SWIFT COULEE / MARSHALL COUNTY DITCH #3 WATERSHED PLANNING

POINT OF CONCURRENCE #1 DEMONSTRATION OF NEED AND PROJECT PURPOSE

Drafted: October 8, 2018

Prepared on behalf of:
Middle-Snake-Tamarac Rivers Watershed District

Technical Assistance by:
Houston Engineering, Inc. (HEI #3429-049)

HoustonEngineering Inc.

MSTRWD

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1 INTRODUCTION

The Middle-Snake-Tamarac Rivers Watershed District (MSTRWD) is composed of approximately 1,476 square miles and is located in the northern (downstream) end of the Red River Valley in Northwestern Minnesota. The MSTRWD encompasses drainage basins of the Middle River, Snake River and Tamarac Rivers. The MSTRWD includes parts of Marshall, Polk, Pennington, Kittson, and Roseau Counties. For this study, the Swift Coulee / Marshall County Ditch #3 (MCD #3) Watershed is a sub-watershed within the Snake River basin. Exhibit 1 shows the 47.6-square mile sub-watershed drainage area with respect to the overall MSTRWD boundary. Exhibit 2 through Exhibit 5 provide additional detail within the Swift Coulee / MCD #3 sub-watershed study area.

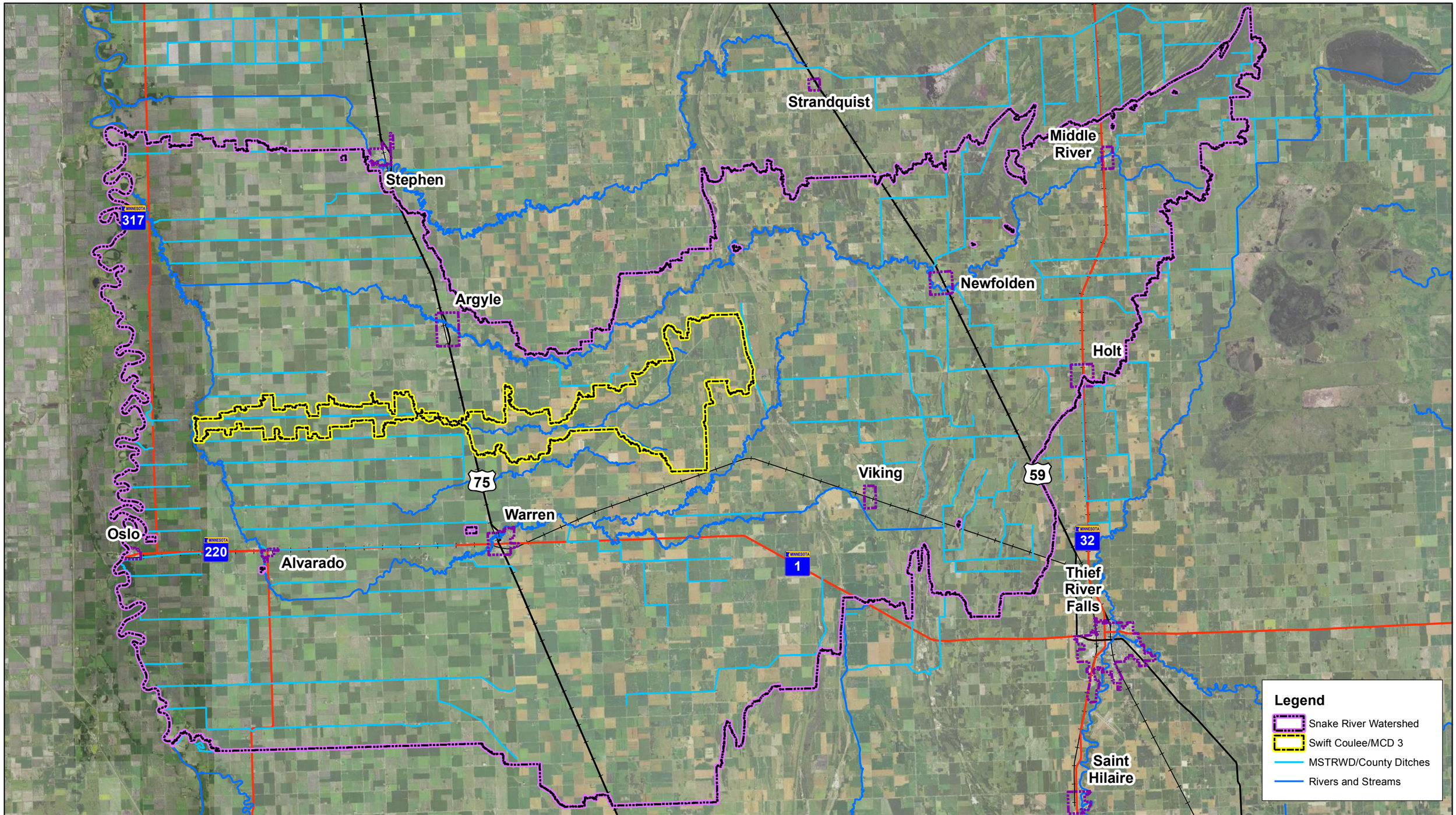

Exhibit 1: Snake River Watershed
Hydrology and Hydraulics Report
Swift Coulee/Marshall County Ditch 3
Middle-Snake-Tamarac Rivers Watershed District

N W E S

0 2.25 4.5 9 13.5 18 Miles

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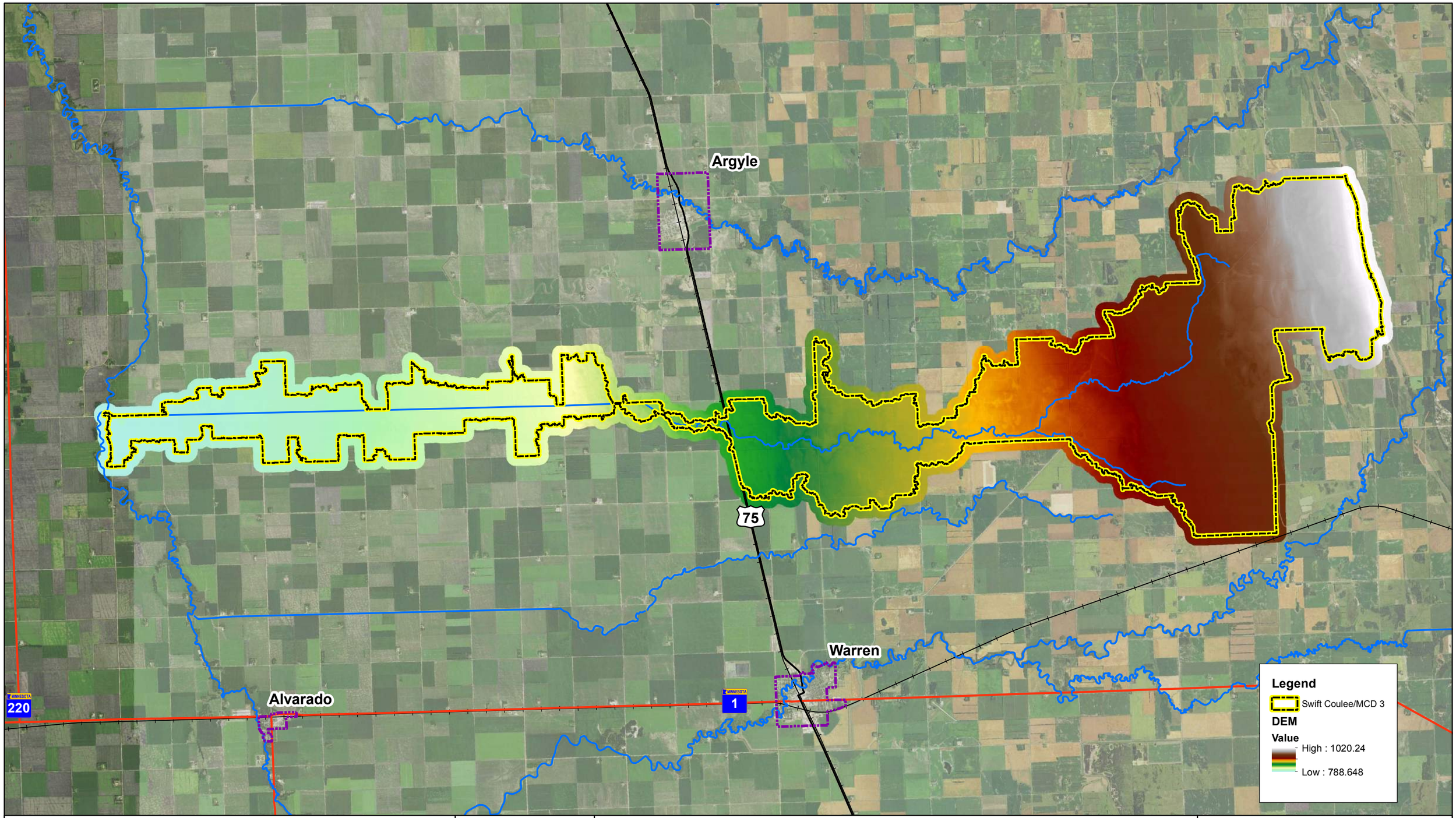

Exhibit 2: DEM

Hydrology and Hydraulics Report
Swift Coulee/Marshall County Ditch 3
Middle-Snake-Tamarac Rivers Watershed District

N
W E
S

0 1 2 4 6 8 Miles

Houston Engineering Inc.

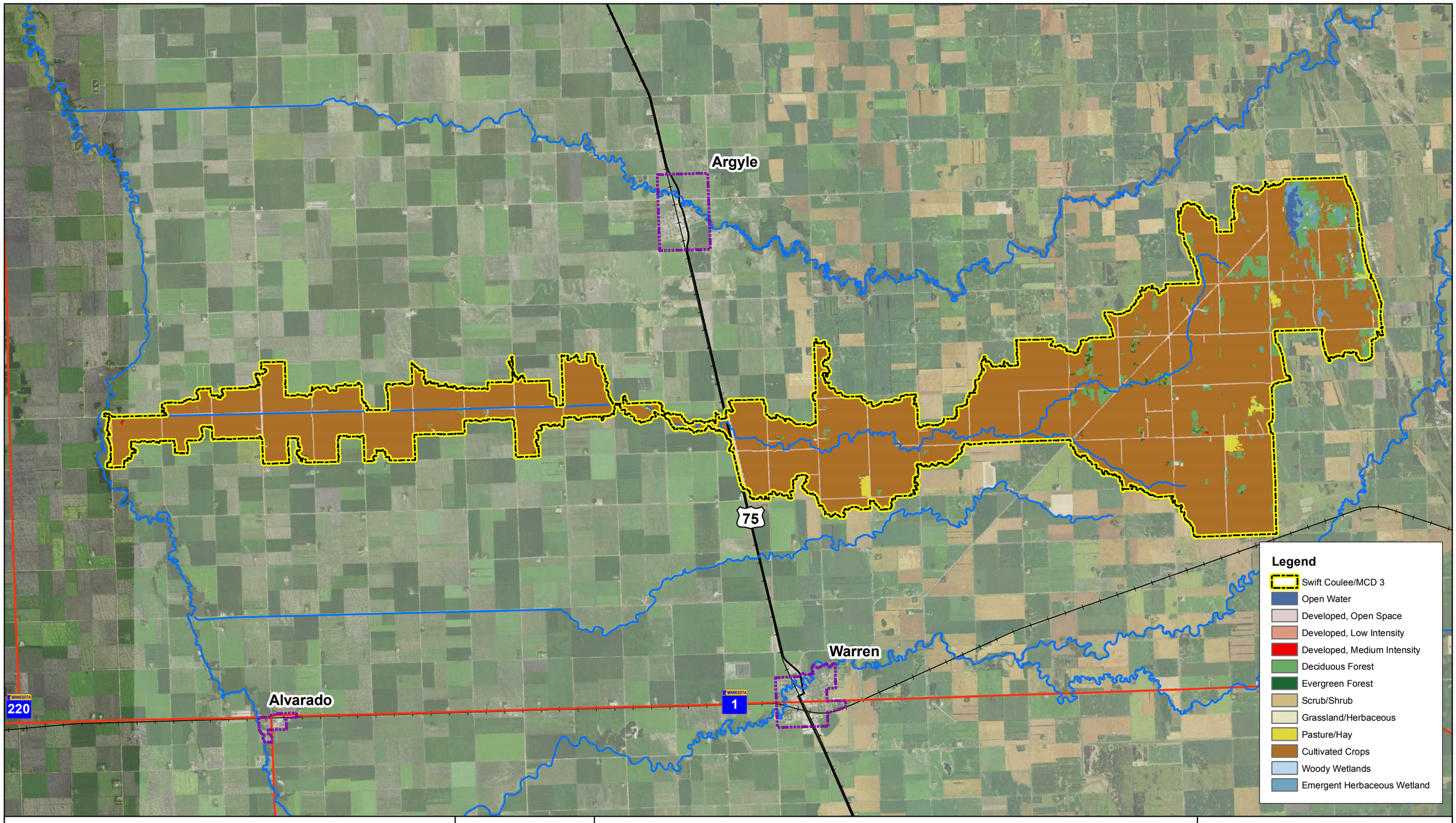

Exhibit 3: NLCD 2011

Hydrology and Hydraulics Report
Swift Coulee/Marshall County Ditch 3
Middle-Snake-Tamarac Rivers Watershed District

N
W E
S

0 1 2 4 6 8 Miles

Houston Engineering Inc.

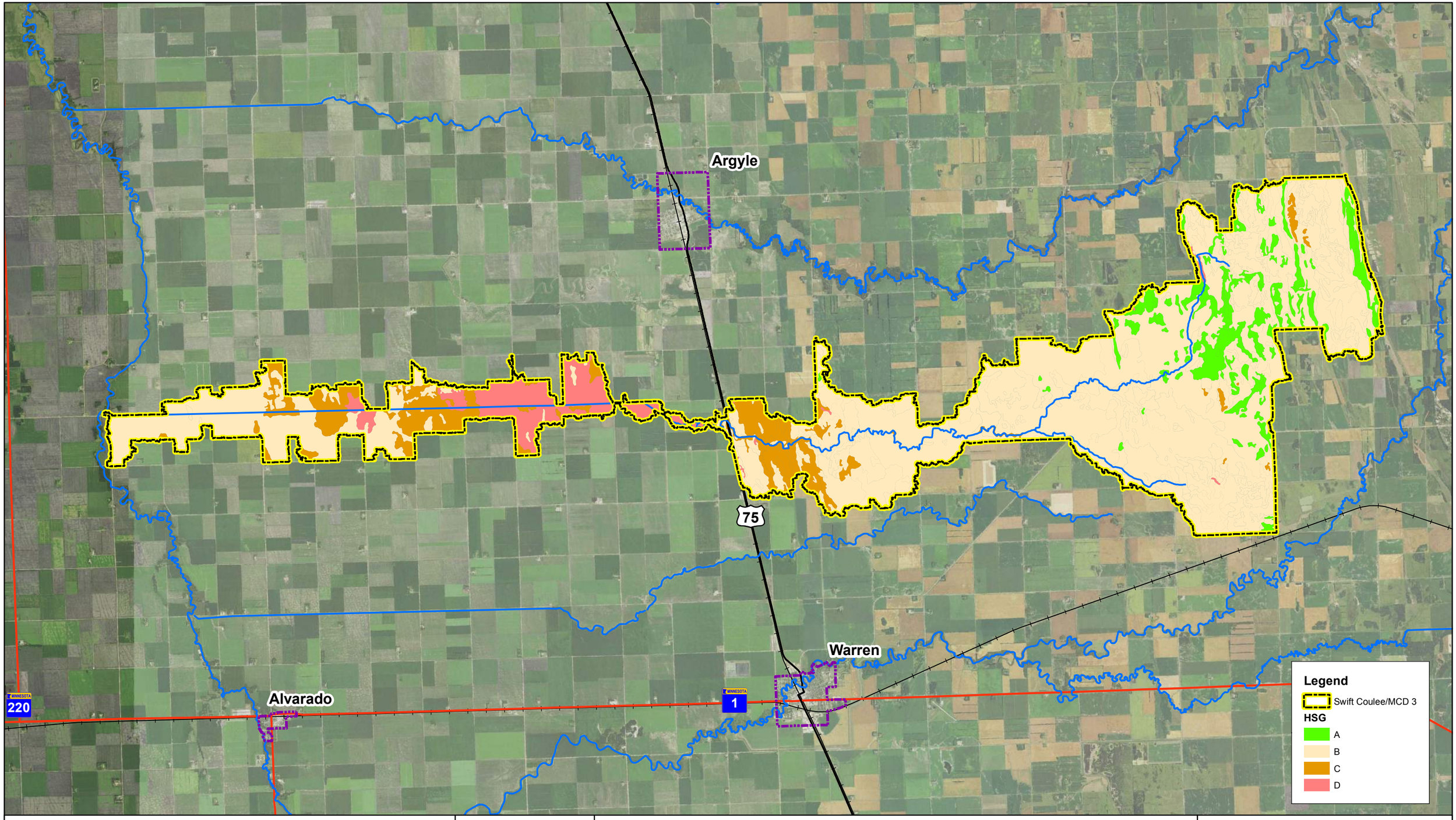

Exhibit 4: Hydrologic Soil Group (HSG)
Hydrology and Hydraulics Report
Swift Coulee/Marshall County Ditch 3
Middle-Snake-Tamarac Rivers Watershed District

N
W E
S

0 1 2 4 6 8 Miles

Houston Engineering Inc.

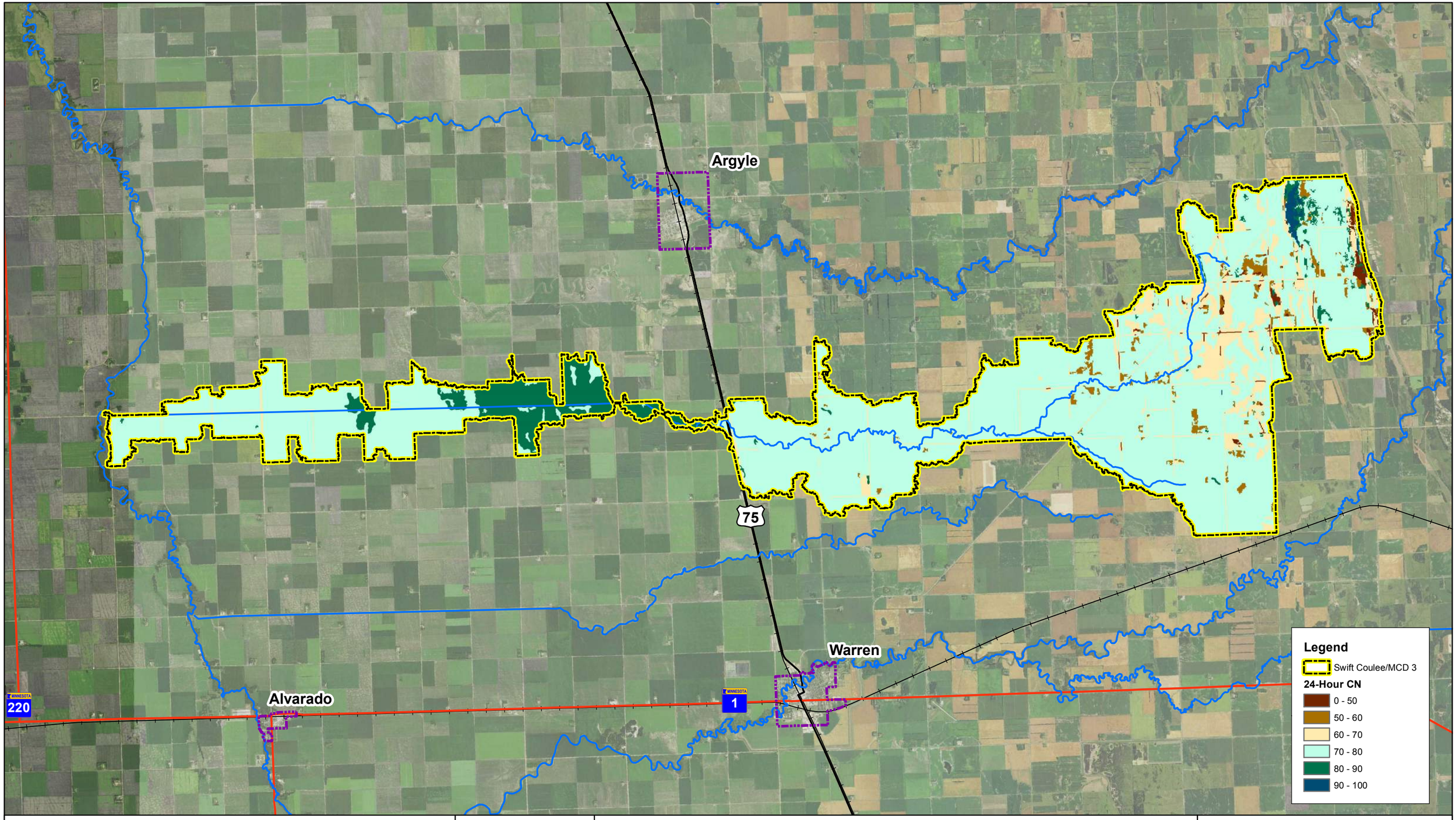

Exhibit 5: 24-Hour Hydrologic CN

Hydrology and Hydraulics Report
Swift Coulee/Marshall County Ditch 3
Middle-Snake-Tamarac Rivers Watershed District

N W E S

0 1 2 4 6 8 Miles

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2 PURPOSE AND NEED FOR ACTION

2.1 PURPOSE:

The purpose of this project is to provide flood damage reduction to agricultural lands due to a 10-year 24-hour rainfall event and to reduce flood damage to public transportation infrastructure in the Swift Coulee / MCD #3 sub-watershed.

2.2 NEED:

There is a need for 10-year 24-hour flood damage reduction for agricultural land and reduction in public transportation infrastructure flood damages in the Swift Coulee / MCD #3 sub-watershed. Additional information supporting this need is included in the following list:

- Flooding results in damages to some rural transportation systems and other public drainage systems. The Swift Coulee / MCD #3 sub-watershed encompasses portions of ten different Townships and records from the Minnesota Disaster Declaration state that the majority of those ten Townships received disaster relief during floods in 1996, 1997, 1999, 2001, and 2006. Even though exact locations are not identifiable pre-2009 in this sub-watershed, in 1997 and 2006 the combined total for the 10 Townships received $568,958 and $303,832.
- Based on information from the Minnesota Disaster Declaration, Counties, Townships, and watershed district data, road and culvert damages occurred in multiple locations within the Swift Coulee / MCD #3 sub-watershed during floods in 2009, 2010, 2012, and 2014. See Map 1 for locations within the Swift Coulee / MCD #3 sub-watershed post-2009. In the year 2009, Marshall County was eligible for approximately $3.5 million. In the year 2010, Marshall County was eligible for approximately $1.2 million. These dollar amounts are given on a county wide basis and the Swift Coulee / MCD #3 sub-watershed is only a small portion of Marshall County, but this shows that flood damage is a costly occurrence throughout the MSTRWD and the Red River Basin.
- Currently, the Swift Coulee / MCD #3 sub-watershed is broken into several FEMA Floodplain Zones. The entire sub-watershed east of Hwy. 75 is in FEMA Floodplain Zone C classification, while west of Hwy. 75 the zoning is a combination of Zone C, A, and A4. Properties in Zone C classifications are areas of minimal flooding, Zone A classification are areas of 100-year flood and flood hazard factors not determined, and Zone A4 are areas of 100-year flood and flood hazard factors determined under the National Flood Insurance Program. Areas within the Swift Coulee / MCD sub-watershed may be required to have flood insurance.
- Sediment accumulation within the Swift Coulee confines the ability to manage water within the channel.
- MCD #3 system was originally designed for an approximate 2-year rainfall event. Hydraulic modeling efforts have shown that the ditch system has slightly less capacity than a 2-year event when comparing peak water surface elevations within the ditch and natural ground elevations of adjacent properties. Improved agricultural drainage practices since the system was built has caused runoff to enter the system more efficiently.
- Channel instability along portions of MCD #3.
- Reduce flood damages within the Swift Coulee / MCD #3 sub-watershed associated with spring snow melt and rains.

- Flooding within the sub-watershed causes breakout flows to other sub-watersheds.
- Flooding in the watershed results in damages to crop land due to channel erosion, delayed planting, prevented planting, and prolonged inundation. Total inundated acres and associated agricultural damages are estimated for various synthetic rainfall events and shown in Table 1 below.

Table 1 – Inundated Lands Summary

Runoff Event	Rainfall Depth* Inches	Total Inundated Acres	Agriculture** Inundated Acres	% of Total Drainage Area
2-year, 24-hour	2.3	2,623	2,108	7
5-year, 24-hour	2..9	4,313	3,600	12
10-year, 24-hour	3.5	5,938	5,061	17
25-year, 24-hour	4.4	7,966	6,920	23
50-year, 24-hour	5.1	10,402	9,148	30
100-year, 24-hour	5.9	12,163	10,751	35

Swift Coulee/ MCD #3 Total Drainage Area = 30,494 Acres

**NOAA Atlas 14 Rainfall Depths*

***Estimated from National Agricultural Statistics Service 2016 Class GIS data layer*

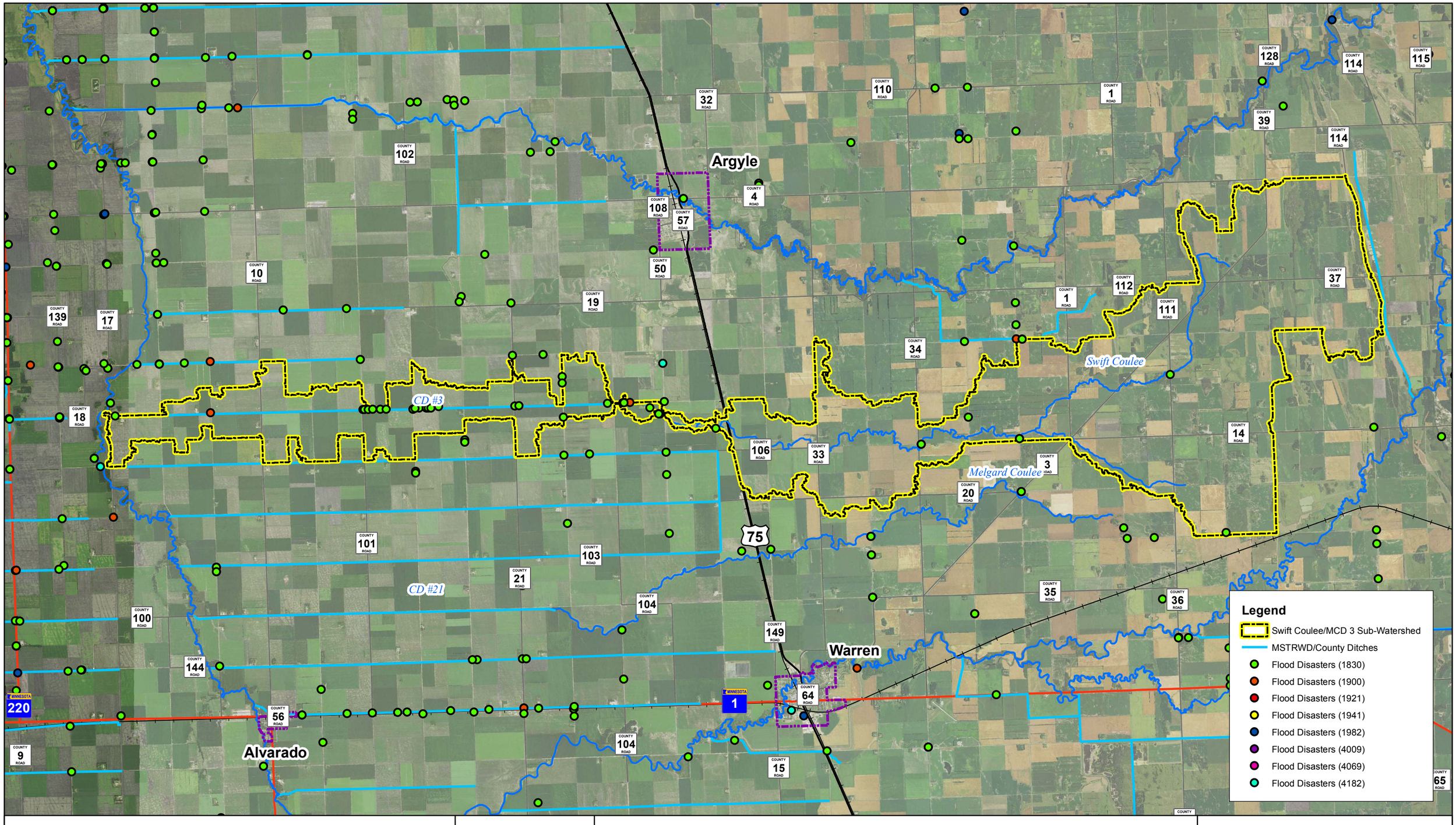
Additional Supplemental Documentation to Support the Existence of the Problems is provided in **Appendix A.**

3 APPENDICIES

Appendix A

Additional Supplemental Documentation to Support the Existence of the Problems

- Map 1 – FEMA Disasters (2009 – Present)
- Map 2 – Channel Erosion and Degradation Areas
- Map 3 – Synthetic 2-Year 24-Hour Rainfall Event
- Map 4 – Synthetic 5-Year 24-Hour Rainfall Event
- Map 5 – Synthetic 10-Year 24-Hour Rainfall Event
- Map 6 – Synthetic 25-Year 24-Hour Rainfall Event
- Map 7 – Synthetic 50-Year 24-Hour Rainfall Event
- Map 8 – Synthetic 100-Year 24-Hour Rainfall Event
- Map 9 – Synthetic 10 Year 24-Hour Duration
- Map 10 – Synthetic 100 Year 24-Hour Duration



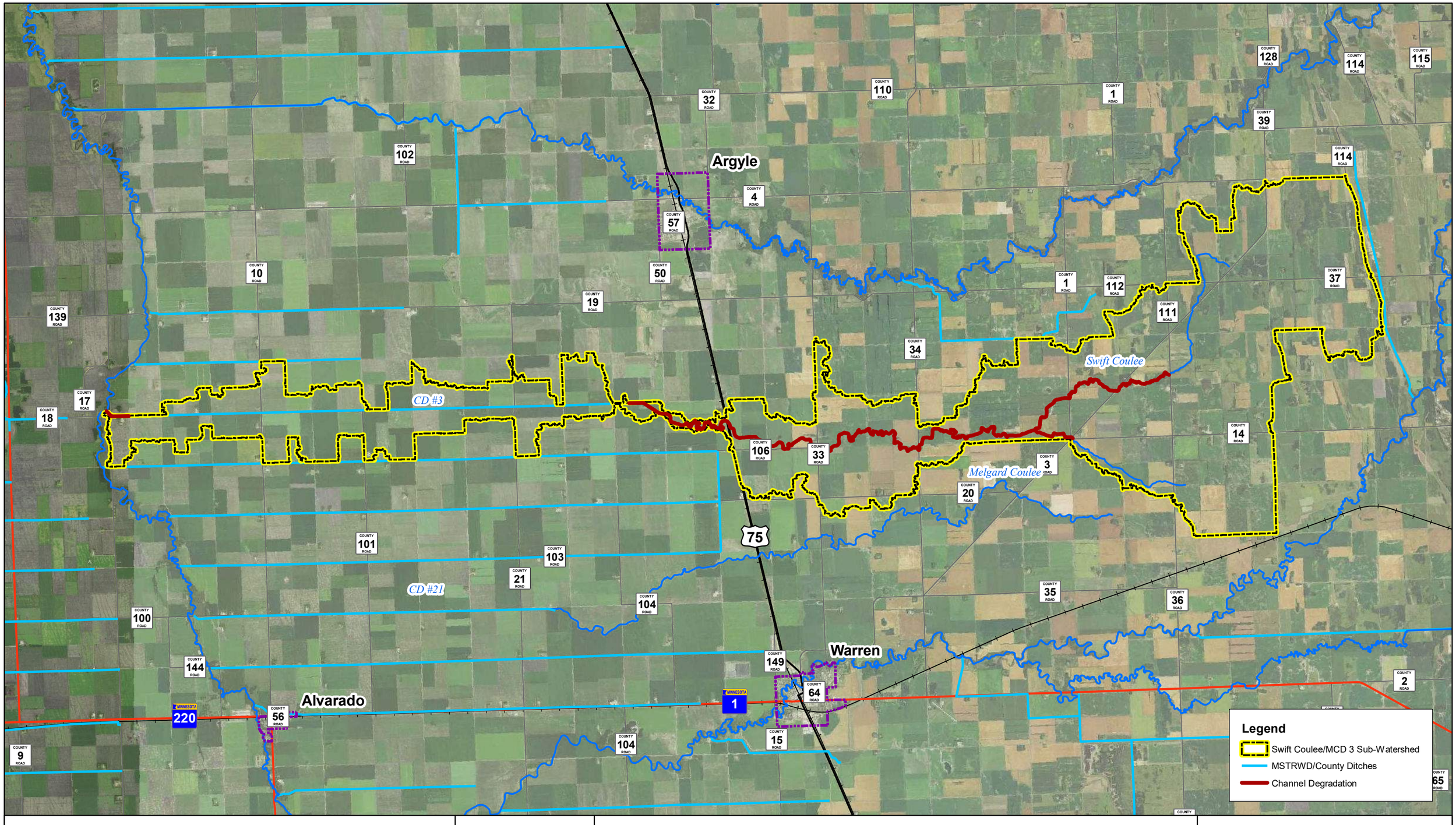
Map 1 - FEMA Disasters (2009 - Present)

Hydrology and Hydraulics Report
Swift Coulee/Marshall County Ditch 3
Middle-Snake-Tamarac Rivers Watershed District

N W E S

0 1 2 4 6 8 Miles

Houston Engineering Inc.



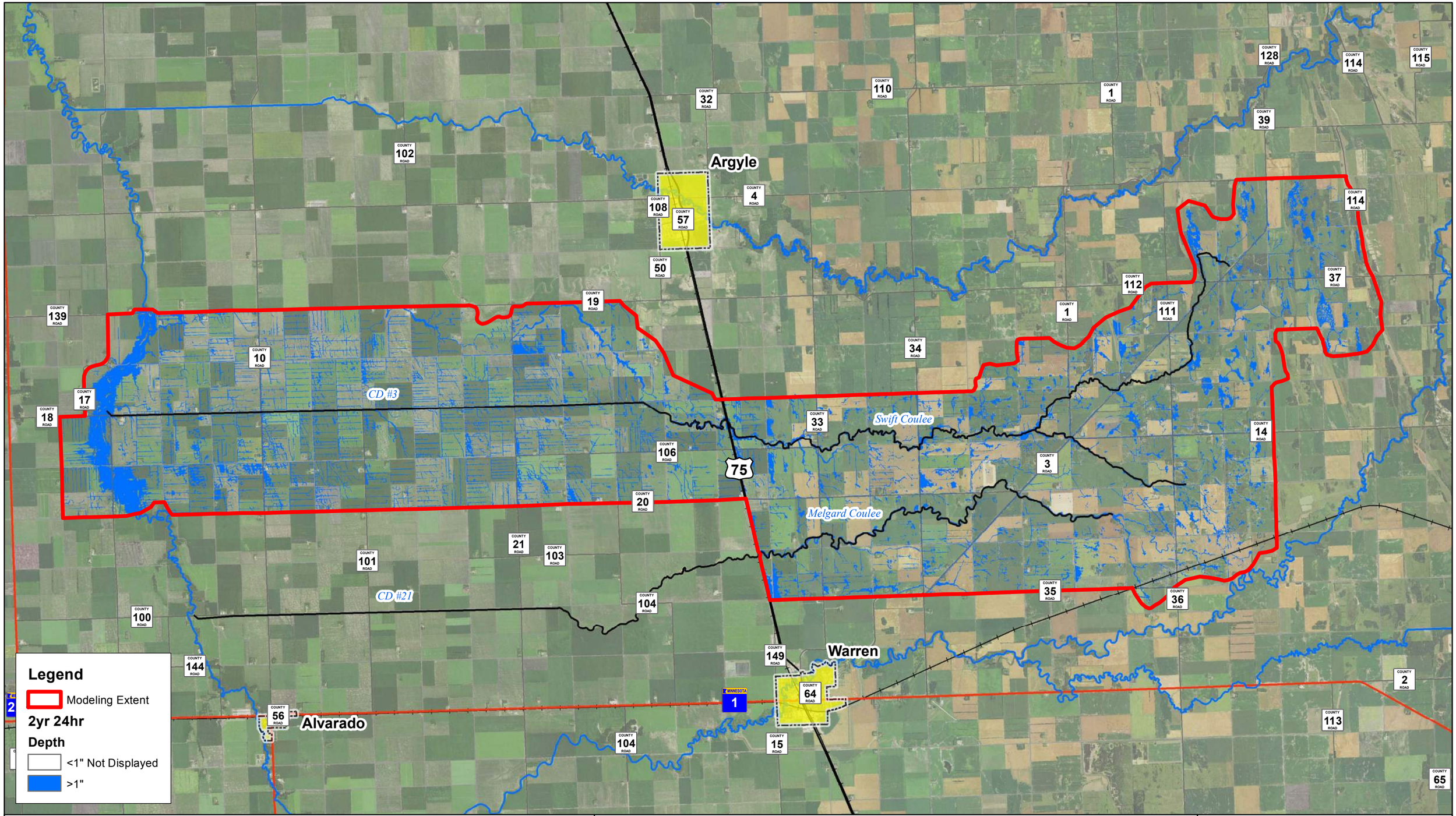
Map 2 - Channel Degradation Areas

Concurrence Point 1
Swift Coulee/Marshall County Ditch 3
Middle-Snake-Tamarac Rivers Watershed District

N W E S

0 1 2 4 6 8 Miles

Houston Engineering Inc.



Map 3 - Synthetic 2-Year 24-Hour Rainfall Event

Hydrology and Hydraulics Report
Swift Coulee/Marshall County Ditch 3
Middle-Snake-Tamarac Rivers Watershed District

N W E S

0 1 2 4 6 8 Miles

Houston Engineering Inc.

Argyle
Warren
Alvarado
CD #3
CD #21
Swift Coulee
Melgard Coulee
75
1
MINNESOTA

Legend

Modeling Extent

5yr 24hr

Depth

<1" (Not Displayed)

>1"

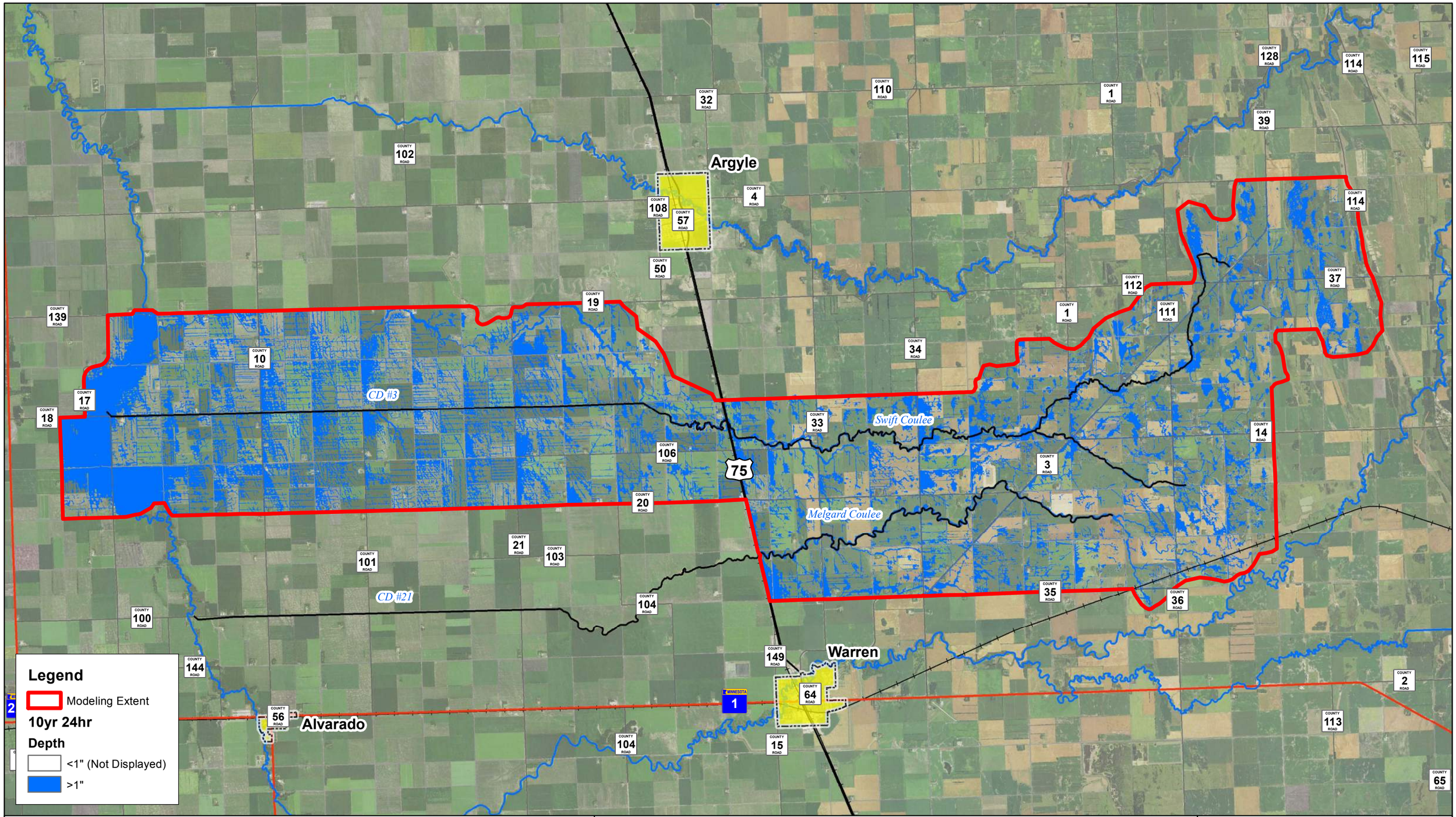
Map 4 - Synthetic 5-Year 24-Hour Rainfall Event

Hydrology and Hydraulics Report
Swift Coulee/Marshall County Ditch 3
Middle-Snake-Tamarac Rivers Watershed District

N W E S

0 1 2 4 6 8 Miles

Houston Engineering Inc.



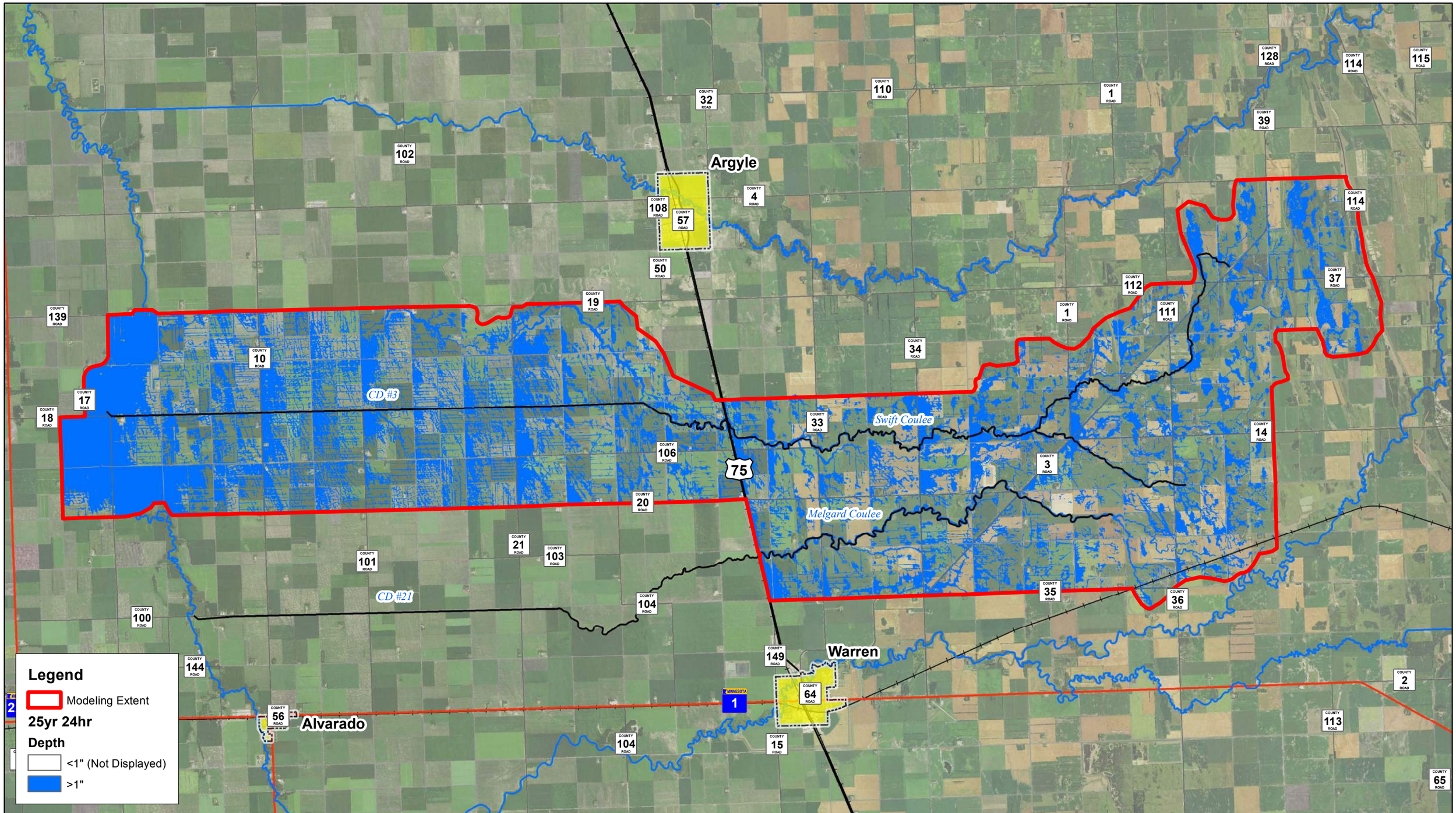
Map 5 - Synthetic 10-Year 24-Hour Rainfall Event

Hydrology and Hydraulics Report
Swift Coulee/Marshall County Ditch 3
Middle-Snake-Tamarac Rivers Watershed District

N W E S

0 1 2 4 6 8 Miles

Houston Engineering Inc.



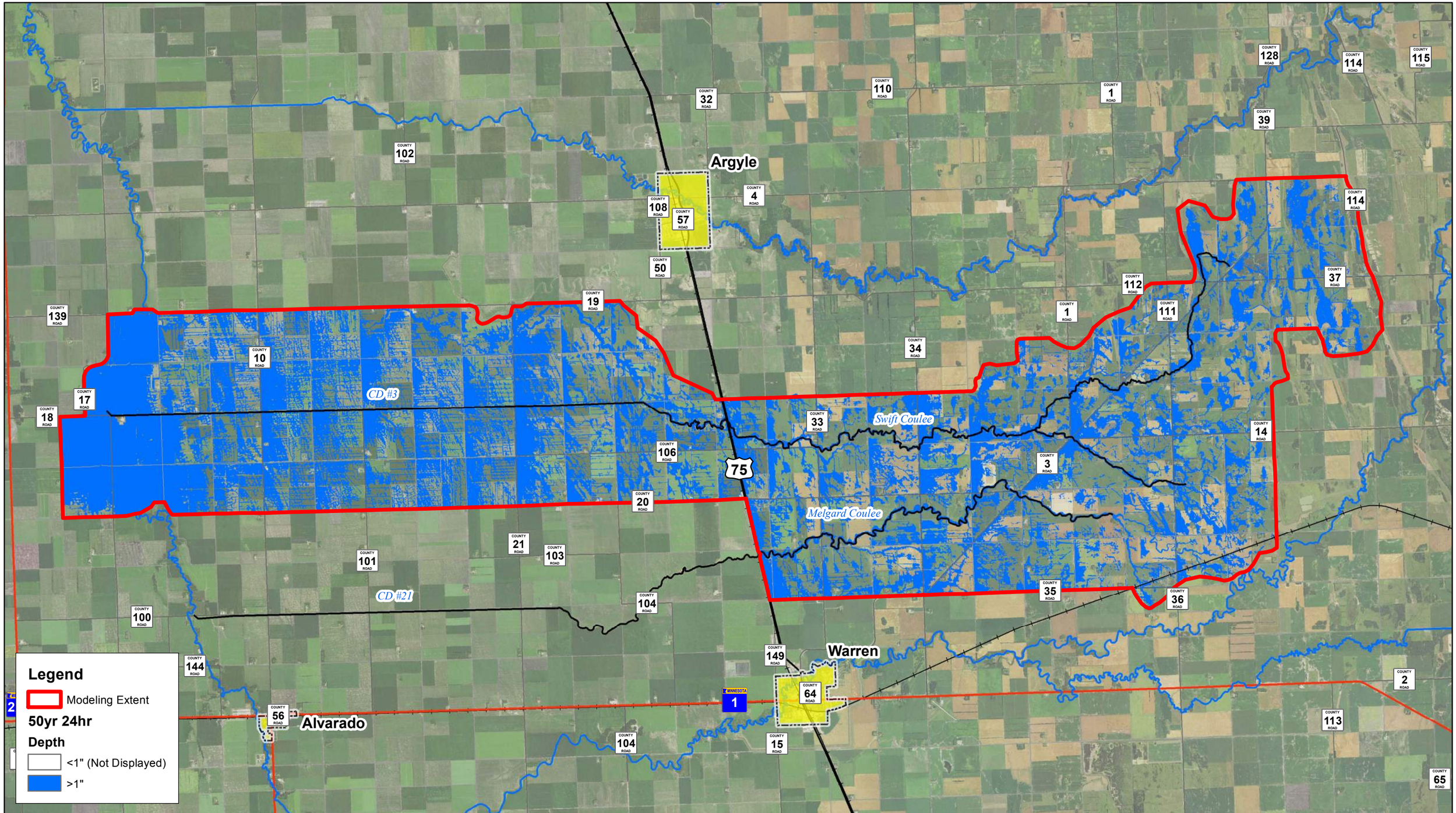
Map 6 - Synthetic 25-Year 24-Hour Rainfall Event

Hydrology and Hydraulics Report
Swift Coulee/Marshall County Ditch 3
Middle-Snake-Tamarac Rivers Watershed District

N W E S

0 1 2 4 6 8 Miles

Houston Engineering Inc.



Map 7 - Synthetic 50-Year 24-Hour Rainfall Event

Hydrology and Hydraulics Report
Swift Coulee/Marshall County Ditch 3
Middle-Snake-Tamarac Rivers Watershed District

Houston Engineering Inc.

Argyle
Warren
Alvarado
CD #3
CD #21
Swift Coulee
Melgard Coulee
MINNESOTA
75
1

Legend

Modeling Extent

100yr 24hr

Depth

<1" (Not Displayed)

>1"

Map 8 - Synthetic 100-Year 24-Hour Rainfall Event

Hydrology and Hydraulics Report
Swift Coulee/Marshall County Ditch 3
Middle-Snake-Tamarac Rivers Watershed District

N
W
E
S

0 1 2 4 6 8 Miles

Houston Engineering Inc.

Argyle

Warren

Alvarado

CD #3

CD #21

Swift Coulee

Melgard Coulee

Approx.
90-100 hrs
(3.8-4.2 days)

Legend

Modeling Extent

10yr 24hr Duration

Value

High : 209.67

Low : 0

Map 9 - Synthetic 10-Year 24-Hour Duration

Hydrology and Hydraulics Report
Swift Coulee/Marshall County Ditch 3
Middle-Snake-Tamarac Rivers Watershed District

N W E S

0 1 2 4 6 8 Miles

Houston Engineering Inc.

Approx.
140-180 hrs
(5.8-7.5 days)

CD #3

CD #21

Swift Coulee

Melgard Coulee

Argyle

Warren

Alvarado

Legend

Modeling Extent

100yr 24hr Duration

Value

High : 210.501

Low : 0

Map 10 - Synthetic 100-Year 24-Hour Duration

Hydrology and Hydraulics Report
Swift Coulee/Marshall County Ditch 3
Middle-Snake-Tamarac Rivers Watershed District

N
W E
S

0 1 2 4 6 8 Miles

Houston Engineering Inc.