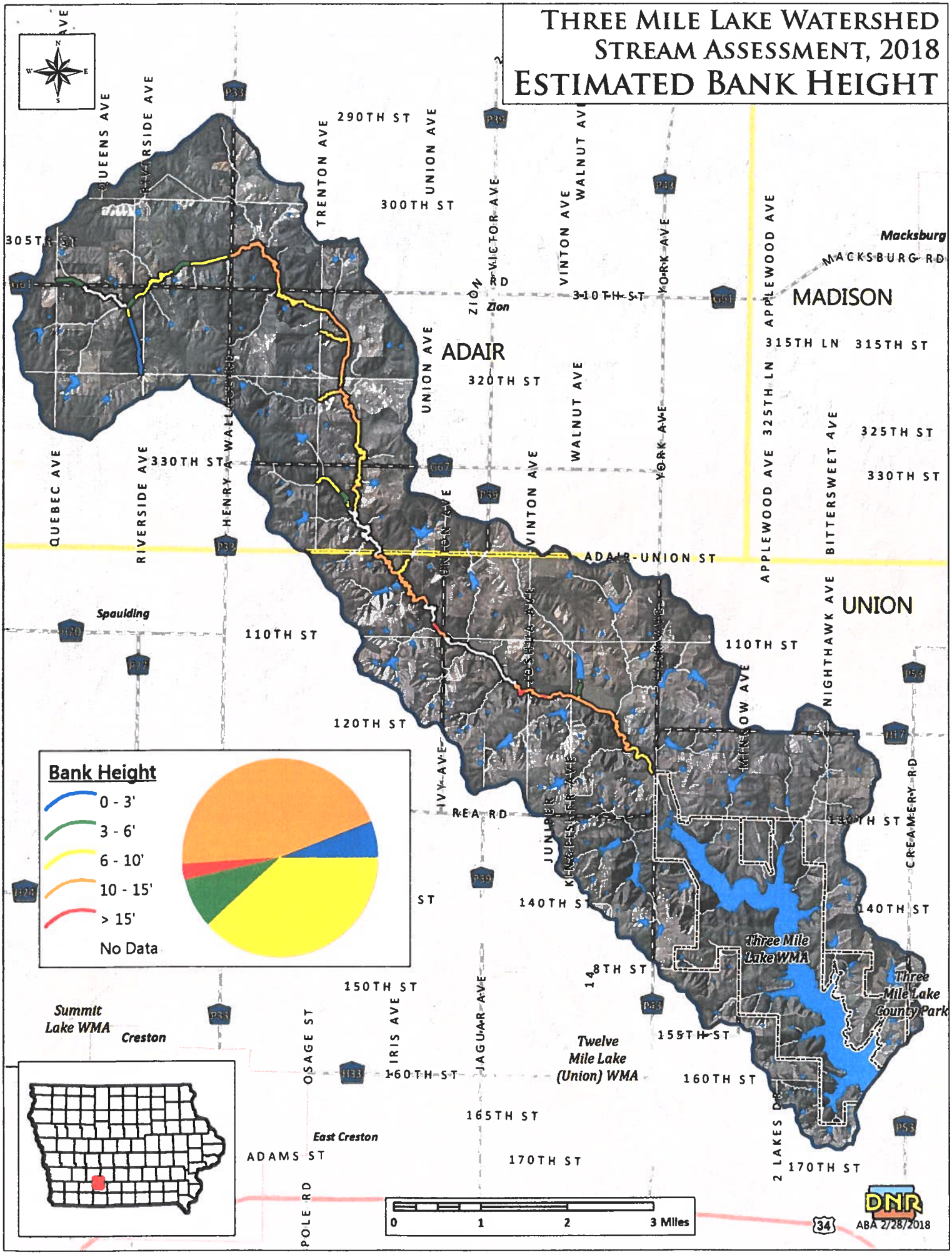
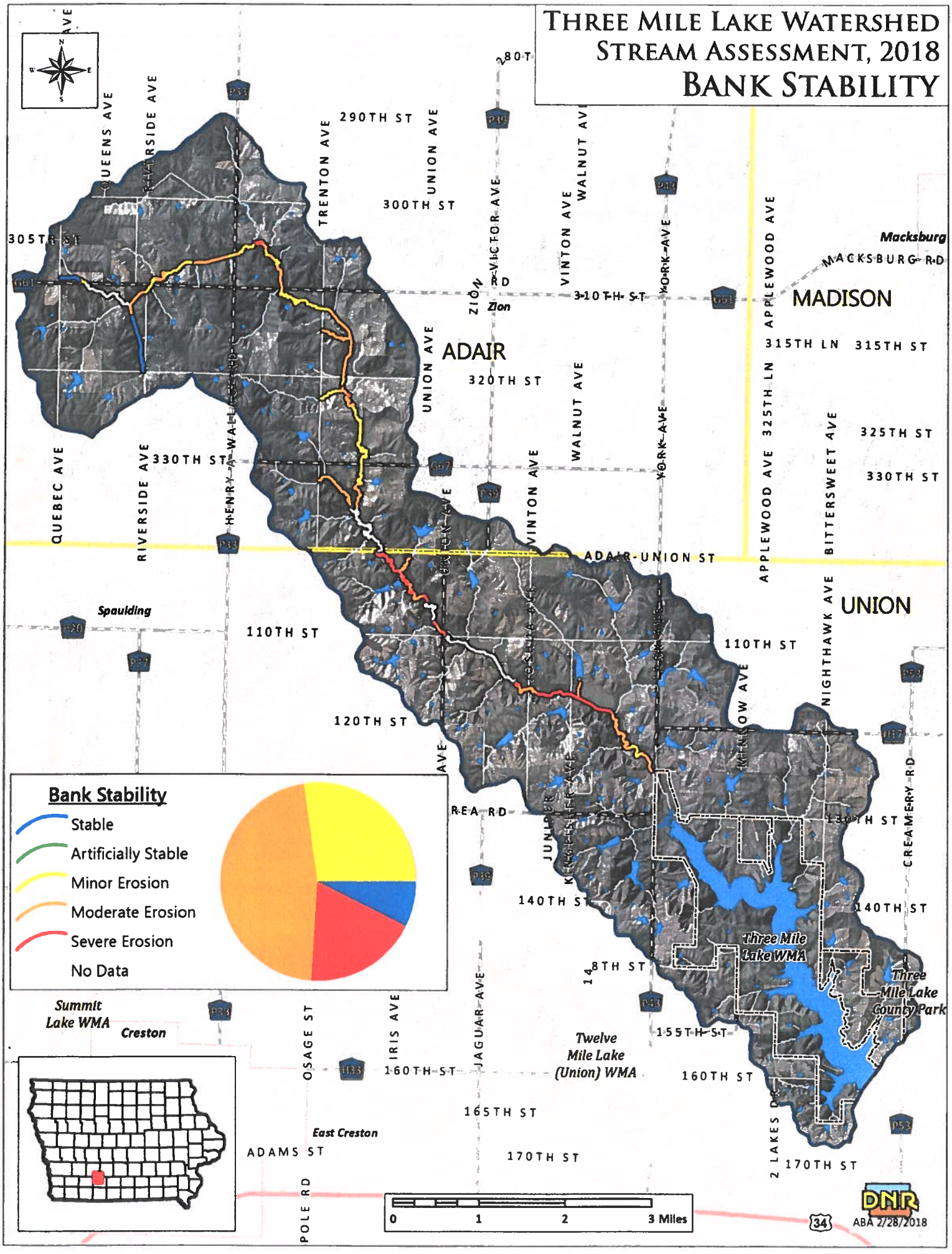

THREE MILE LAKE WATERSHED,
UNION & ADAIR COUNTIES
CATCHMENTS OF EXISTING BMPs
Catchments of Existing BMPs
Pond Catchments (90% Trap Efficiency in Sediment Delivery Model)
WASCOB Catchments (75% Trap Efficiency in Sediment Delivery Model)
Terrace Catchments (Used in Sheet & Rill/RUSLE Model)
ADAIR
MADISON
UNION
Three Mile Lake WMA
Three Mile Lake County Park
Green Valley State Park
Mitchell Marsh WMA
Spaulding
Zion
Creston
290TH ST
300TH ST
310TH ST
320TH ST
325TH ST
330TH ST
ADAIR-UNION ST
110TH ST
120TH ST
REA RD
140TH ST
150TH ST
155TH ST
160TH ST
170TH ST
ADAMS ST
TRENTON AVE
UNION AVE
VICTOR AVE
VINTON AVE
YORK AVE
WALNUT AVE
RIVERSIDE AVE
QUEBEC AVE
EAGLE AVE
GREEN VALLEY RD
CHERRY ST RD
IVY AVE
JOSHUA AVE
KINGFISHER AVE
MINNOW AVE
APPLEWOOD AVE
NIGHTHAWK AVE
COTTONWOOD LN
OSAGE ST
POLE RD
LARK AVE
2 LAKES DR
0 1 2 3 Miles
ABA 6/28/2018

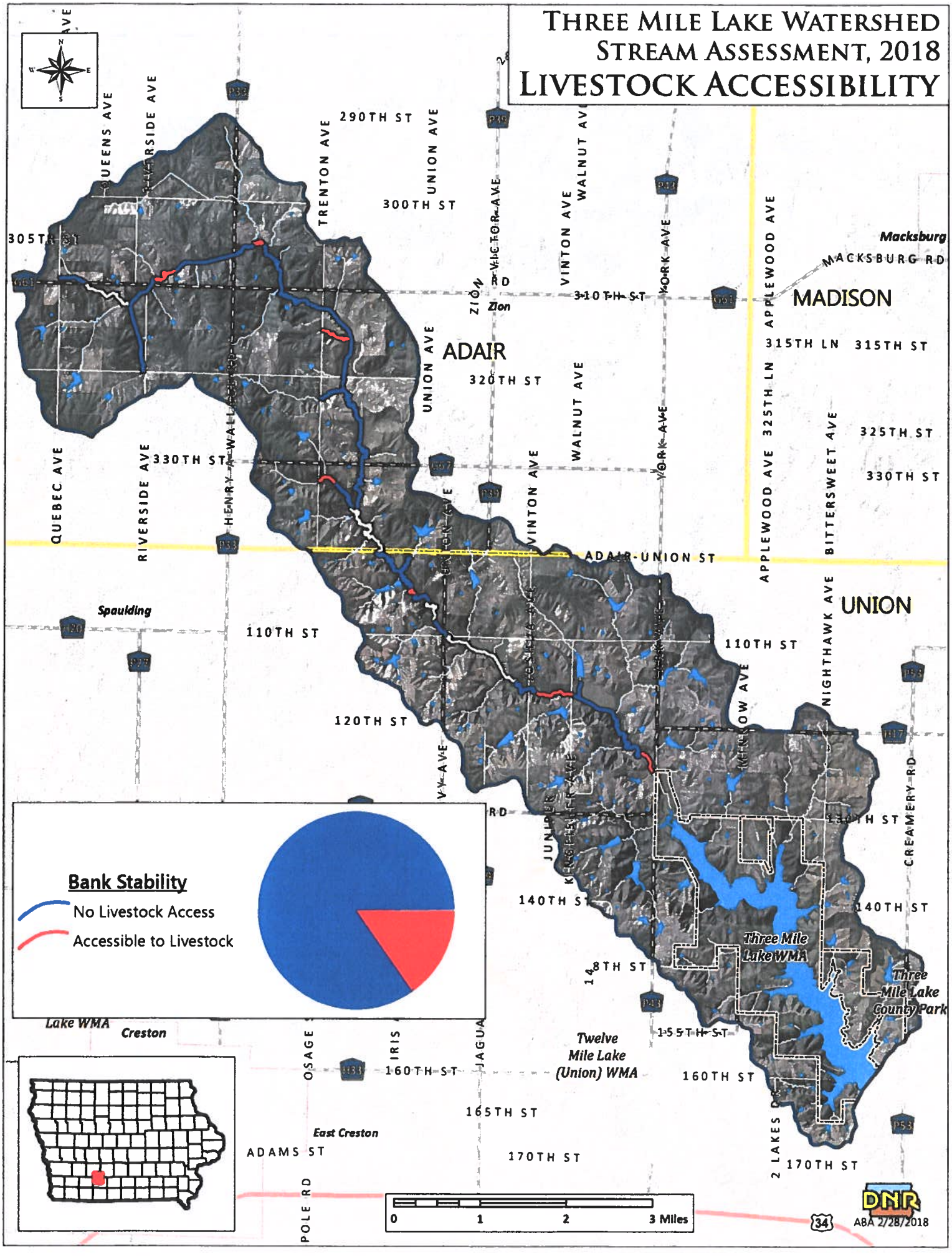
Three Mile Lake Watershed Stream Assessment, 2018
Estimated Bank Height



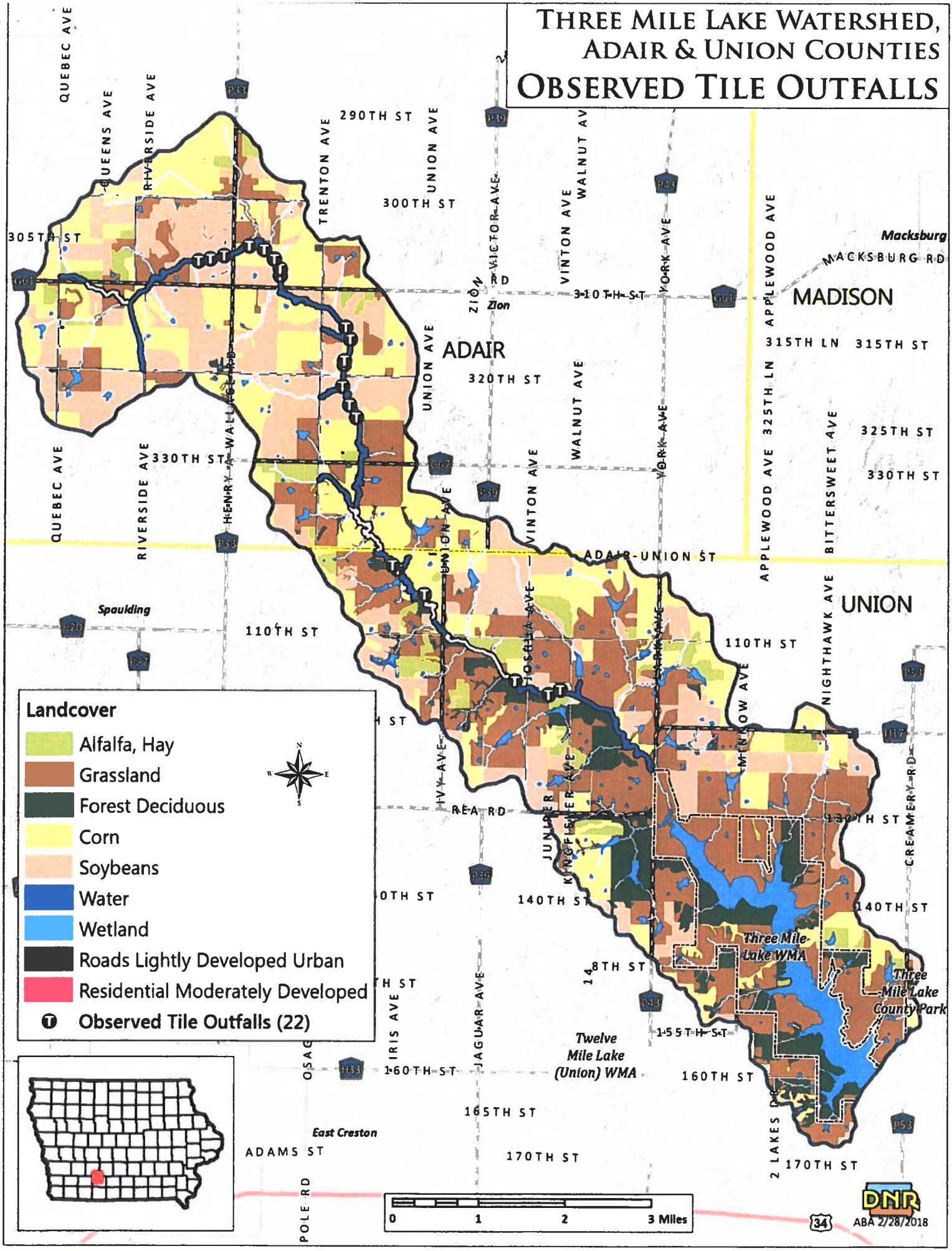
Three Mile Lake Watershed
Stream Assessment, 2018
Bank Stability



Three Mile Lake Watershed Stream Assessment, 2018
Livestock Accessibility



Three Mile Lake Watershed, Adair & Union Counties
Observed Tile Outfalls



Threemile Creek
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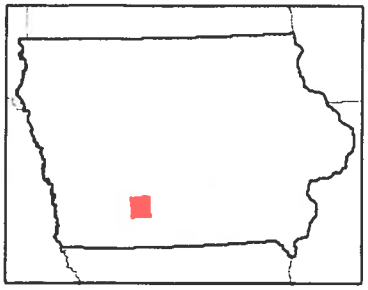
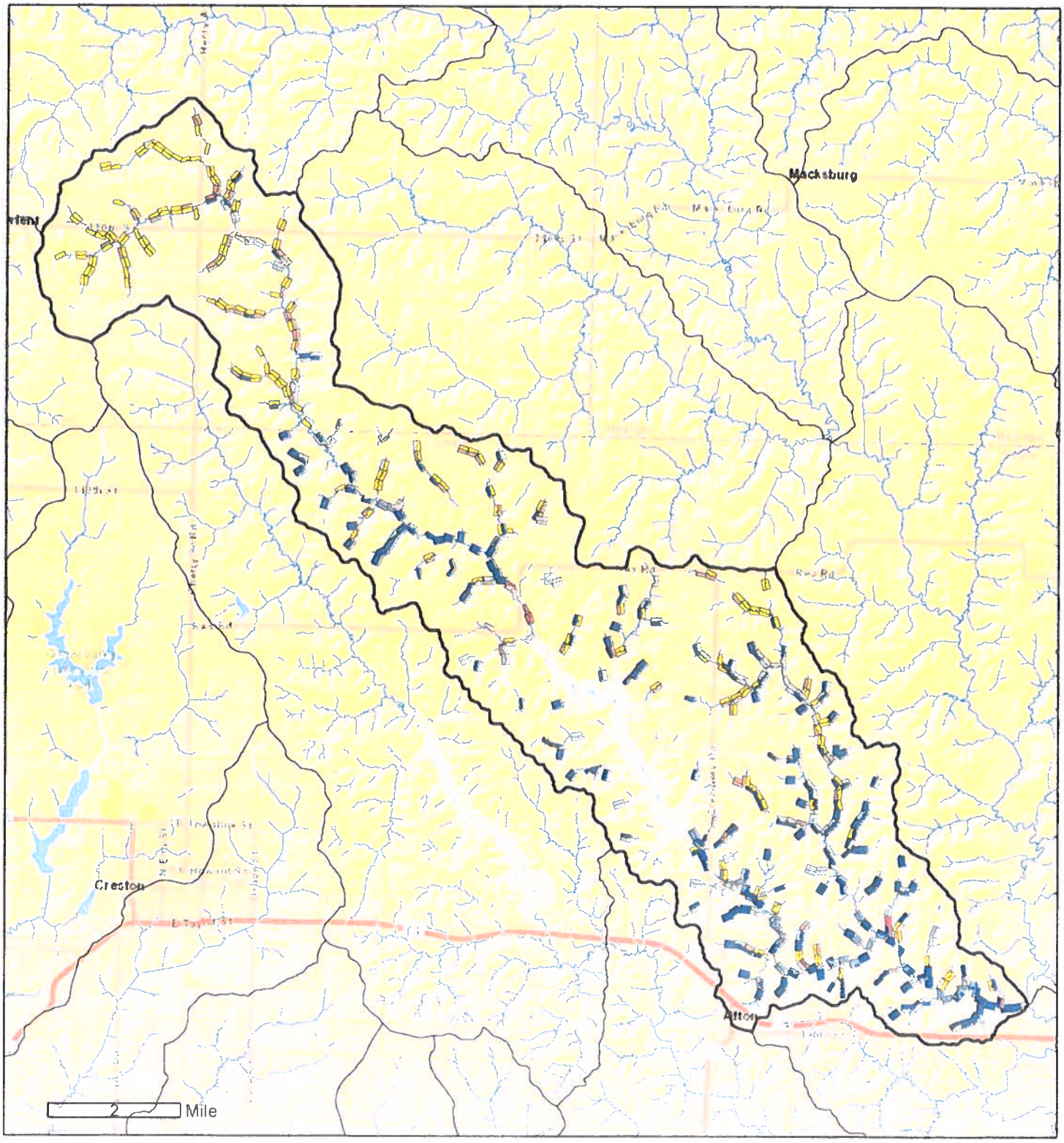


Riparian Saturated Buffer - Suitability/Failure Class

- Suitable for saturated buffers
- Suitable with carbon enhancement
- LandUse
- Topography
- Soils
- Soils/Topography
- SteepBanks
- SteepBanks/Soils
- SteepBanks/Topography
- SteepBanks/Soils/Topography



Source: NLAE, USDA, Esri

see https://www.nrrig.mwa.ars.usda.gov/st40_huc/satBuff.html