Draft Study Report

Dakota Dunes/N. Sioux City Planning Study

Operations Analysis and Recommendations

Dakota Dunes and North Sioux City, SD

December 22, 2017

Dakota Dunes/North Sioux City
Planning Study

Dakota Dunes and North Sioux City, South Dakota
December, 2017

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EXECUTIVE SUMMARY

The communities of Dakota Dunes and North Sioux City have partnered with the Sioux Interstate Metropolitan Planning Council (SIMPCO) and the South Dakota Department of Transportation (SDDOT), to study their primary roadways and plan roadway improvements that will provide proper transportation service through the year 2040. This study is a special effort within the ongoing transportation planning process conducted by SIMPCO for the metropolitan area including Sioux City, Iowa, and the surrounding cities, counties, and communities.

Data was gathered at locations throughout Dakota Dunes and North Sioux City and the data was used to analyze existing traffic operations and safety. Conditions were also forecast for the years of 2022 (five-year build condition) and 2040. The results of the analysis comprised a short list of deficiencies, concerns, and needs to coordinate community planning and enhance traffic flow.

Alternatives were developed to address the identified future transportation needs. Those alternatives were vetted through discussions with the Study Advisory Team and community. The results of those discussions are the recommendations contained in this report:

<u>Dakota Dunes</u>

- Short-term (0-5 years)
  - Complete roundabout project at 2 River Dr. and Cottonwood Dr. – around 5 years to complete project. Project will be needed when the interim development plan is completed.
- Short to Mid-term (5-15 years)
  - Dakota Dunes will work to replace curb ramps along Dakota Dunes Blvd. as projects allow, getting all street ramps upgraded to meet ADA guidelines.
- Long-term (15-25 years)
  - Monitor the intersection of Dakota Dunes Blvd. and Sioux Point Rd. to ensure LOS is adequate to support traffic.

<u>North Sioux City</u>

- Short-term (0-5 years)
  - Continue to coordinate with landowners/developers to prepare a plan for relocating Sioux Point Rd. and Streeter Dr. to connect to Sodrac Dr. so the frontage road connections near the Exit 2 interchange can be removed.
- Short to mid-term (5-15 years)
  - Remove frontage road connections prior to signal at SB ramp terminal at Exit 2.
  - Construct turn lanes on Northshore Dr. to reduce queuing and improve operations at school driveways.
  - Implement median on River Dr. at S. Derby Ln.

- Long-term (15-25 years)
  - Either reconstruct Northshore Dr. as 3-lane or construct new street along the north side of schools that connects to Exit 4.

<u>SDDOT</u>

- Short-term (0-5 years)
  - Consider adding second northbound left turn lane at Exit 1 ramp terminal.
- Short to mid-term (5-15 years)
  - Monitor southbound off ramp terminal at Exit 2 for signal.
  - Consider options for southbound ramp terminal at Exit 4. North Sioux City has endorsed roundabout concept.
  - Monitor signal warrants at Exit 4 northbound ramp terminal.
- Long-term (15-25 years)
  - Monitor interchange and bridge conditions at Exits 2 and 4 to determine when improvements are needed. These will be considered during Decennial Study in 2020 and 2030.

INTRODUCTION

Background

The communities of Dakota Dunes and North Sioux City have partnered with the Sioux Interstate Metropolitan Planning Council (SIMPCO) and the South Dakota Department of Transportation (SDDOT), to study their primary roadways and plan roadway improvements that will provide proper transportation service through the year 2040. This study is a special effort within the ongoing transportation planning process conducted by SIMPCO for the metropolitan area including Sioux City, Iowa, and the surrounding cities, counties, and communities.

Purpose

Interstate 29 is the primary transportation facility through North Sioux City and Dakota Dunes, carrying a large portion of daily commuting traffic along with regular through traffic. The arterial and collector roadways that connect to I-29 also experience periodic congestion associated with the local commuting traffic. This study evaluates the level of safety and congestion on those arterial and collector streets and develops improvements to enhance safety and reduce congestion through the 2040 horizon year.

Project Location

The focus of this study is on four roadways that connect to I-29:

- Northshore Drive in North Sioux City via Exit 4
- River Drive in North Sioux City via Exit 2
- Dakota Dunes Boulevard in Dakota Dunes via Exit 1
- Sioux Point Road/Streeter Drive in both communities between Exits 1 and 4

The study area is shown in **Figure 1**.

Several intersections have been identified for specific analysis. They include:

- Sioux Point Road/Steamboat Drive
- Sioux Point Road/Tower Road
- Sioux Point Road/Dakota Dunes Boulevard
- Dakota Dunes Boulevard/Cottonwood Lane
- Dakota Dunes Boulevard/I-29 NB
- Dakota Dunes Boulevard/I-29 SB
- Dakota Dunes Boulevard/Courtyard Drive
- Dakota Dunes Boulevard/Levee Trail
- Dakota Dunes Boulevard/Meadows Boulevard
- Dakota Dunes Boulevard/Pinehurst Trail
- River Drive/Sodrac Drive
- River Drive/Sioux Point Road
- River Drive/I-29 SB
- River Drive/I-29 NB
- River Drive/South Derby Lane

- River Drive/North Derby Lane
- Northshore Drive/Westshore Drive
- Northshore Drive/West High School driveway
- Northshore Drive/Middle High School driveway
- Northshore Drive/East High School driveway
- Northshore Drive West Elementary School driveway
- Northshore Drive/East Elementary School driveway
- Northshore Drive/Penrose Drive
- Northshore Drive/Streeter Drive
- Northshore Drive/I-29 SB
- Northshore Drive/I-29 NB
- Northshore Drive/Military Road
- Northshore Drive/Highway 105

The locations of the analysis intersections are shown in **Figures 2-4**.

Data Gathering

New turning movement counts were collected at the study analysis intersections and geometric data was gathered through field investigation. Specific field observations were conducted at the following locations:

- School vehicular demand and pedestrian conflicts at school driveways on Northshore Drive
- Pedestrian demand and behavior at intersections on Dakota Dunes Boulevard

Methods and Assumptions

The methods and assumptions employed in study analysis were addressed in a Methods and Assumptions Memorandum. A copy of the memorandum is included in the Appendix.

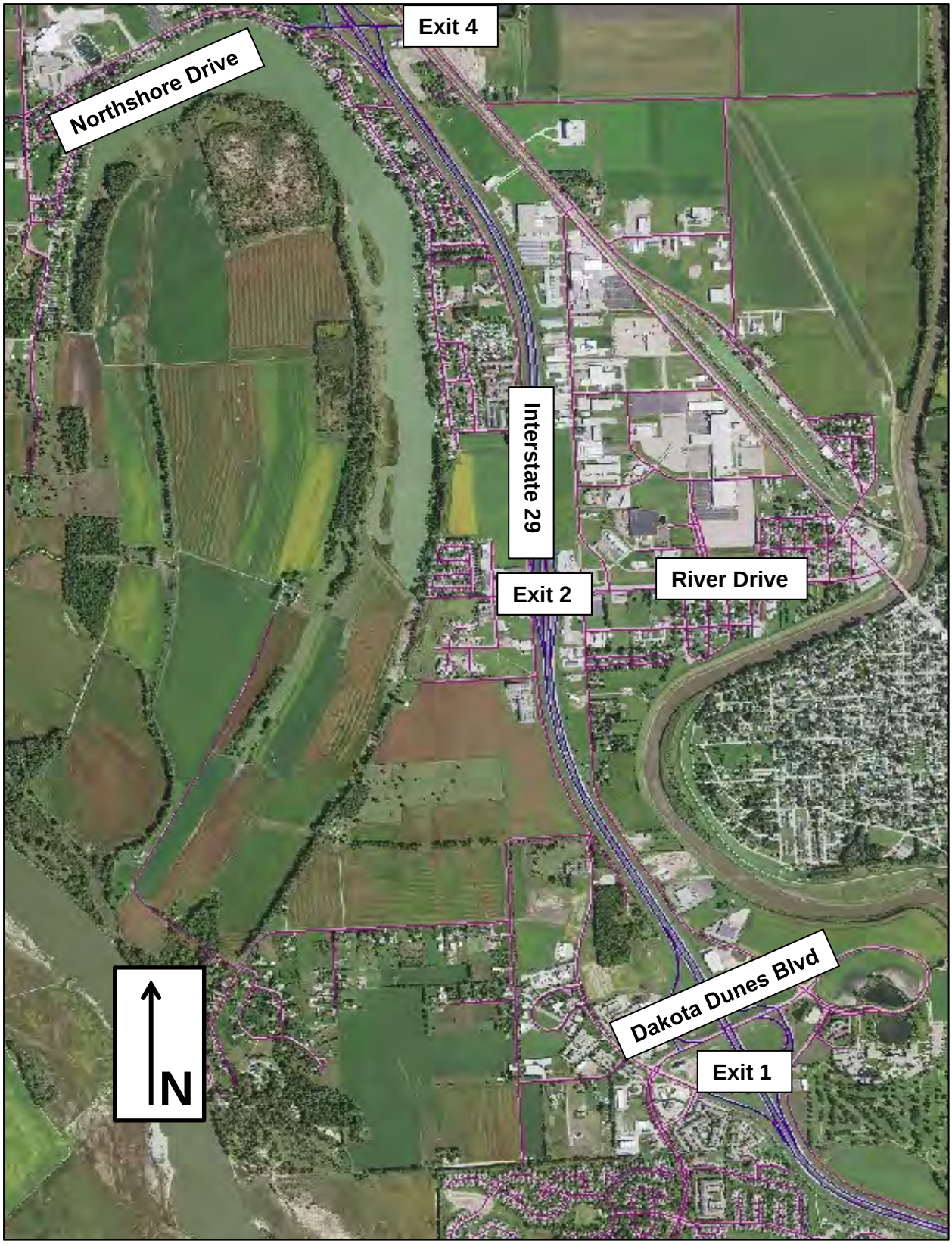


Figure 1 – Study Area

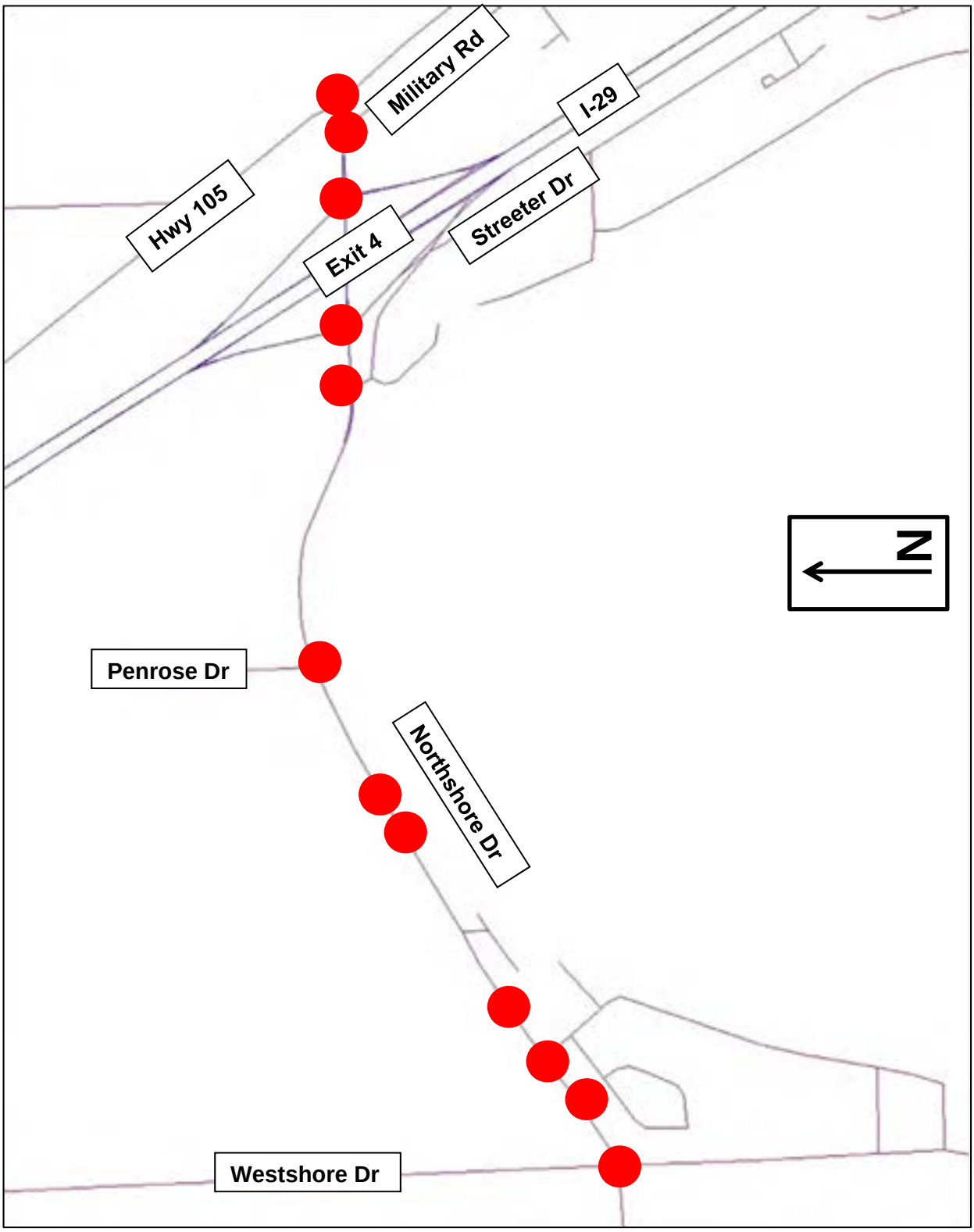


Figure 2 – Study Area Analysis Intersections – Northshore Drive

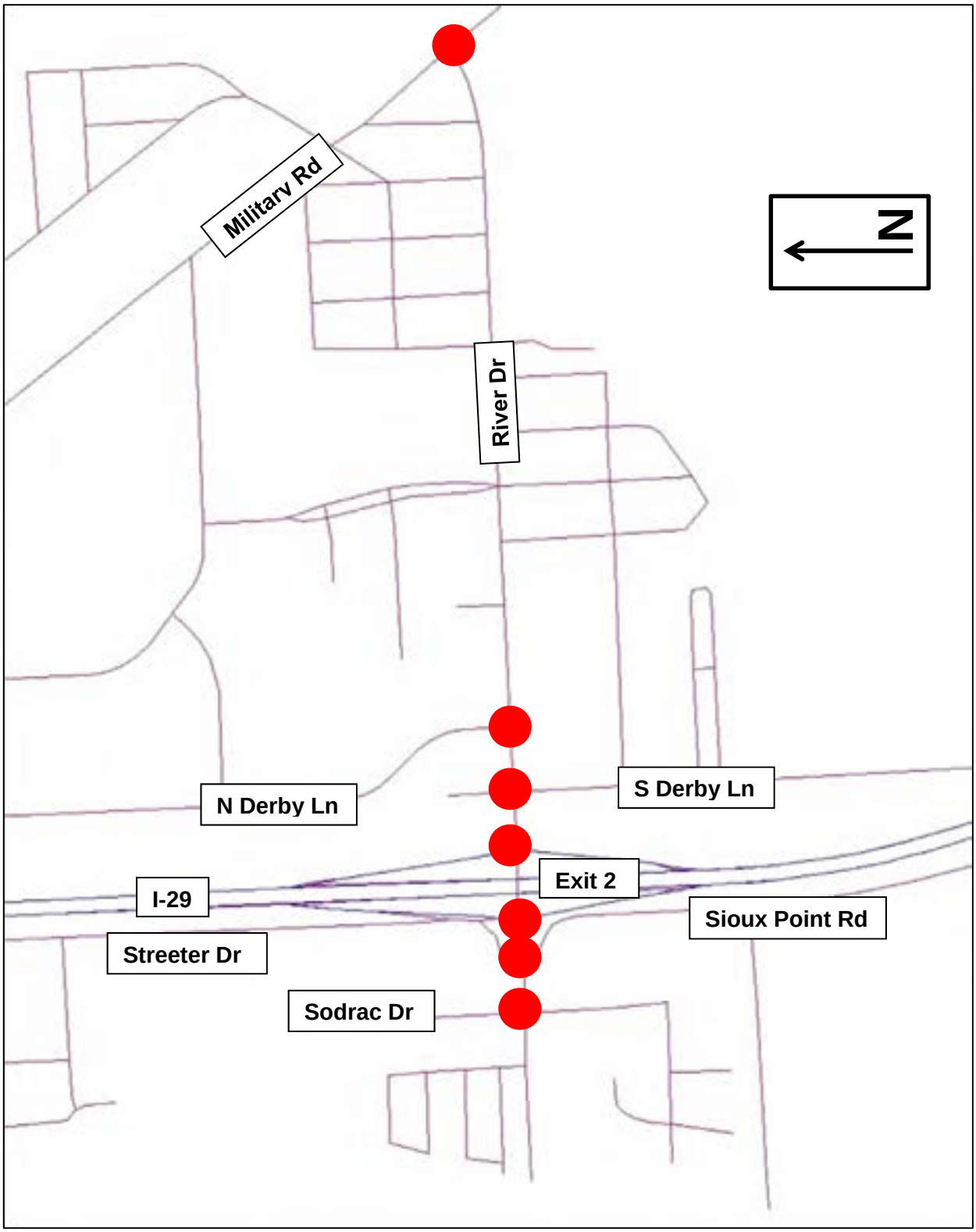


Figure 3 – Study Area Analysis Intersections – River Drive

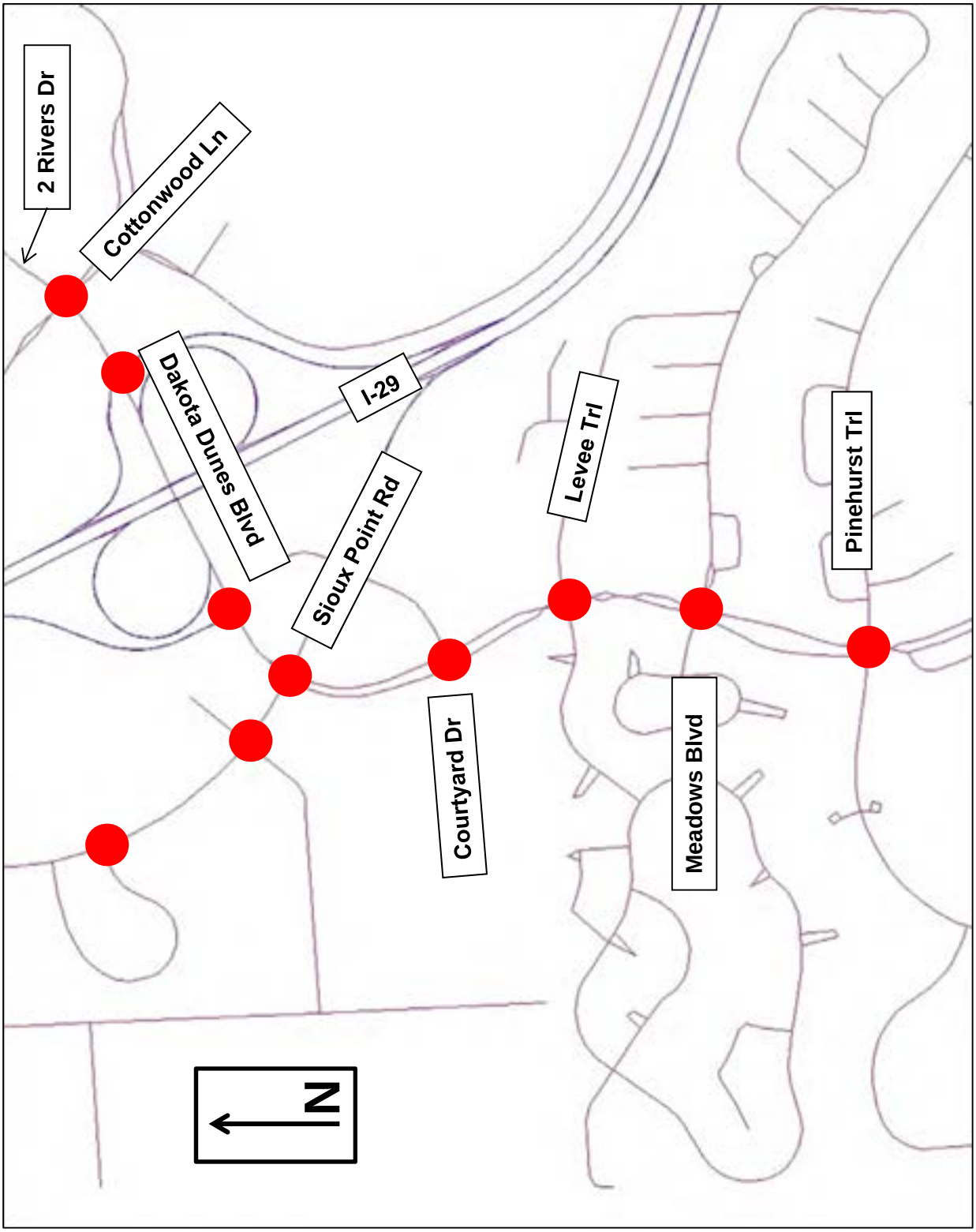


Figure 4 – Study Area Analysis Intersections – Dakota Dunes Blvd

Existing Conditions Analysis

The safety and operation of the existing study area roadways were analyzed to determine locations that may be in need of improvement. The analysis included evaluation of crash records, observations of vehicular demand and pedestrian conflicts on Northshore Drive in the vicinity of schools, observations of pedestrian behavior on Dakota Dunes Boulevard and level of service analysis at study area intersections.

Crash Analysis

Crash records were provided by SDDOT in a geodatabase for the study area. The crash records were analyzed to produce crash record summaries and crash maps for the study area intersections which are provided in the Appendix.

The crash records showed that crash incidence at all the study area intersections was low, with most intersections experiencing 0-1 crashes per year. The crash rates were so low that there was insufficient data to determine any crash trends or produce a statistical analysis of critical crash rates in the study area. An overall summary of the crashes per year at the study area intersections is shown in **Table 1**.

School Observation

An observation was conducted on April 18, 2017 at the Elementary and High School driveways on Northshore Drive. The intent of the observation was to identify the demand of vehicles to enter and leave the schools, identify potential conflicts between students and vehicles, identify needed changes in traffic control, and identify other needed roadway changes due to the presence of the schools adjacent to Northshore Drive.

The observation resulted in these findings:

- The lack of a left turn lane on Northshore Drive causes occasional backups as drivers wait to enter the schools.
- The exiting vehicle queues at the schools can be in excess of 10 vehicles at peak times.
- Signal warrants should be reviewed for the school driveways.
- There are no school-crossing signs installed at the crosswalk flasher at the Elementary School.

A follow-up analysis of the traffic signal warrants for the Elementary and High School driveways showed that traffic signals are not currently warranted at any of these locations.

Pedestrian Observation

An observation was conducted on April 20, 2017 along Dakota Dunes Boulevard to identify potential problems with the existing pedestrian facilities. The observation resulted in these findings:

- Pedestrian demand to cross Dakota Dunes Boulevard is light – only 2 pedestrians attempted to cross during a 35 minute observation period.

- There are no gaps between vehicles during peak hours to allow a pedestrian to completely cross Dakota Dunes Boulevard. The pedestrians that did cross made a 2-stage crossing with a wait in the median. While the study area intersections don't comply with warrants for traffic signals, other pedestrian devices may be used. Such devices may include crosswalks with special signs and markings, and pedestrian-activated warning beacons.
- There are additional pedestrians that use the Dakota Dunes Boulevard facilities without crossing the street.
- The sidewalks along Dakota Dunes Boulevard are not fully compliant with the Americans with Disabilities Act (ADA). A program should be prepared for updating the sidewalks to comply with the ADA.

The Americans with Disabilities Act (ADA) requires specified slopes, landing areas, and tactile warning devices at intersections.

A rolled-curb transition no longer complies with the ADA.

TABLE 1 - INTERSECTION CRASHES

DAKOTA DUNES/NORTH SIOUX CITY TRAFFIC STUDY

INTERSECTION	YEAR					TOTAL
	2012	2013	2014	2015	2016	
SIOUX POINT RD/STEAMBOAT DR	0	0	0	0	0	0
SIOUX POINT RD/TOWER RD	0	1	0	0	1	2
SIOUX POINT RD/DAKOTA DUNES BLVD	0	1	1	2	1	5
DAKOTA DUNES BLVD/COTTONWOOD LN	0	1	1	0	0	2
DAKOTA DUNES BLVD/I-29 NB	0	0	2	2	0	4
DAKOTA DUNES BLVD/I-29 SB	1	0	1	0	0	2
DAKOTA DUNES BLVD/COURTYARD DR	0	0	1	2	2	5
DAKOTA DUNES BLVD/LEVEE TRL	0	1	0	0	4	5
DAKOTA DUNES BLVD/MEADOWS BLVD	0	0	0	1	1	2
DAKOTA DUNES BLVD/PINEHURST TRL	0	0	0	1	1	2
RIVER DR/SODRAC DR	0	0	0	0	0	0
RIVER DR/SIOUX POINT RD	2	0	0	1	1	4
RIVER DR/I-29 SB	0	0	0	0	1	1
RIVER DR/I-29 NB	2	1	1	1	1	6
RIVER DR/S DERBY LN	0	1	3	0	1	5
RIVER DR/N DERBY LN	0	1	1	1	0	3
RIVER DR/MILITARY RD	3	0	0	1	0	4
NORTHSHORE DR/WESTSHORE DR	0	1	0	0	0	1
NORTHSHORE DR/WEST HIGH SCHOOL DRIVEWAY	0	0	0	0	0	0
NORTHSHORE DR/MIDDLE HIGH SCHOOL DRIVEWAY	0	1	0	0	0	1
NORTHSHORE DR/EAST HIGH SCHOOL DRIVEWAY	0	0	0	0	1	1
NORTHSHORE DR/WEST ELEMENTARY SCHOOL DRIVEWAY	0	0	0	0	0	0
NORTHSHORE DR/EAST ELEMENTARY SCHOOL DRIVEWAY	0	0	0	0	0	0
NORTHSHORE DR/PENROSE DR	0	0	0	0	0	0
NORTHSHORE DR/STREETER DR	0	0	1	0	0	1
NORTHSHORE DR/I-29 SB	0	0	0	0	0	0
NORTHSHORE DR/I-29 NB	0	0	0	1	0	1
NORTHSHORE DR/MILITARY RD	0	0	0	1	1	2
NORTHSHORE DR/OLD SD 105	0	0	0	0	2	2

Operations Analysis

The existing operations at the study area intersections were evaluated using Highway Capacity Manual techniques in HCS 7 software. The Highway Capacity Manual is published by the Transportation Research Board of the National Academies of Science and Engineering and has been recognized by the Federal Highway Administration as the standard for evaluation of intersection operations.

Observations of traffic volumes provide an understanding of the general nature of traffic, but are insufficient to indicate either the ability of the street network to carry additional traffic or the quality of service provided by the street system. For this reason, the concept of *level of service* (LOS) was developed to correlate numerical traffic operational data to subjective descriptions of traffic performance at intersections. Each lane of traffic has delay associated with it and therefore a correlating LOS. The delay for each of these lanes leads to the calculation of the LOS for the entire intersection. LOS categories range from LOS "A" (best) to "F" (worst) as shown in **Table 2**.

Table 2: Level of Service Description

Level of Service	SIGNALIZED Intersection Control Delay (sec.)	UNSIGNALIZED Intersection Control Delay (sec.)	Intersection LOS Description
A	<=10.0	<=10.0	Free flow, insignificant delays.
B	10.1-20.0	10.1-15.0	Stable operation, minimal delays.
C	20.1-35.0	15.1-25.0	Stable operation, acceptable delays.
D	35.1-55.0	25.1-35.0	Restricted flow, regular delays.
E	55.1-80.0	35.1-50.0	Maximum capacity, extended delays. Volumes at or near capacity. Long queues form upstream from intersection.
F	>80.0	>50.0	Forced flow, excessive delays. Represents jammed conditions. Intersection operates below capacity with low volumes. Queues may block upstream intersections.

Source: *Highway Capacity Manual,* Transportation Research Board, 2010

The operations analysis shows that three ramp terminal intersections have a low enough level of service to indicate the need for future improvement:

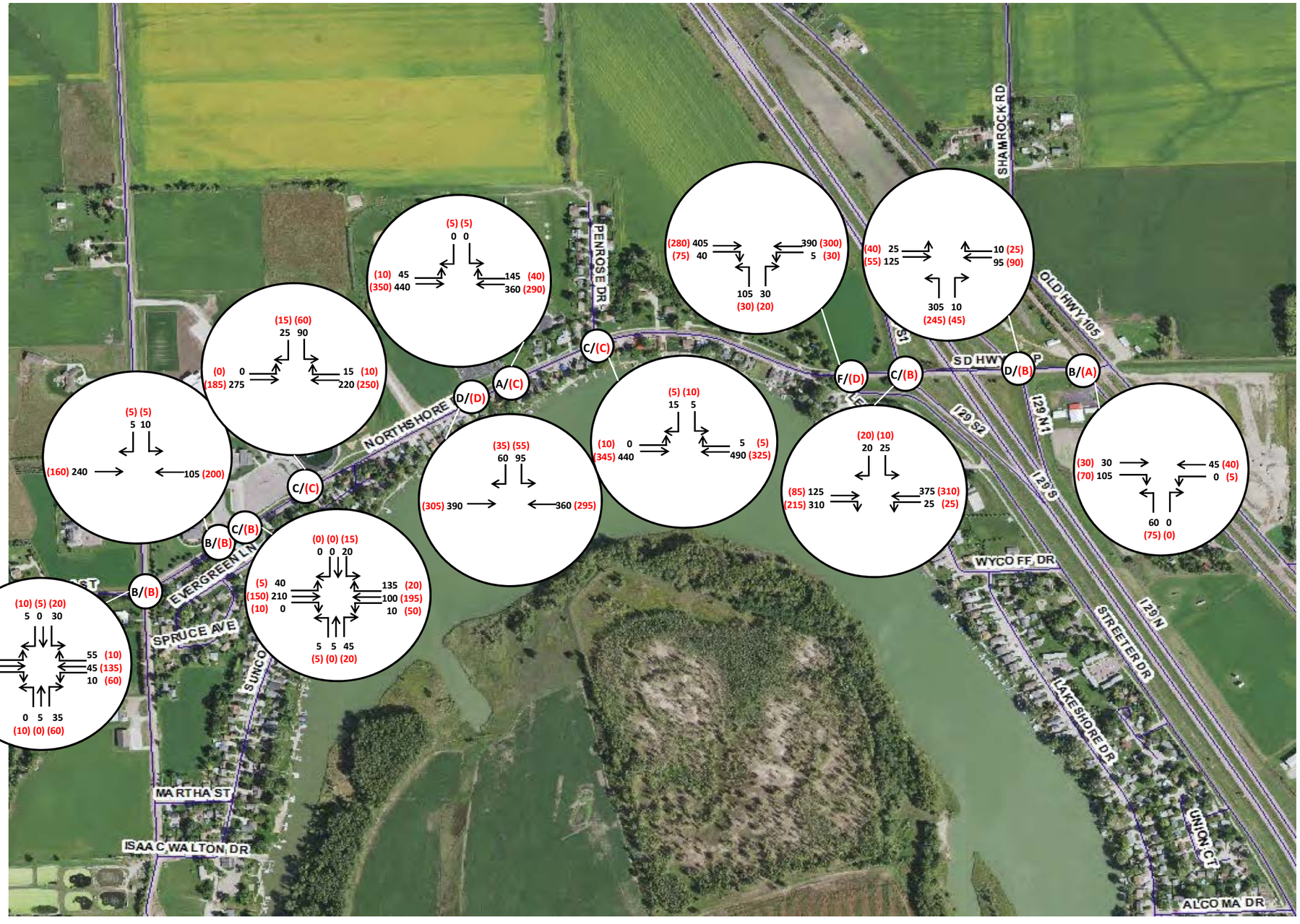
- Northshore Drive/I-29 NB – LOS D at stopped approach
- River Drive/I-29 SB – LOS F at stopped approach
- Dakota Dunes/I-29 NB – LOS E at signalized approach

Four intersections on the arterial/collector street system also have a level of service that may indicate a long-term need for improvement:

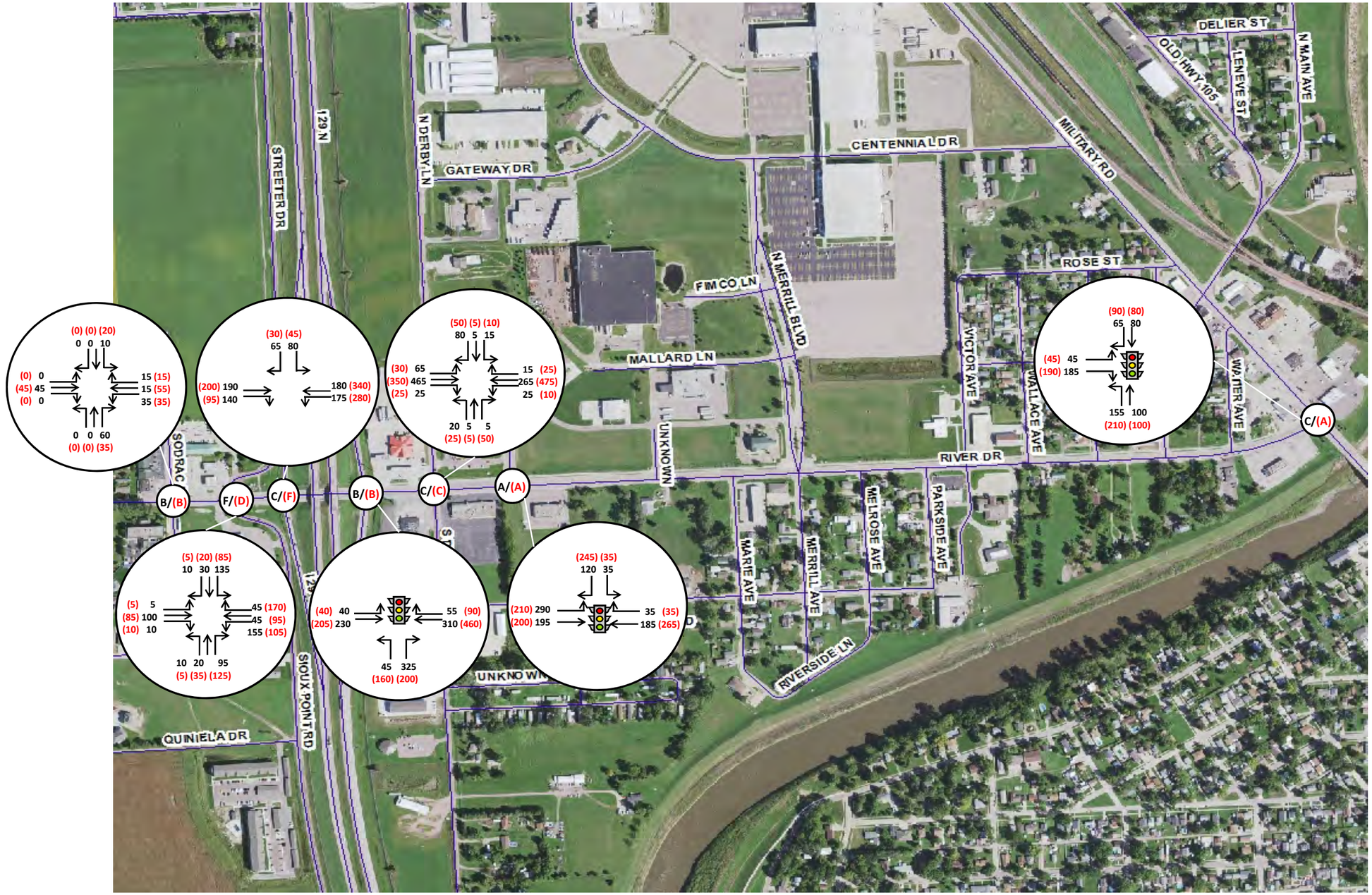
- Northshore Drive/Streeter Drive – LOS F at stopped approach

- River Drive/Sioux Point Road – LOS F at stopped approach
- Dakota Dunes Boulevard/Cottonwood Lane – LOS E at stopped approach
- Dakota Dunes Boulevard/Levee Trail – LOS E at stopped approach

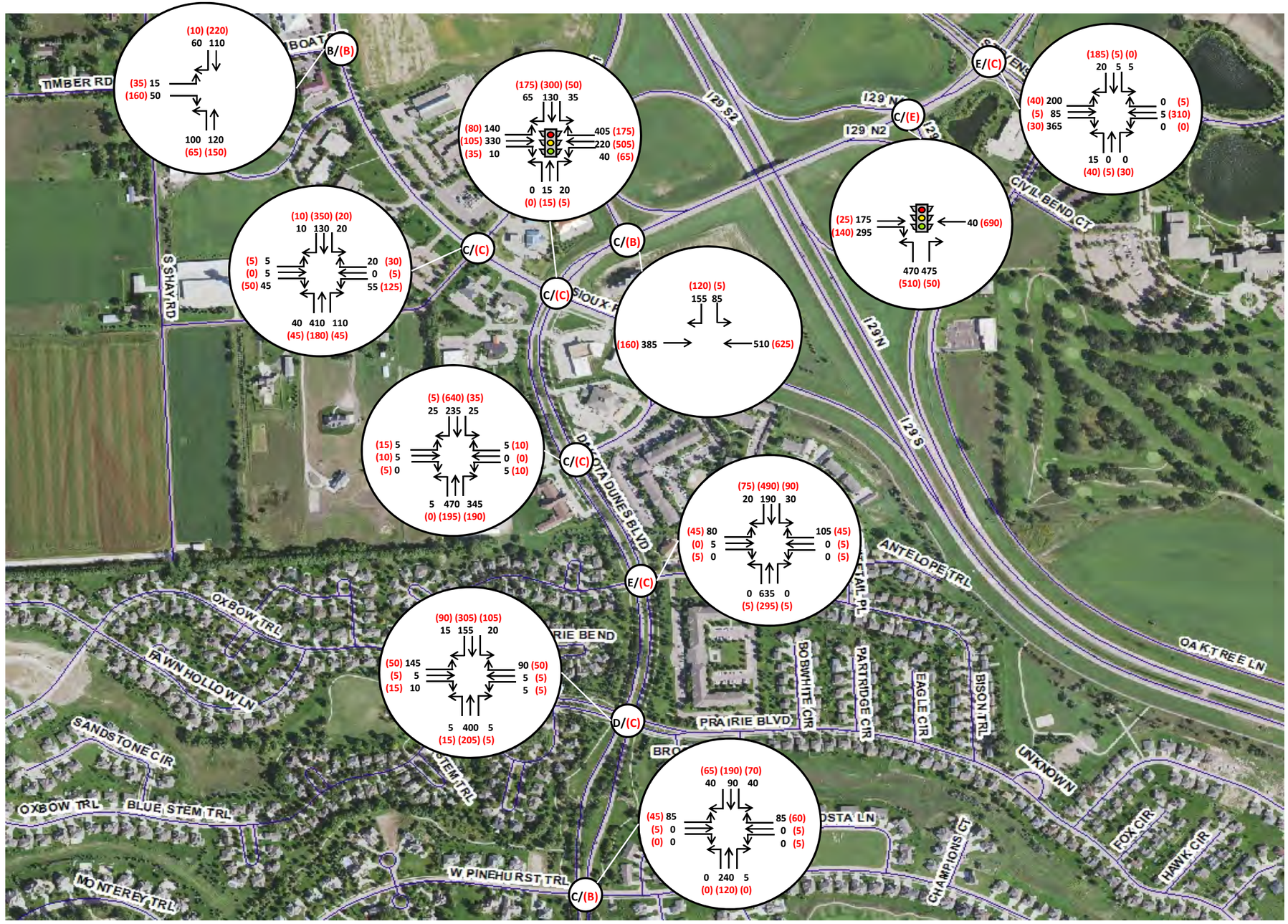
Concepts will be developed for study area improvements later in this report. The current peak hour traffic volumes and levels of service are shown in **Figures 5-7**.



HDR	DAKOTA DUNES/NORTH SIOUX CITY PLANNING STUDY	NORTHSHORE DRIVE EXISTING PEAK HOUR TRAFFIC VOLUMES AND LEVEL OF SERVICE	OCTOBER 10, 2017	FIGURE 5



HDR	DAKOTA DUNES/NORTH SIOUX CITY PLANNING STUDY	RIVER DRIVE EXISTING PEAK HOUR TRAFFIC VOLUMES AND LEVEL OF SERVICE	OCTOBER 10, 2017	FIGURE 6



HDR	DAKOTA DUNES/NORTH SIOUX CITY PLANNING STUDY	DAKOTA DUNES BLVD/SIOUX PT RD EXISTING PEAK HOUR TRAFFIC VOLUMES AND LEVEL OF SERVICE	OCTOBER 10, 2017	FIGURE 7

FUTURE YEAR CONDITIONS ANALYSIS

Traffic demand was forecast for two future time periods: 2022 and 2040. The 2022 scenario represents the build-out of currently planned development within the study area and was determined using trip generation rates published in the Institute of Transportation Engineers *Trip Generation Manual* (9th Edition, 2012). The 2040 scenario represents land use development within the planning horizon and was developed using the regional travel demand model maintained and operated by SIMPCO. The forecast traffic volumes were applied to the existing street system for analysis in this section of the report to determine future transportation deficiencies. Alternatives to correct those future deficiencies are addressed in the next section of the report.

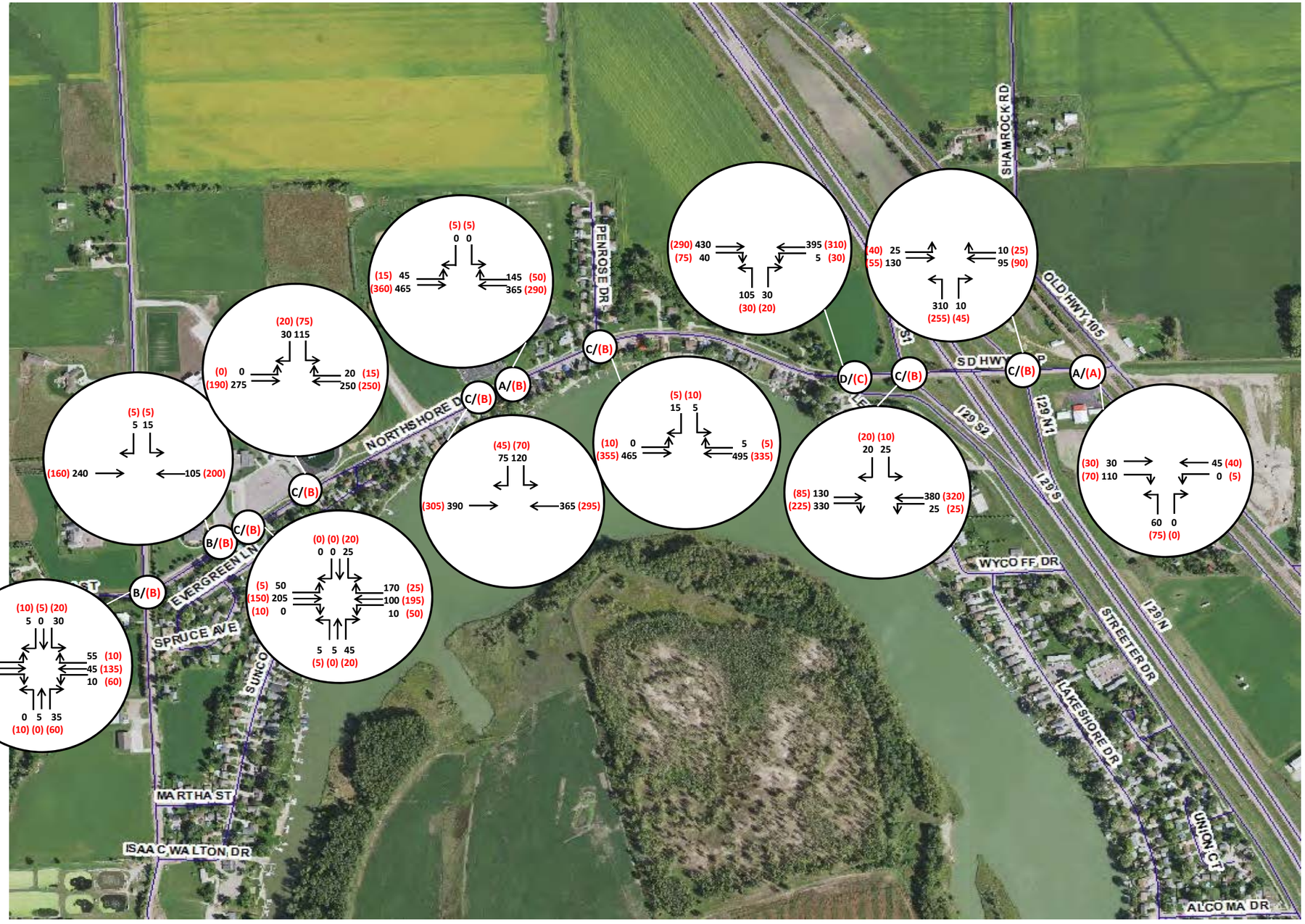
Both the 2022 and 2040 scenarios with the existing street system showed level of service results similar to the existing conditions scenario. The following Interstate ramp terminal intersections showed levels of service needing improvement as they resulted in LOS “D” or worse:

- River Drive/I-29 SB
- Dakota Dunes/I-29 NB

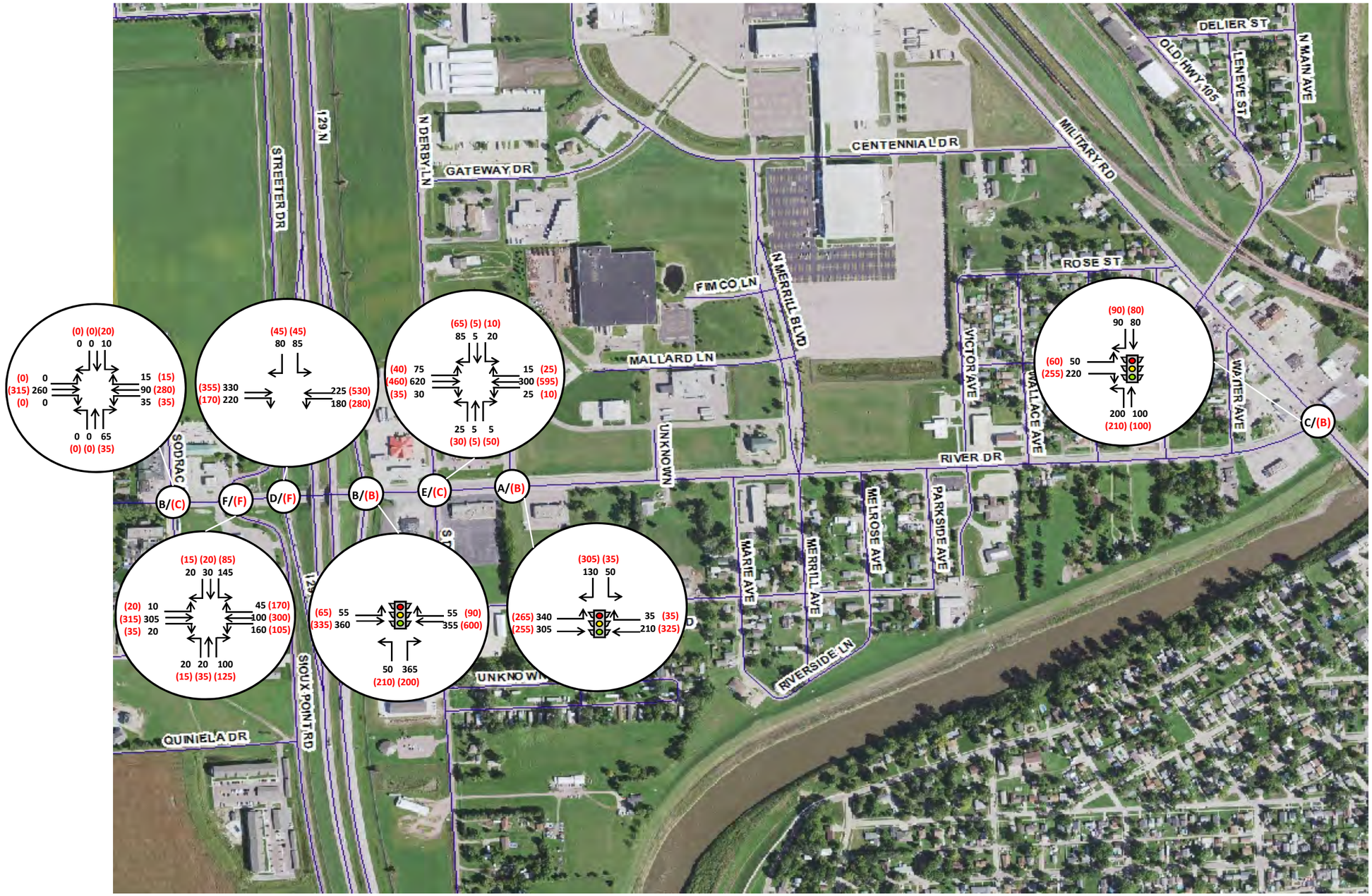
The following arterial/collector street intersections showed levels of service needing improvement:

- Northshore Drive/Streeter Drive
- River Drive/Sioux Point Road
- Dakota Dunes Boulevard/Cottonwood Lane
- Dakota Dunes Boulevard/Levee Trail

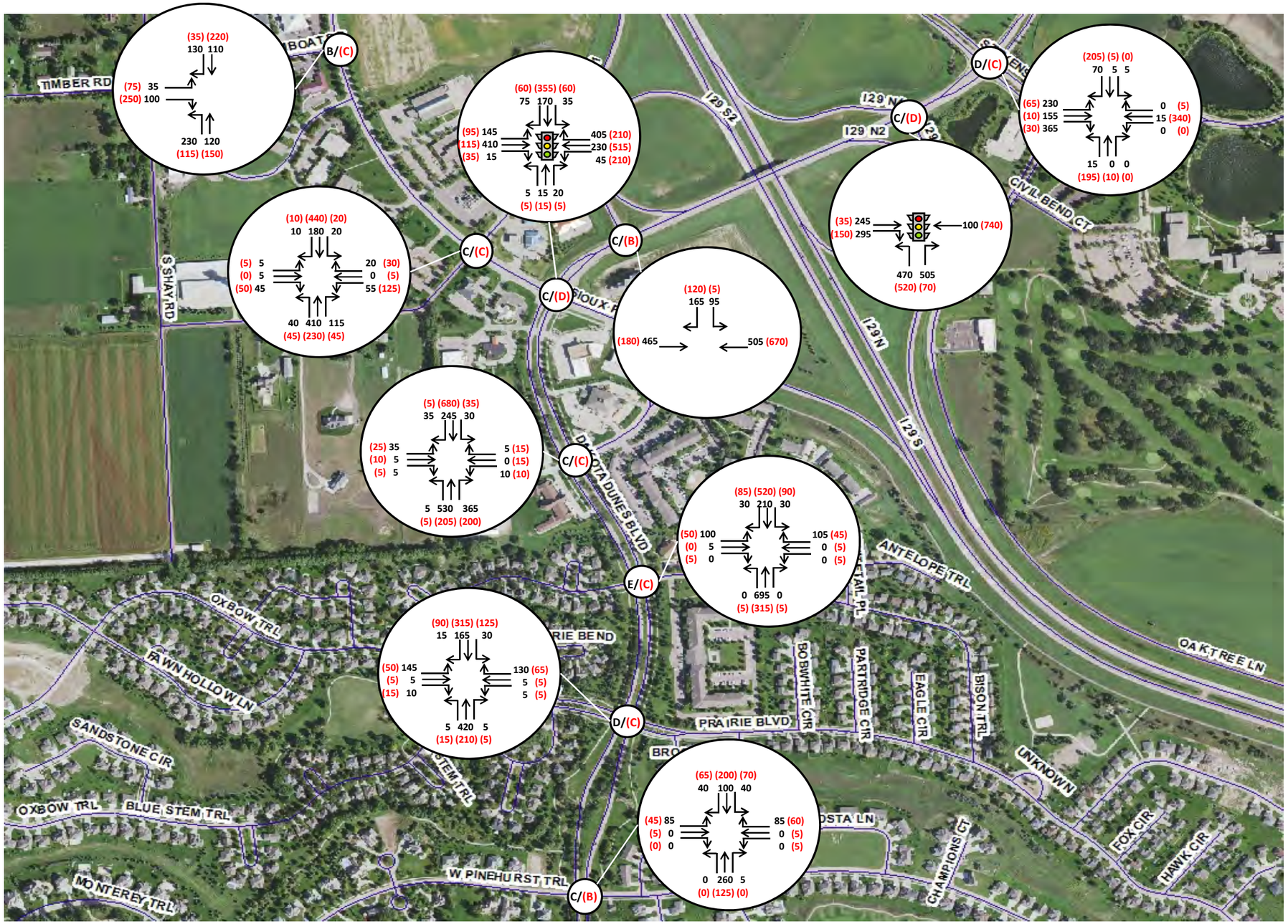
Peak hour turning movement volumes and levels of service for the 2022 and 2040 scenarios with the existing street system are shown in **Figures 8 – 13**.



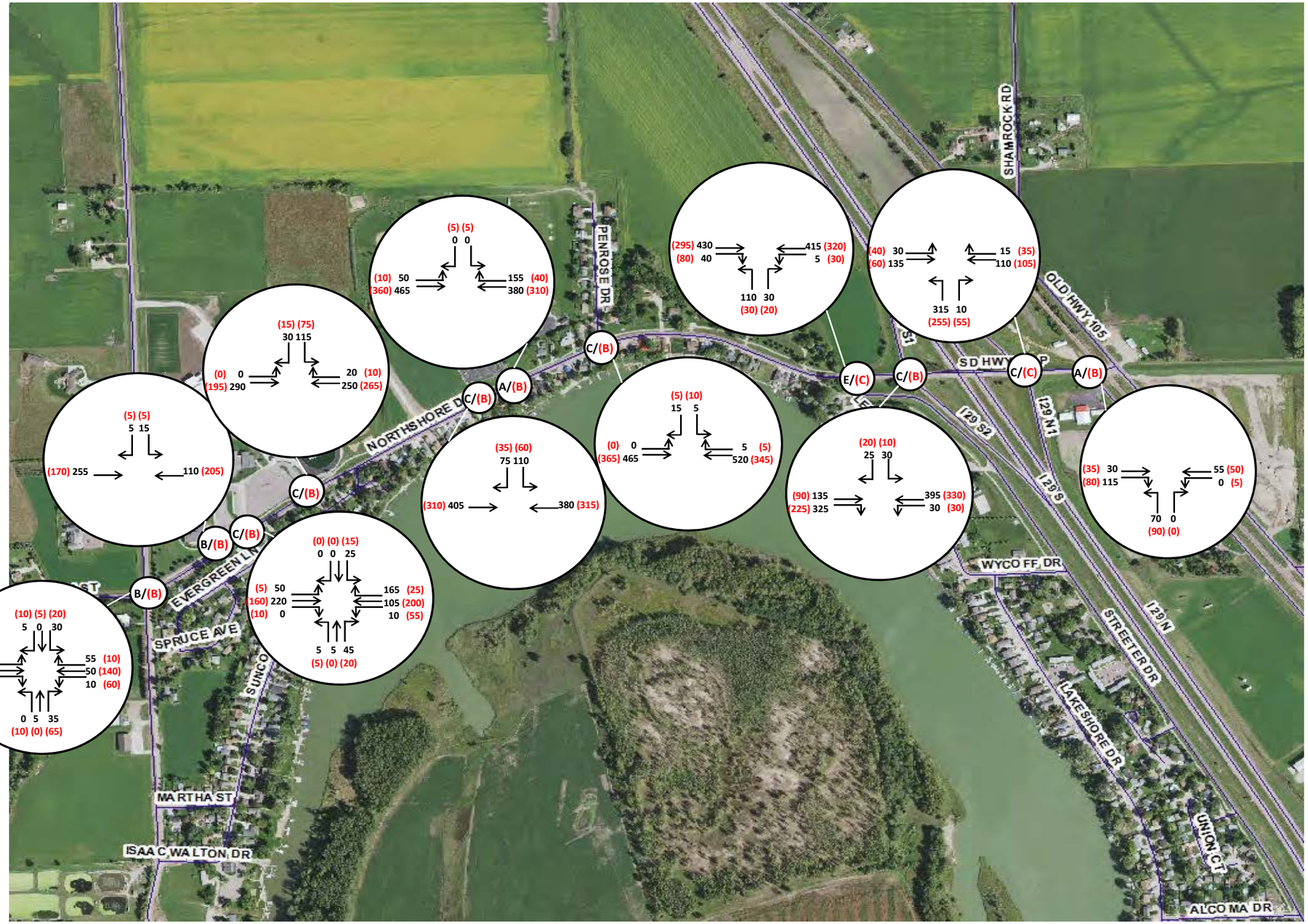
HDR	DAKOTA DUNES/NORTH SIOUX CITY PLANNING STUDY	NORTHSHORE DRIVE 2022 PEAK HOUR TRAFFIC VOLUMES AND LEVEL OF SERVICE	OCTOBER 10, 2017	FIGURE 8



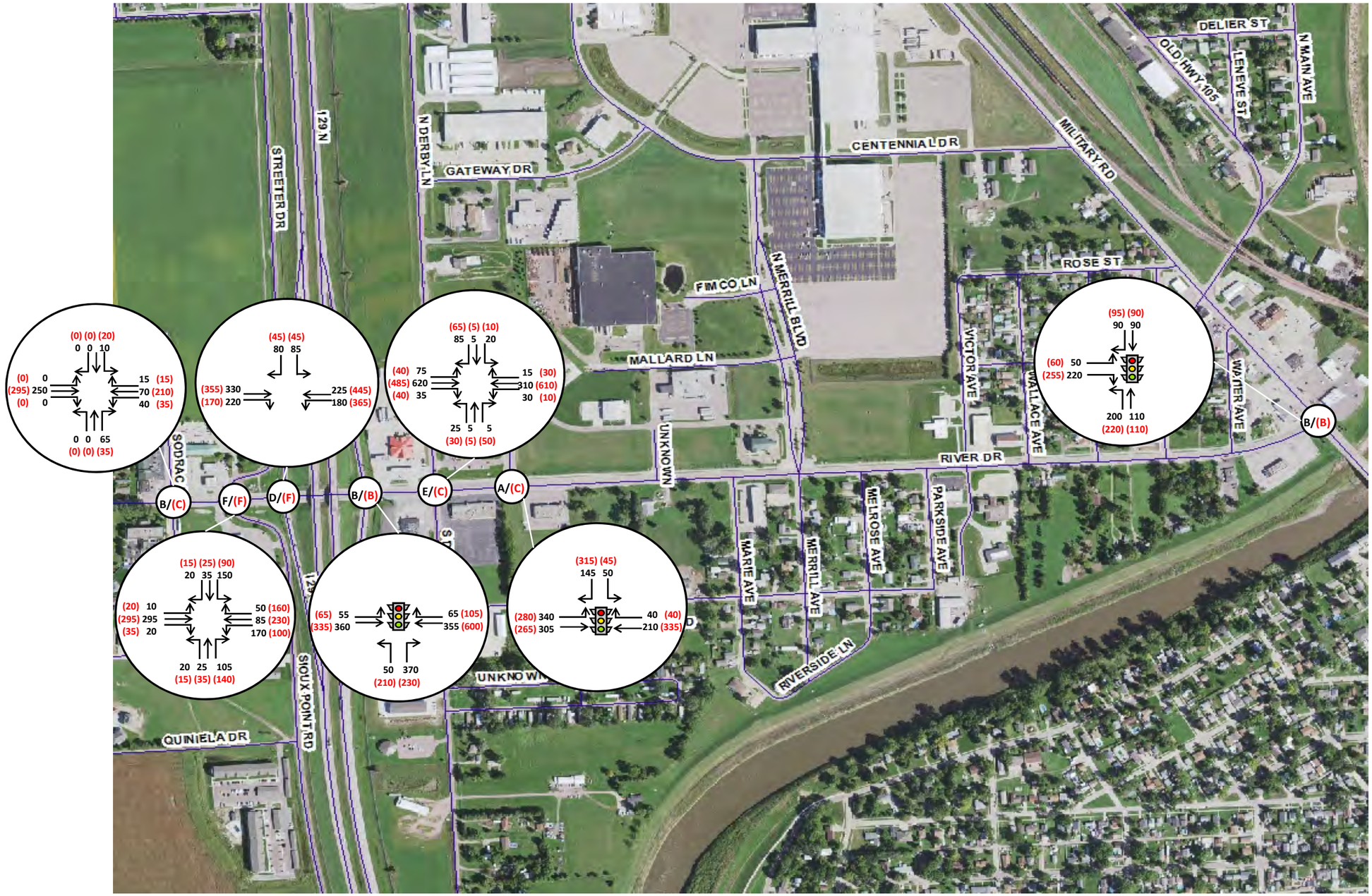
HDR	DAKOTA DUNES/NORTH SIOUX CITY PLANNING STUDY	RIVER DRIVE 2022 PEAK HOUR TRAFFIC VOLUMES AND LEVEL OF SERVICE	OCTOBER 10, 2017	FIGURE 9



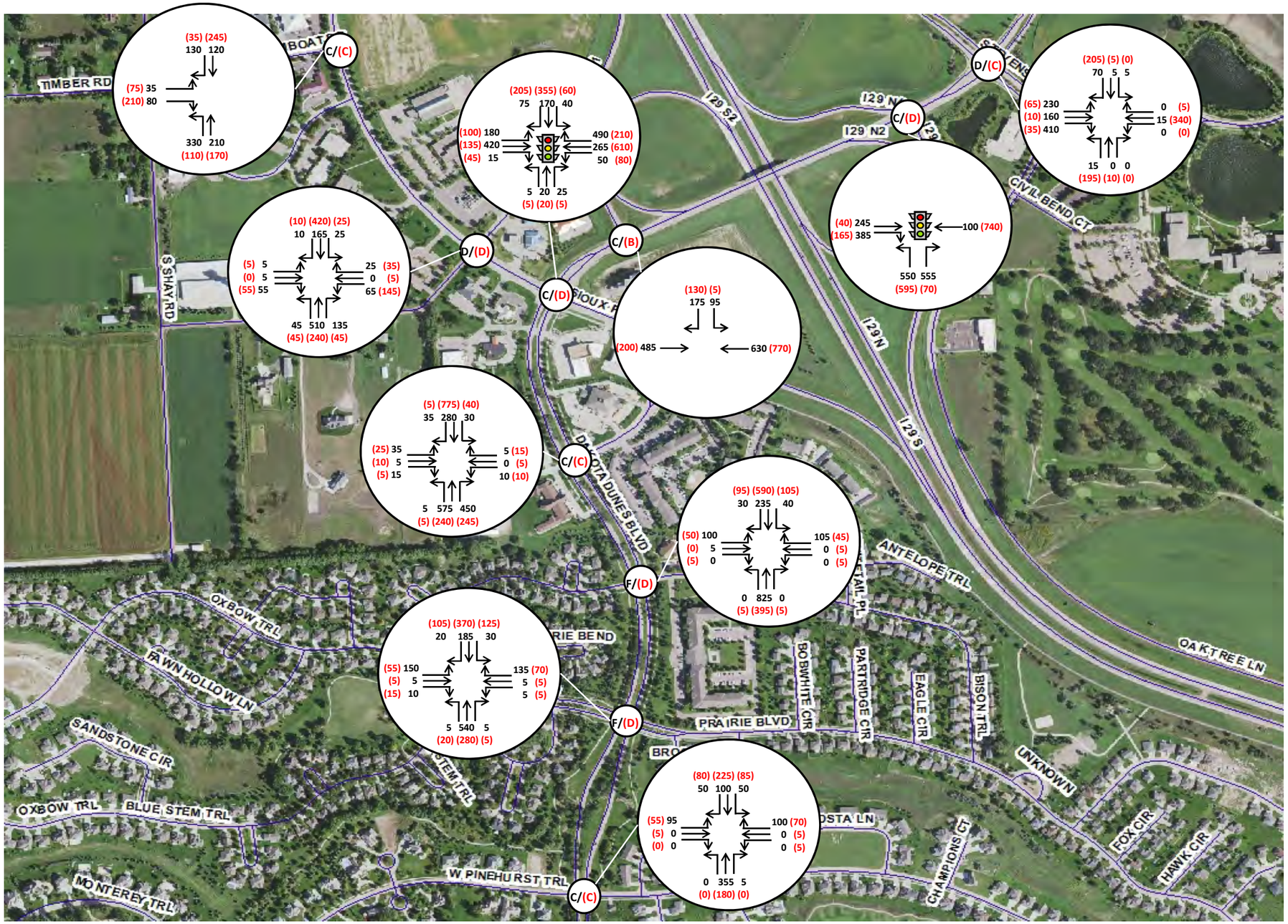
HDR	DAKOTA DUNES/NORTH SIOUX CITY PLANNING STUDY	DAKOTA DUNES BLVD./SIOUX POINT RD. 2022 PEAK HOUR TRAFFIC VOLUMES AND LEVEL OF SERVICE	OCTOBER 10, 2017	FIGURE 10



HDR	DAKOTA DUNES/NORTH SIOUX CITY PLANNING STUDY	NORTHSHORE DRIVE 2040 PEAK HOUR TRAFFIC VOLUMES AND LEVEL OF SERVICE	OCTOBER 10, 2017	FIGURE 11



HDR	DAKOTA DUNES/NORTH SIOUX CITY PLANNING STUDY	RIVER DRIVE 2040 PEAK HOUR TRAFFIC VOLUMES AND LEVEL OF SERVICE	OCTOBER 10, 2017	FIGURE 12



HDR	DAKOTA DUNES/NORTH SIOUX CITY PLANNING STUDY	DAKOTA DUNES BLVD./SIOUX POINT RD. 2040 PEAK HOUR TRAFFIC VOLUMES AND LEVEL OF SERVICE	OCTOBER 10, 2017	FIGURE 13

Alternatives Development

A number of roadway improvement alternatives were developed to address the capacity deficiencies identified in the intersection analysis, to address public concerns, to coordinate with other community planning efforts, and enhance traffic flow. The improvement alternatives are each described below and shown in **Figures Alt 1 – Alt 14**.

Alternative 1:

Alternative 1 realigns Cottonwood Lane to provide better spacing between Cottonwood Lane and the I-29 northbound ramp terminal. The additional space between intersections will allow for smoother lane transitions, greater vehicle stacking, and enhance the ability to signalize the Cottonwood Lane/2 Rivers Drive intersection in the future.

Alternative 2:

Alternative 2 realigns Cottonwood Lane to provide better spacing between Cottonwood Lane and the I-29 northbound ramp terminal and provides a roundabout intersection at Cottonwood Lane/2 Rivers Drive. This alternative provides many of the advantages of Alternative 1, while providing a roundabout intersection that will operate more safely and efficiently than a signalized intersection under the expected conditions.

Alternative 3:

Alternative 3 provides a roundabout at the current location of Cottonwood Lane and 2 Rivers Drive. The roundabout allows the intersection to remain at its current location. Concerns exist with traffic growth between the I-29 NB ramp and Cottonwood Lane.

Alternative 4:

Alternative 4 provides an additional left turn lane for the northbound off-ramp from I-29 to 2 Rivers Drive. The additional lane will provide less delay and queuing for ramp traffic.

Alternative 5:

Alternative 5 provides additional lanes for westbound and southbound through traffic at Dakota Dunes Boulevard/Sioux Point Road. The additional lanes will reduce delay and queuing for all intersection users.

Alternative 6:

Alternative 6 shows two options for re-aligning the frontage road and the Sioux Point Rd./Shay Rd. intersection. The existing intersection creates driver confusion and the proposed intersection will create a cleaner connection between the Dakota Dunes and North Sioux City communities.

Alternative 7:

Alternative 7 shows various options for realigning Sioux Point Road to connect to Sodrac Drive in North Sioux City. The realignment will create a cleaner connection between the Dakota Dunes and North Sioux City communities and will create greater spacing between the collector street intersection and the I-29 interchange at River Drive.

Alternative 8:

Similar to Alternative 7, Alternative 8 shows a realignment of Street Drive to connect to Sodrac Drive. The realignment will create a cleaner connection for north-south traffic and will create greater spacing between the collector street intersection and the I-29 interchange at River Drive.

Alternative 9:

Alternative 9 involved construction of a median on River Drive in the vicinity of the South Derby Lane intersection. The median will enhance safety by eliminating left turns and improve the level of service at the River Drive/South Derby Lane intersection.

Alternative 10:

Alternative 10 creates a dedicated northbound left turn lane for the River Drive/Military Road intersection. The left turn lane should enhance intersection safety.

Alternative 11:

Alternative 11 replaces the existing southbound diamond ramps at the I-29/Northshore Drive interchange with a folded diamond configuration. The southbound off-ramp will be realigned to the west to create a new terminal intersection at Streeter Drive. The southbound on-ramp will loop in the northwest quadrant of the interchange. The new ramp configuration would allow creation of a signalized intersection and would improve expected delay at the existing Streeter Drive intersection. The design geometric aligns Streeter Drive with the southbound off-ramp, but still presents level of service concerns.

Alternative 12:

Alternative 12 redirects traffic west of the Exit 4 interchange to a new east-west dike road that has been proposed to protect area development from flooding. The proposed dike road would provide direct access to the north side of the school properties further to the west. Traffic from Streeter Drive would be connected directly to Northshore Drive, eliminating the existing intersection.

Alternative 13:

Alternative 13 would create a single-lane roundabout intersection at the southbound ramp terminal at the Exit 4 interchange. The roundabout would allow direct connection of Streeter Drive, eliminating much of the existing delay and enhancing safety.

Alternative 14:

Alternative 14 would improve Northshore Drive to a 3-lane section due to the turning traffic and number of driveways. This assumes the Dike road alternative is not constructed.

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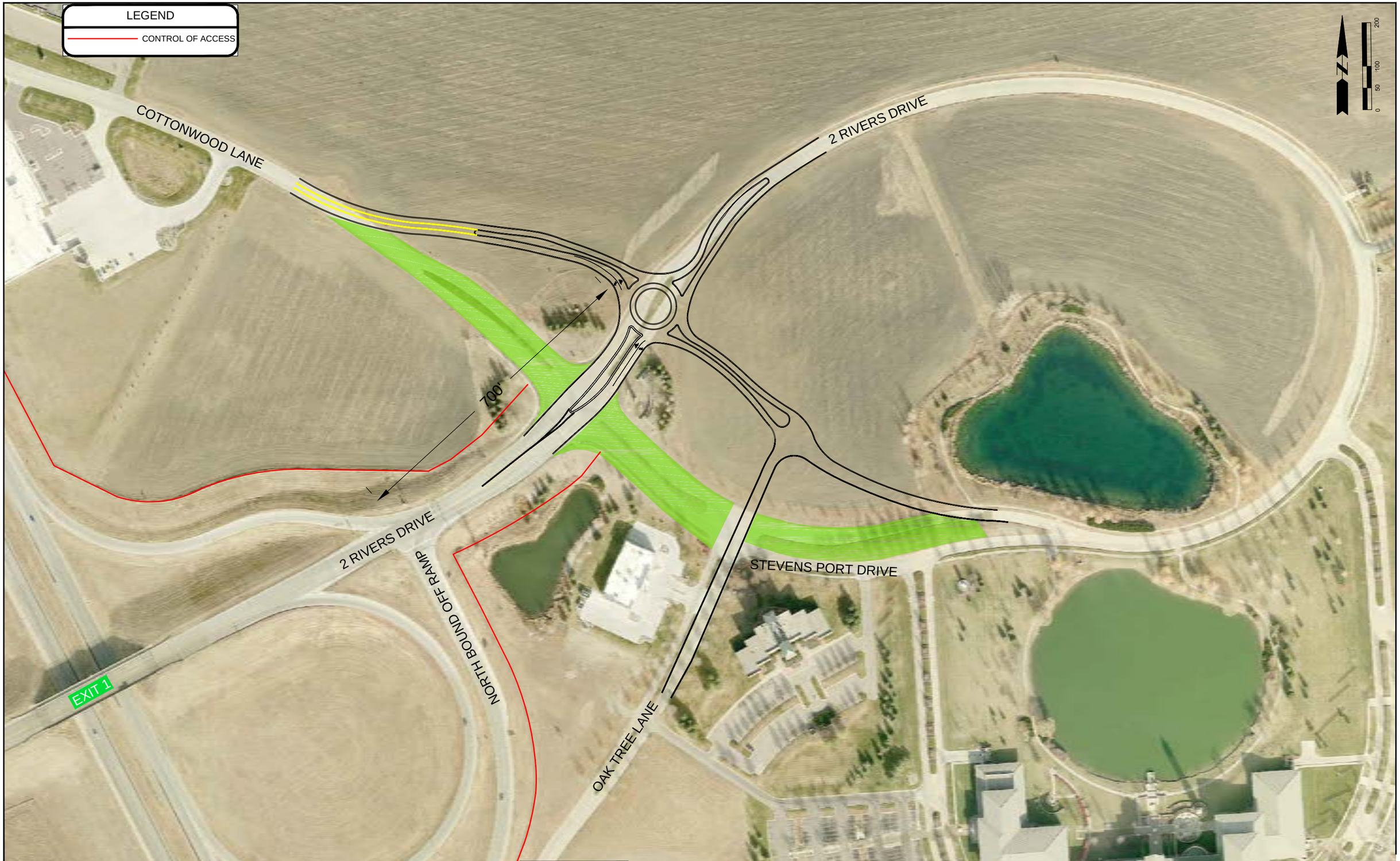

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DAKOTA DUNES / N. SIOUX CITY TRAFFIC STUDY

DATE
12/27/17

EXHIBIT NUMBER
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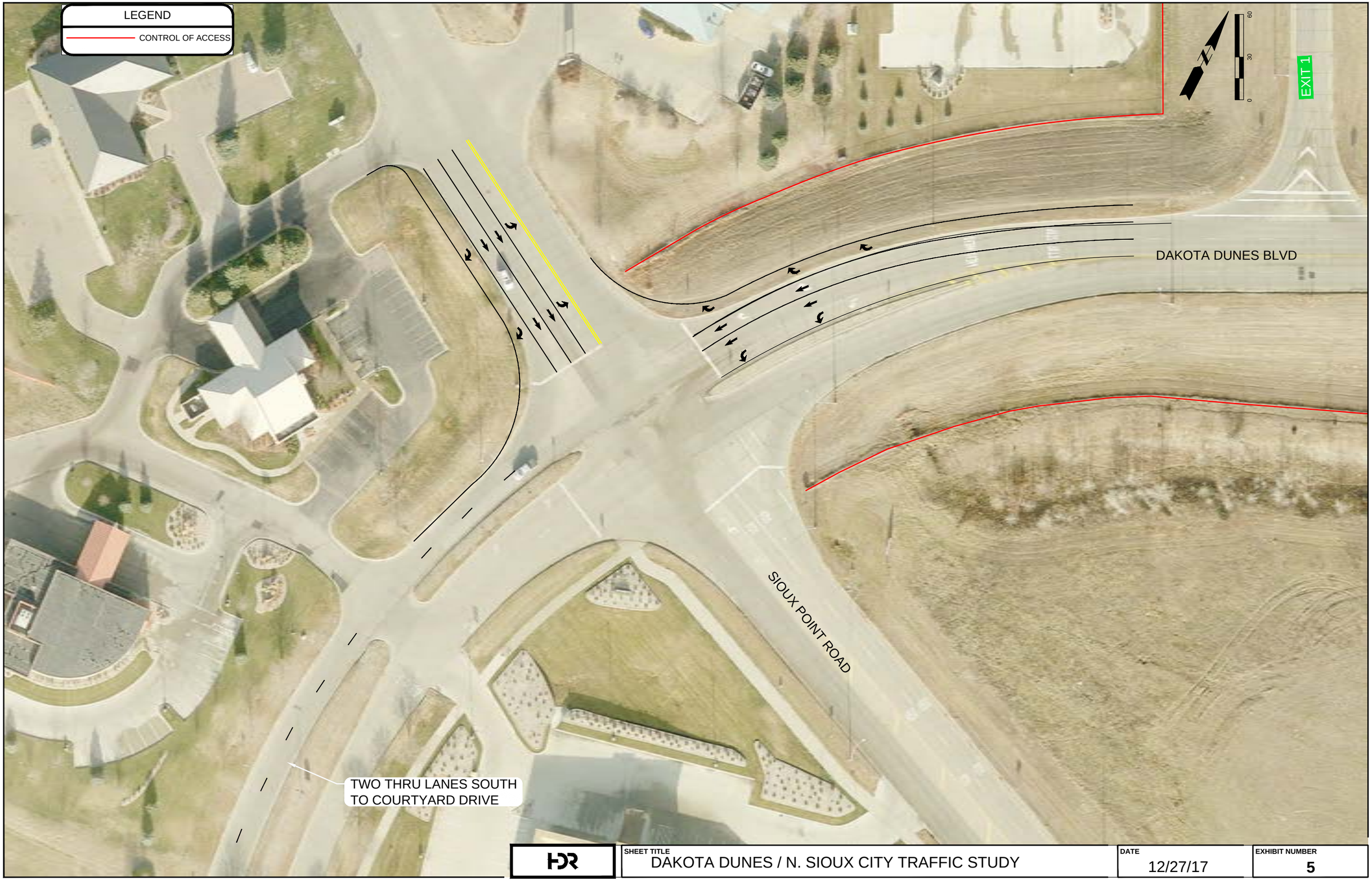

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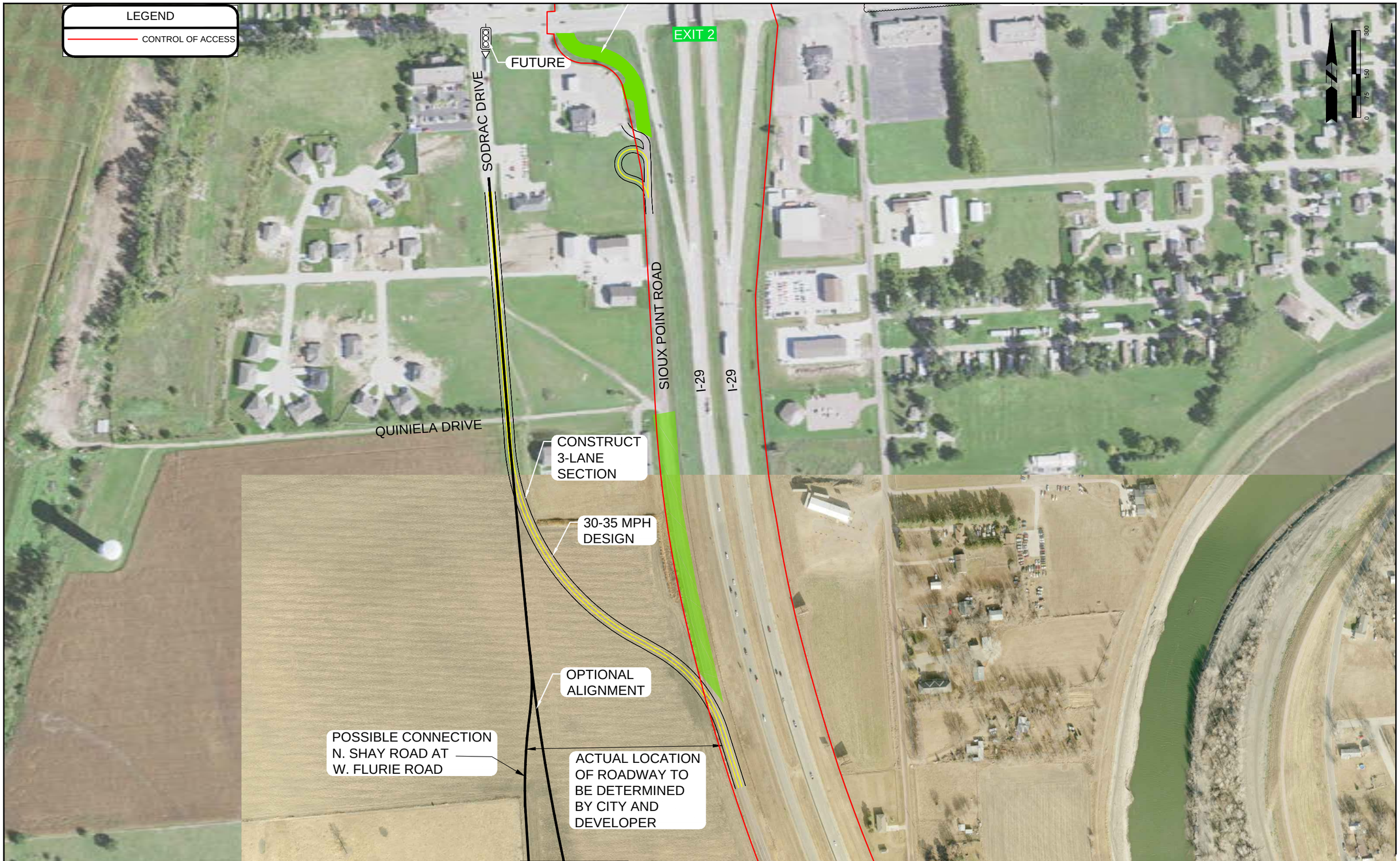

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DAKOTA DUNES / N. SIOUX CITY TRAFFIC STUDY

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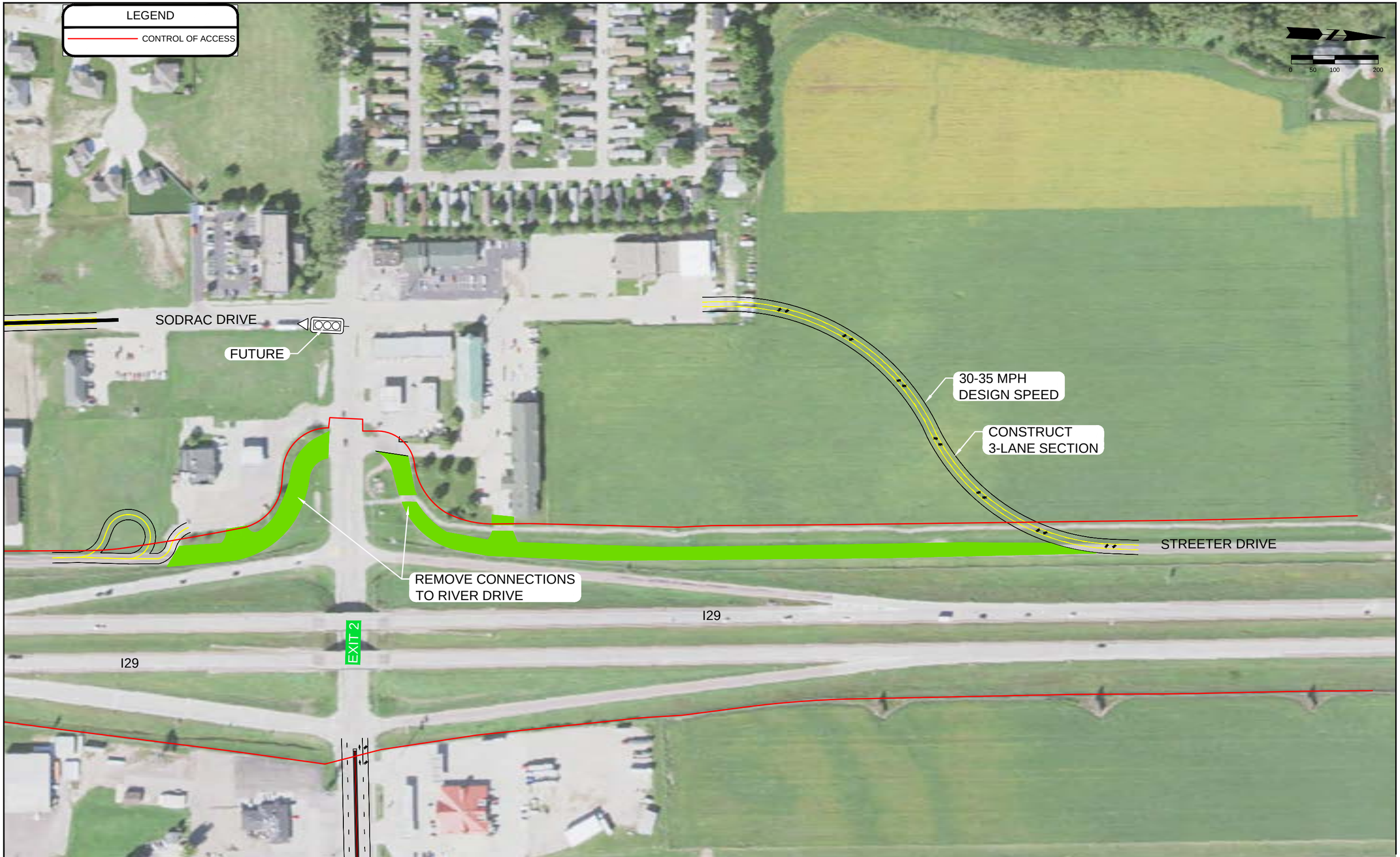

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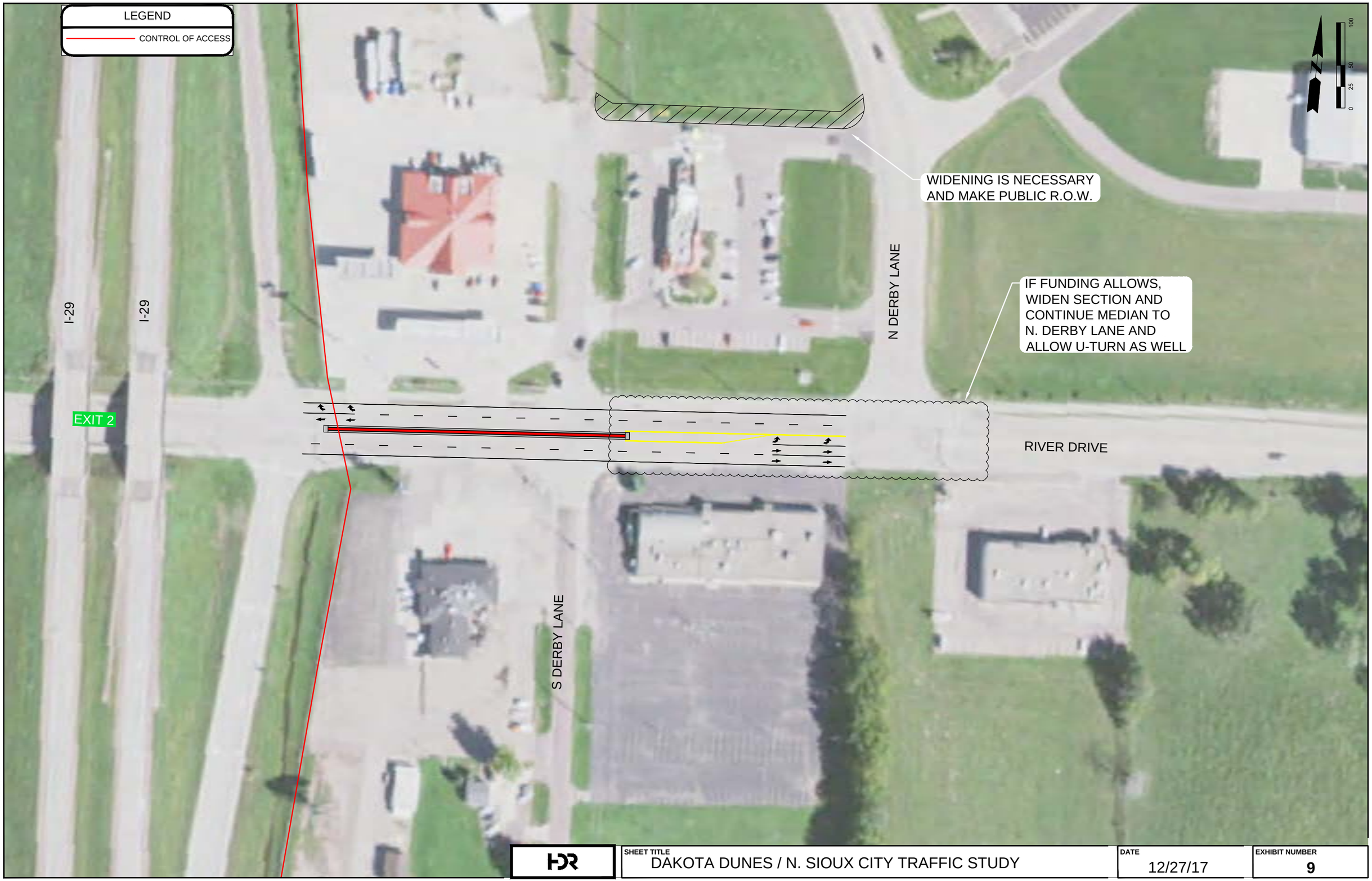

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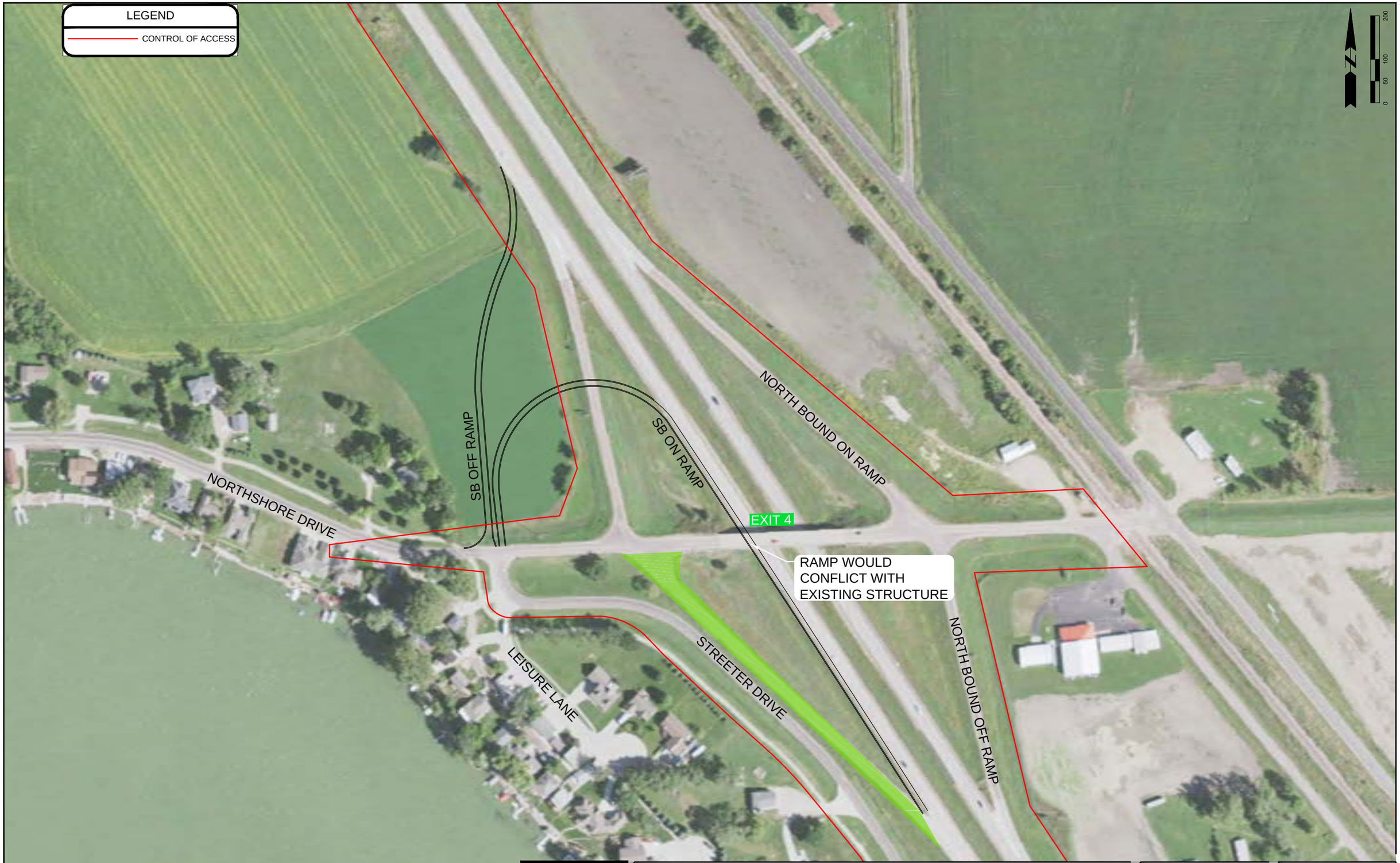

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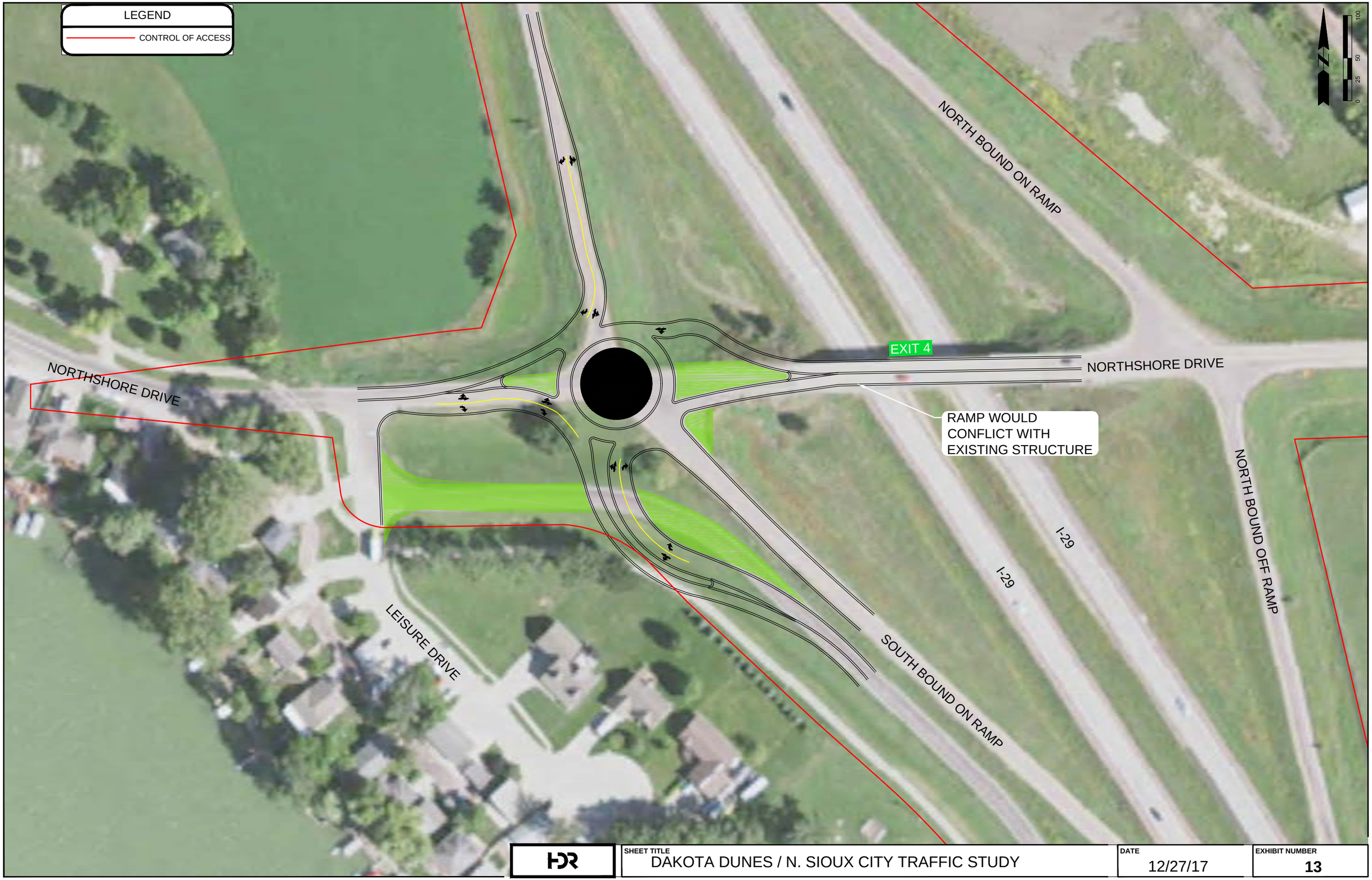

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	DAKOTA DUNES / N. SIOUX CITY TRAFFIC STUDY	12/27/17	14

Recommendations

The following recommendations were developed based on analysis of existing and forecast conditions and discussions with the Dakota Dunes CID, the City of North Sioux City, SIMPCO, and SDDOT.

Dakota Dunes

- Short-term (0-5 years)
  - Complete roundabout project at 2 River Dr. and Cottonwood Dr. – around 5 years to complete project. Project will be needed when the interim development plan is completed.
- Short to Mid-term (5-15 years)
  - Dakota Dunes will work to replace curb ramps along Dakota Dunes Blvd. as projects allow, getting all street ramps upgraded to meet ADA guidelines.
- Long-term (15-25 years)
  - Monitor the intersection of Dakota Dunes Blvd. and Sioux Point Rd. to ensure LOS is adequate to support traffic.

North Sioux City

- Short-term (0-5 years)
  - Continue to coordinate with landowners/developers to prepare a plan for relocating Sioux Point Rd. and Streeter Dr. to connect to Sodrac Dr. so the frontage road connections near the Exit 2 interchange can be removed.
- Short to mid-term (5-15 years)
  - Remove frontage road connections prior to signal at SB ramp terminal at Exit 2.
  - Construct turn lanes on Northshore Dr. to reduce queuing and improve operations at school driveways.
  - Implement median on River Dr. at S. Derby Ln.
- Long-term (15-25 years)
  - Either reconstruct Northshore Dr. as 3-lane or construct new street along the north side of schools that connects to Exit 4.

SDDOT

- Short-term (0-5 years)
  - Consider adding second northbound left turn lane at Exit 1 ramp terminal.
- Short to mid-term (5-15 years)
  - Monitor southbound ramp terminal at Exit 2 for signal.
  - Consider options for southbound ramp terminal at Exit 4. North Sioux City has endorsed roundabout concept.
  - Monitor signal warrants at Exit 4 northbound ramp terminal.
- Long-term (15-25 years)

- Monitor interchange and bridge conditions at Exits 2 and 4 to determine when improvements are needed. These will be considered during Decennial Study in 2020, 2030 or beyond.

APPENDIX

1 – 2017 Level of Service

2 – 2022 Level of Service

3 – 2040 Level of Service

4 – Methods and Assumptions Document

5 – Crash Maps and Records

6 – School Observation Notes

7 – Traffic Counts