HOUSTON ENGINEERING INC.

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CASS COUNTY ROADWAY 18 EXTENSION STUDY

From Cass County Roadway 17 to Cass County Roadway 15

METROCOG
FM REGIONAL TRANSPORTATION PLANNING ORGANIZATION

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1 EXECUTIVE SUMMARY

The Cass County Highway Department, in coordination with both the Normanna and Pleasant Township officials, made a request to the Fargo-Moorhead Metro Council of Governments to study the potential extension of Cass County Roadway 18 along 52nd Street SE. The study area for this project includes 52nd Street SE in Cass County from Cass County Roadway 17 west to Cass County Roadway 15 in both the Normanna and Pleasant Townships within Cass County, North Dakota.

The existing conditions analysis of the study area identified existing utilities, land uses, and environmental features. The existing conditions analysis also reviewed the roadway typical sections for 52nd Street SE and County Roadway 18 and the Sheyenne River crossing bridge. The 2018 traffic volumes for 52nd Street SE ranged from 155 to 200 vehicles per day with approximately 20 to 25 percent heavy vehicles. There were six crashes from 2013 to 2017 on 52nd Street SE with one fatal crash.

The future conditions developed forecasted traffic volumes on 52nd Street SE for the years 2025 and 2040 for a no-build, aggregate and paved roadway surface alternatives. The 2025 forecasted traffic forecasts ranged from 175 to 230 vehicles per day for the no-build alternatives, 190 to 245 vehicles per day for the aggregate surface alternative, and 220 to 300 vehicles per day for the paved surface alternative. The 2045 forecasted traffic forecasts ranged from 220 to 280 vehicles per day for the no-build alternatives, 245 to 300 vehicles per day for the aggregate surface alternative, and 280 to 325 vehicles per day for the paved surface alternative. No impacts to the study area are expected due to the proposed Fargo-Moorhead diversion.

The project purpose is to study the feasibility of extending CR 18 from CR 17 to CR 15 and transitioning ownership to a county roadway and the roadway typical section to meet county roadway standards. The goals associated with this project are as follows:

- Study the county roadway network connection for CR 18 between CR 17 and CR 15 to maintain a roadway network that allows users to travel on a standard roadway cross-section to Kindred and between CR 15 and Interstate 29.
- Provide recommendations/alternatives for a roadway that maintains a suitable driving surface throughout the year and accommodates traffic mix consisting of passenger cars, heavy trucks, and agriculture implements.
- Provide recommendations/alternatives that will minimize the potential for crashes along the corridor.
- Support the goals and objectives of the *Cass County Transportation and Comprehensive Plan*

The project needs include the following:

- County roadway system connectivity
- Insufficient roadway surface conditions due to subgrade
- To minimize the potential for crashes along the corridor
- To support the goals and objectives of the *Cass County Transportation and Comprehensive Plan*

Throughout the duration of the project, a Study Review Committee periodically met to discuss the findings of the project and to review and provide comments on the Study's memoranda. A public input meeting was held on December 4th, 2018 at the Kindred High School commons area. Comments were received at the meeting and for two weeks after the public meeting.

The final analysis of the alternatives included three alignments on the existing alignment (no-build, existing alignment with County typical section, and relocation of the church) and three alignments adjusting the location of the Sheyenne River crossing bridge (alignments A, B, C). The Study Review Committee was tasked with only ranking the Sheyenne River crossing alternatives. The criteria used in analyzing the Sheyenne River crossing alternatives was developed and approved by the Study Review Committee and was provided to the committee for their ranking of the Sheyenne River crossing alternatives. The results of the Committee's rankings were alignment B followed by alignment C and finally alignment A.

2 INTRODUCTION

2.1 PROJECT SCOPE AND LIMITS

The Cass County Highway Department, in coordination with both the Normanna and Pleasant Township officials, made a request to the Fargo-Moorhead Metro Council of Governments (Metro COG) to study the potential extension of Cass County Roadway 18 (CR 18) along 52nd Street SE. The study area for this project includes 52nd Street SE in Cass County from Cass County Roadway 17 (CR 17) west to Cass County Roadway 15 (CR 15) in both the Normanna and Pleasant Townships within Cass County, North Dakota. The study area for the project is shown in Figure 1.

Throughout the study, memoranda were completed for the following phases of the study:

- Existing Conditions Analysis
- Future Conditions Analysis
- Purpose and Need of the Study
- Public Input Summary
- Alternatives Analysis

The memoranda were used to develop the final report for the project.

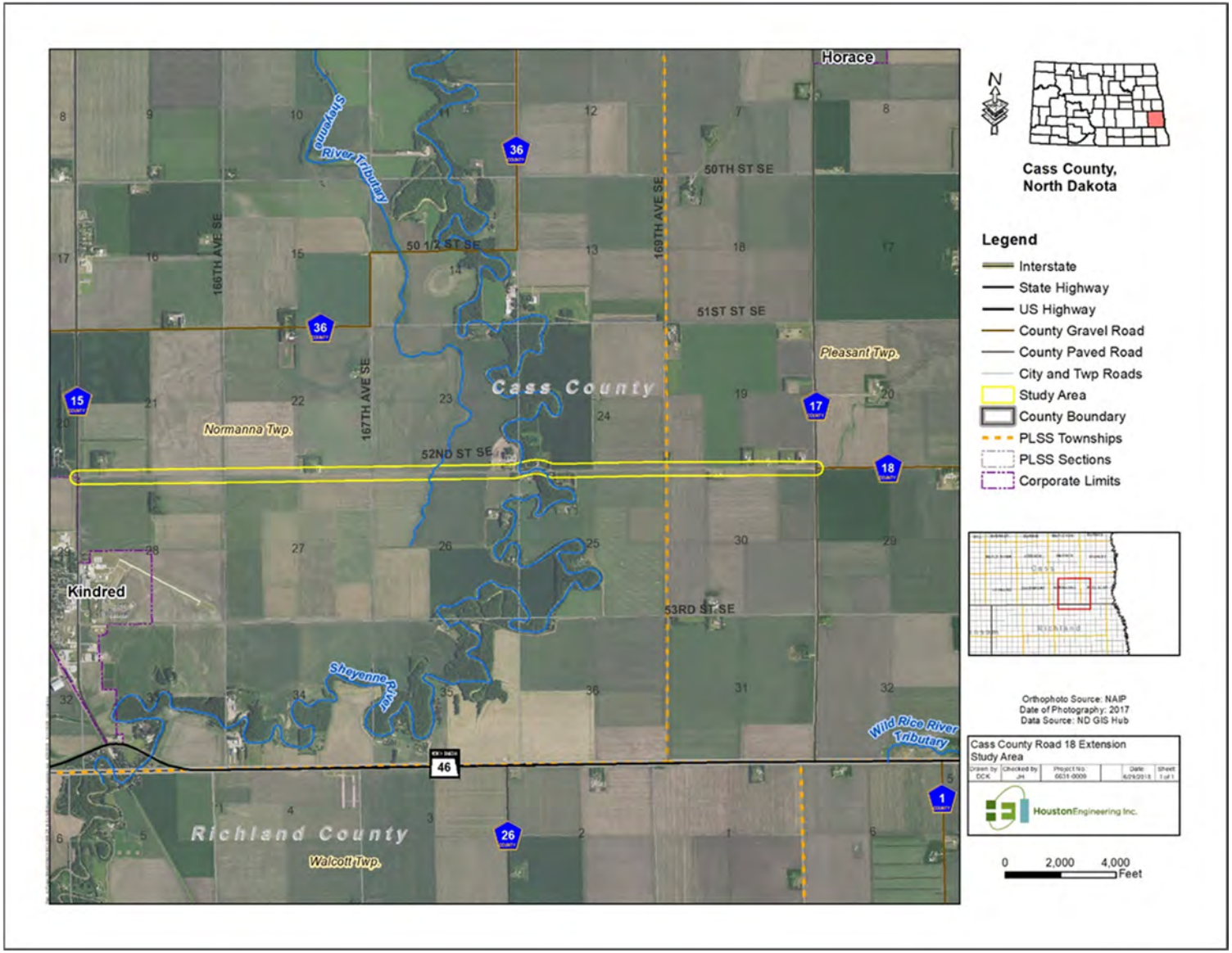

Figure 1. Study Area

3 EXISTING CONDITION ANALYSIS

3.1 ROADWAY TYPICAL SECTION AND ATTRIBUTES

The existing 52nd Street SE and CR 18 roadway typical sections are shown in Figure 1. Three typical sections are shown in Figure 2; one for the existing aggregate surfaced roadway section on 52nd Street SE throughout the study area, CR 18 for the section within 2 miles of CR17, and one for the bridge section across the Sheyenne River. The 52nd Street SE roadway section is currently an aggregate surface with open ditch drainage along both the north and south sides of the roadway. As shown in Figure 2, the roadway, ditch, and right-of-way (ROW) widths vary based on the location within the corridor, but the aggregate surface is typically 28 to 30 feet wide. The CR 18 typical section is similar to the 52nd Street SE typical section with a slightly wider aggregate surface of approximately 30 to 32 feet. The townships both complete annual aggregate surface maintenance on 52nd Street SE. The spread rate of gravel used for each township vary between 150 cubic yards per mile (CY/mile) to 365 CY/mile based on the amount of available funding. Cass County currently maintains CR 18 at a gravel spread rate of 365 CY/mile.

Driveway and field access locations along both 52nd Street SE and CR 18 typically have corrugated metal pipe culverts for drainage. Flood protection measures have been implemented on the east end of the study area. The measures include levees and sluice gates installed on the north side of the roadway. Approximately 0.75 miles west of the Sheyenne River bridge, two transverse corrugated metal pipe culverts cross 52nd Street SE providing conveyance for a tributary of the Sheyenne River. Several drainage improvements have been made at the intersection of 52nd Street SE and CR 17 including multiple culverts and roadway ditch improvements. The 52nd Street corridor speed limit is 55 miles per hour (MPH) with the exception of reduced speed zones of 40 MPH approaching the Sheyenne River bridge and 25 MPH immediately adjacent to the bridge.

The 52nd Street SE intersection with CR 15 has two-way stop-control on the 52nd Street SE approaches and the intersection with CR 17 is controlled by a yield sign on the 52nd Street SE approach and stop sign on the CR 18 approach. Several north-south township roadways intersect with 52nd Street SE throughout the project study area. The north-south township roadways are typically yield controlled with yield signs at the intersections with 52nd Street SE. Additional access locations along 52nd Street SE are typically at driveway approaches or field locations. The spacing and locations of the access points along the corridor are acceptable, but some may need to be slightly relocated or combined if any improvements to the roadway are made.

The roadways in the study area were included in the functional class figure within the *Cass County Comprehensive and Transportation Plan.* The Cass County Functional Class figure lists both CR 15 and CR 17 as Major Collectors with CR 18 and 52nd Street SE as Local/Township classification. North Dakota 46 is classified as a Minor Arterial in the comprehensive plan and as a State Corridor with the North Dakota Department of Transportation (NDDOT) State Highway Performance Classification System. According to the Comprehensive Plan, both CR 15 and CR 17 are classified as Regionally Significant Candidate Corridors. Vehicle load restrictions are typically placed on CR 15 and CR 17 during the spring thaw.

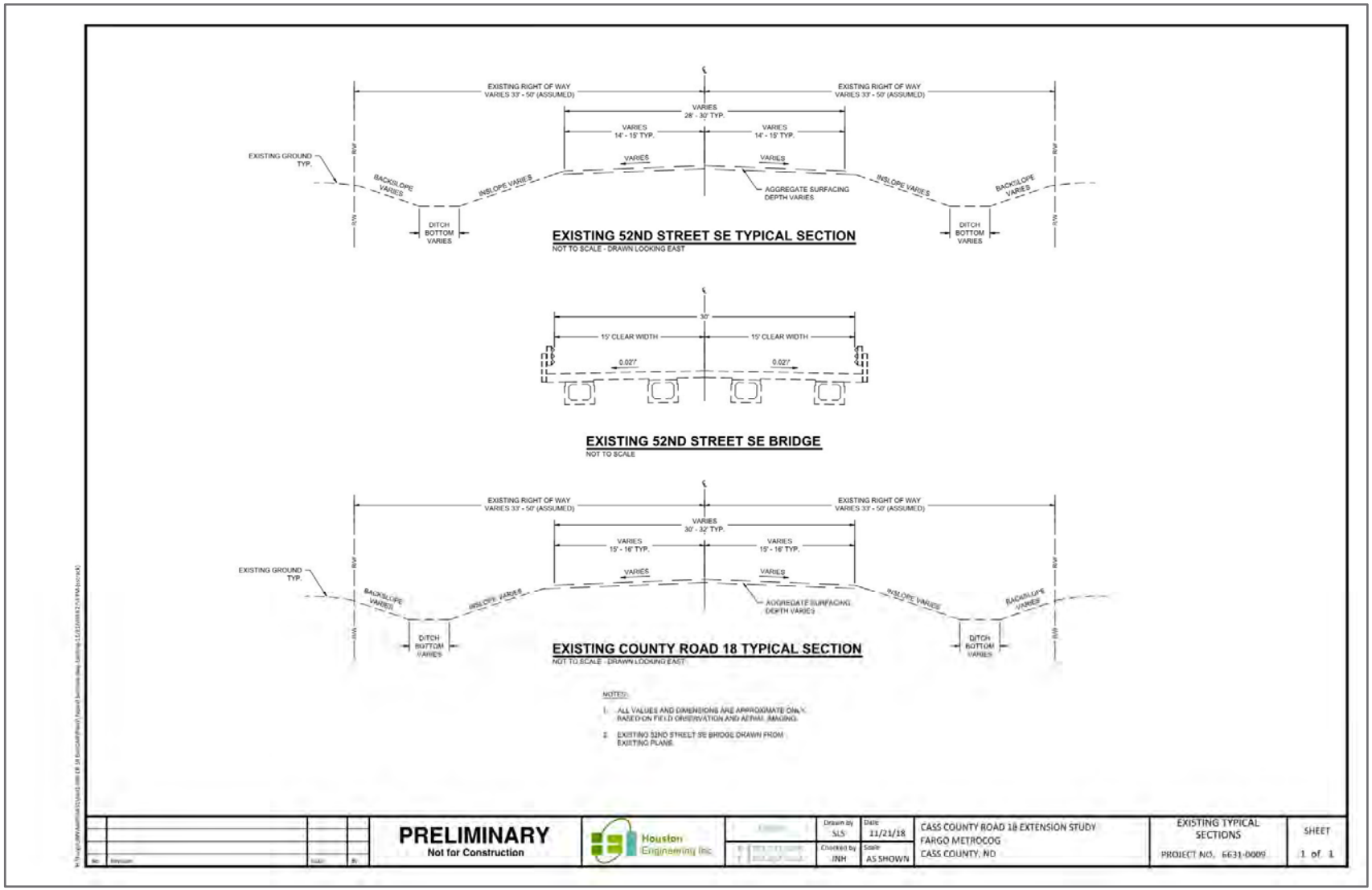

Figure 2. 52nd Street SE Typical Sections

3.2 BRIDGE ACROSS THE SHEYENNE RIVER

The existing bridge on 52nd Street SE that crosses the Sheyenne River was constructed in 1995. The typical section for the roadway is shown in Figure 2. The bridge spans are prestressed concrete and the bridge deck is cast-in-place concrete. According to the most recently available National Bridge Inventory (NBI) report from 2015, the overall condition of the bridge is "Good" with the superstructure and substructure both being categorized "Very Good". The sufficiency rating of the bridge according to the NBI report is a 99.7. The channel bank is beginning to slump, and the embankment protection devices have widespread minor damage according to the NBI report. The bridge was included in *Cass County Comprehensive and Transportation Plan*'s "Cass County Bridge Condition Average" figure with a bridge condition average range of 7.1 to 8.0 out of 10, and in the "2037 and beyond" construction phase for replacement.

3.3 EXISTING UTILITIES IN STUDY AREA

The study area does contain electrical, fiber optic, telephone, and rural water utilities. A utility locate and survey were not conducted for this study. Any utility information provided in this report and study are for information purposes only and are not intended to be used for design or construction. Based on a review of existing above ground utility structures along the corridor, several of the underground utilities run parallel to 52nd Street SE in the backslope of the north ditch of the roadway. Throughout the corridor, fiber optic and telephone underground lines are located north of the roadway and cross beneath the roadway to service residences on the south side of the roadway. Overhead electric utilities are typically located along the north field edges and run most of the eastern half of the project terminating just west of the bridge. There are also short runs of overhead electrical utilities serving the two western most residential and commercial locations within the study area. The overhead electrical lines do cross 52nd Street SE at three locations within a 0.5 mile stretch from the Sheyenne River bridge to the east. At the location of the Norman Lutheran church, the overhead power lines are located on the south side of the roadway directly across from the church. There are valve locations for Cass County Rural Water located north of 52nd Street SE in the study area. Based on plan documents for the Sheyenne River bridge, the rural water line does cross beneath the roadway at the ag residential locations just west of the bridge.

3.4 EXISTING LAND USES WITHIN THE STUDY AREA

The Cass County existing land use plan contained within the *Cass County Comprehensive and Transportation Plan* provides the existing land uses in the study area that are based on the seven land use categories used in Cass County. Along the 52nd Street SE corridor in the study area, the primary land use "agriculture" with a few areas of "single family residential", "farm exempt", and "ag with residential". The residential land uses are located near the Sheyenne River Bridge and at the east end of the study area. There is also a "commercial/industrial/multi-family residential" land use area for a manufacturing facility located 1.5 miles east of the intersection with CR 15. The Norman Lutheran church, located just east of the Sheyenne River bridge, is classified as a "single-family residential" in the land use plan. The very west 0.75 miles of 52nd Street SE is included in the City of Kindred's Extraterritorial Area.

3.5 EXISTING ENVIRONMENTAL FEATURES

The wetlands for the study area were reviewed using data from the National Wetlands Inventory available from the United States Fish and Wildlife Service. Two figures are provided with Figure 3 showing the palustrine and riverine wetlands that are located within and near the study area and Figure 4 showing a more detailed view of the palustrine and riverine wetlands within the study area. The project study area has the Sheyenne River and the Sheyenne River tributary for flowing water. There are three primary locations for palustrine wetlands located in sections 23 and 26 of the Normanna Township. As shown in Figure 4, the locations that are within the roadway ditch section that are classified as wetlands are located in the section from the Sheyenne River bridge to the west approximately a 0.5 mile.

3.6 2018 TRAFFIC VOLUMES

Traffic volumes at two segments of 52nd Street SE and one segment of CR 18 were collected Tuesday May 15th to Friday May 18th and Monday October 15 to Friday October 19 of 2018. The traffic volumes were counted for approximately 72 consecutive hours at all locations. The Kindred Public School system was in session when the traffic volumes were collected. The traffic volumes were reviewed for any differences, and an average of the two counting periods was determined. The traffic volumes included in this report are Average Annual Daily Traffic (AADT) volumes that are based on the actual number of vehicles counted during the two count periods and then adjusted to account for daily and seasonal variations. AADTs provide the average volume of traffic using the roadway throughout the year. Actual traffic counts on random days may be either above or below the AADT, but the AADT provides an average for the entire year. Intersection turning movements were not counted as a part of this study.

The AADTs for the three count locations are shown in Figure 5, Figure 6, and Figure 7. The AADTs for the spring and fall ranged from 86 and 136 vehicles per day (VPD) on CR 18 near CR 17 to 115 and 197 VPD on the west end of the study area. The traffic consisted of 20 to 25 percent heavy vehicles (vehicles with more than 2 axles) throughout the study area. The heavy vehicle percentages were slightly lower on the existing CR 18 section. It is important to note that the traffic counts were taken while agricultural producers were starting to plant and harvest the agricultural fields in the area surrounding the study area. The travel direction distribution at the count locations was approximately 55 to 60 percent travelling westbound to approximately 40 to 45 percent travelling eastbound during the spring count period and 50 percent eastbound and westbound during the fall count period. The directional distribution may signal that vehicles are traveling west to Kindred or elsewhere on 52nd Street SE, but returning to their residence or place of origin by another route such as North Dakota 46 and a north-south county or township roadway.

The peak hour, the highest volume of four consecutive 15-minute counting periods, for all locations was consistent between 7:00 am and 8:00 am with minor 15-minute adjustments for the morning period of each day. The afternoon/evening peak hour was not as consistent as the morning peak hour for all three locations. The PM peak hour was typically either 3:30 pm to 4:30 pm or approximately around the 5:00 pm hour. A potential reason for the variation of the evening/afternoon peak hour may be due to rain events on one of the count days and the resulting saturated condition of the gravel roadways. Although, there is not enough evidence to draw a conclusion that the condition of the roadway impacts the traffic volume on the roadway. The peak hours from the fall traffic counts were similar in the hour that had the peaking volumes to the spring data.

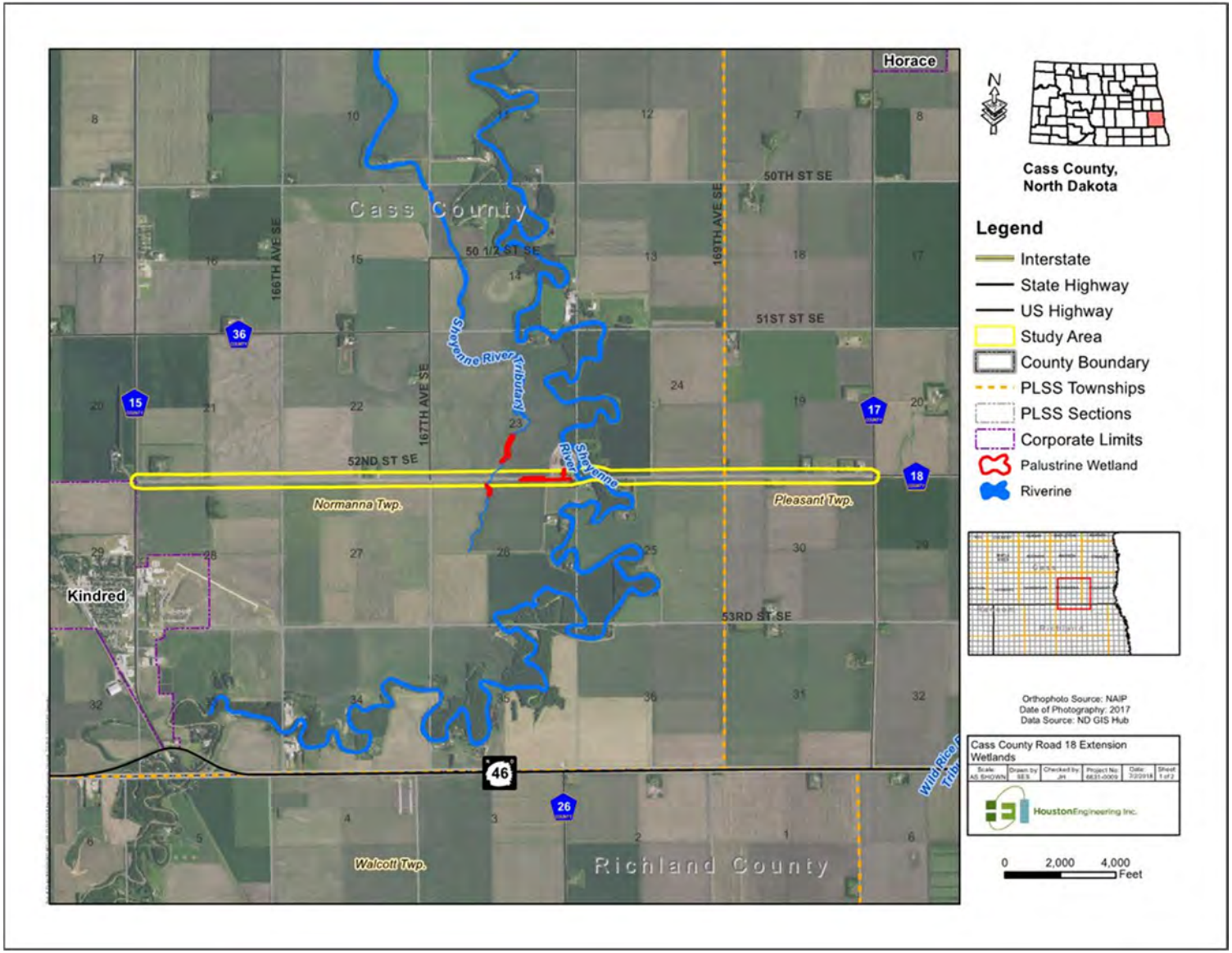

Figure 3. Environmental Map for Study Area

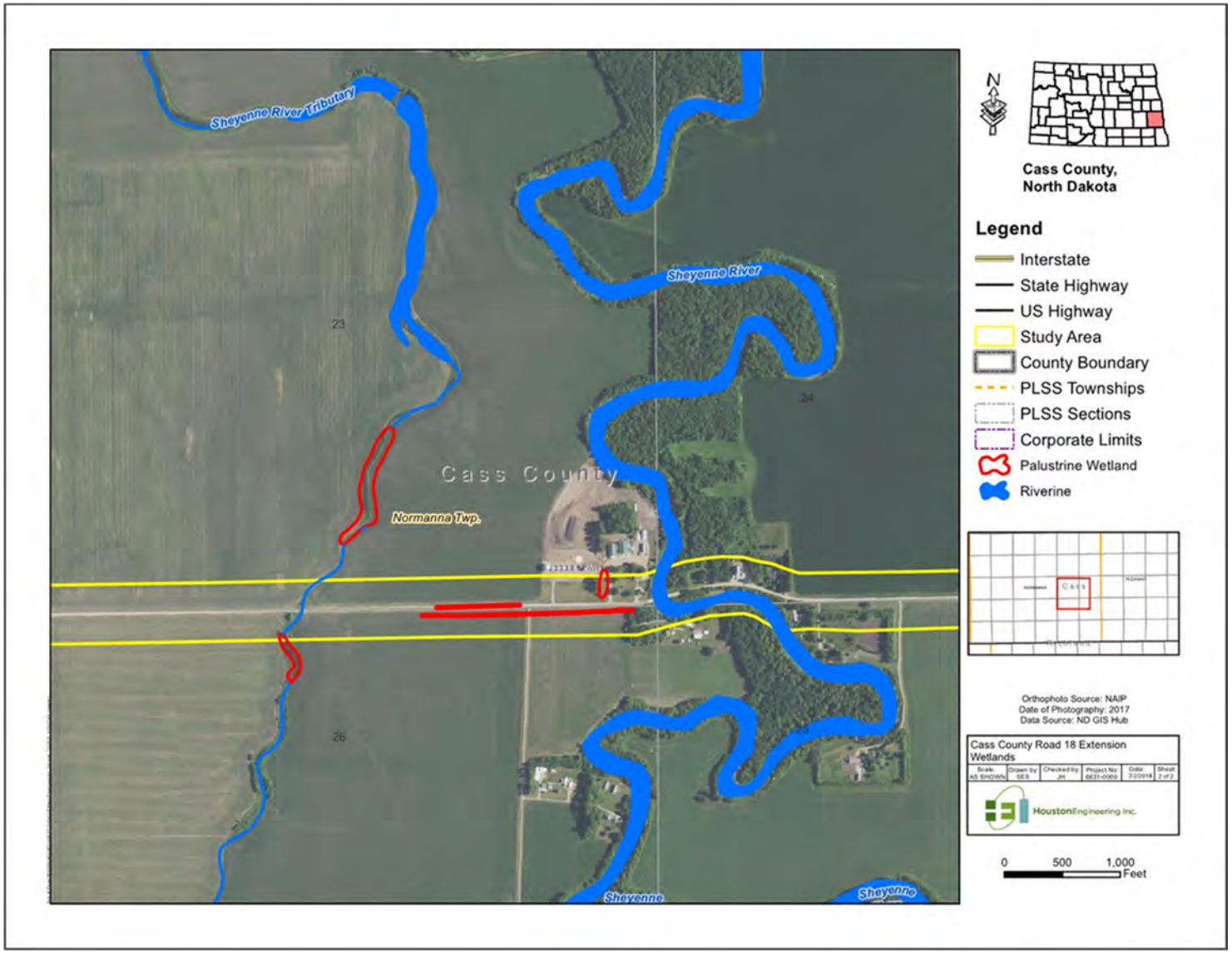

Figure 4. Wetlands within the Study Area

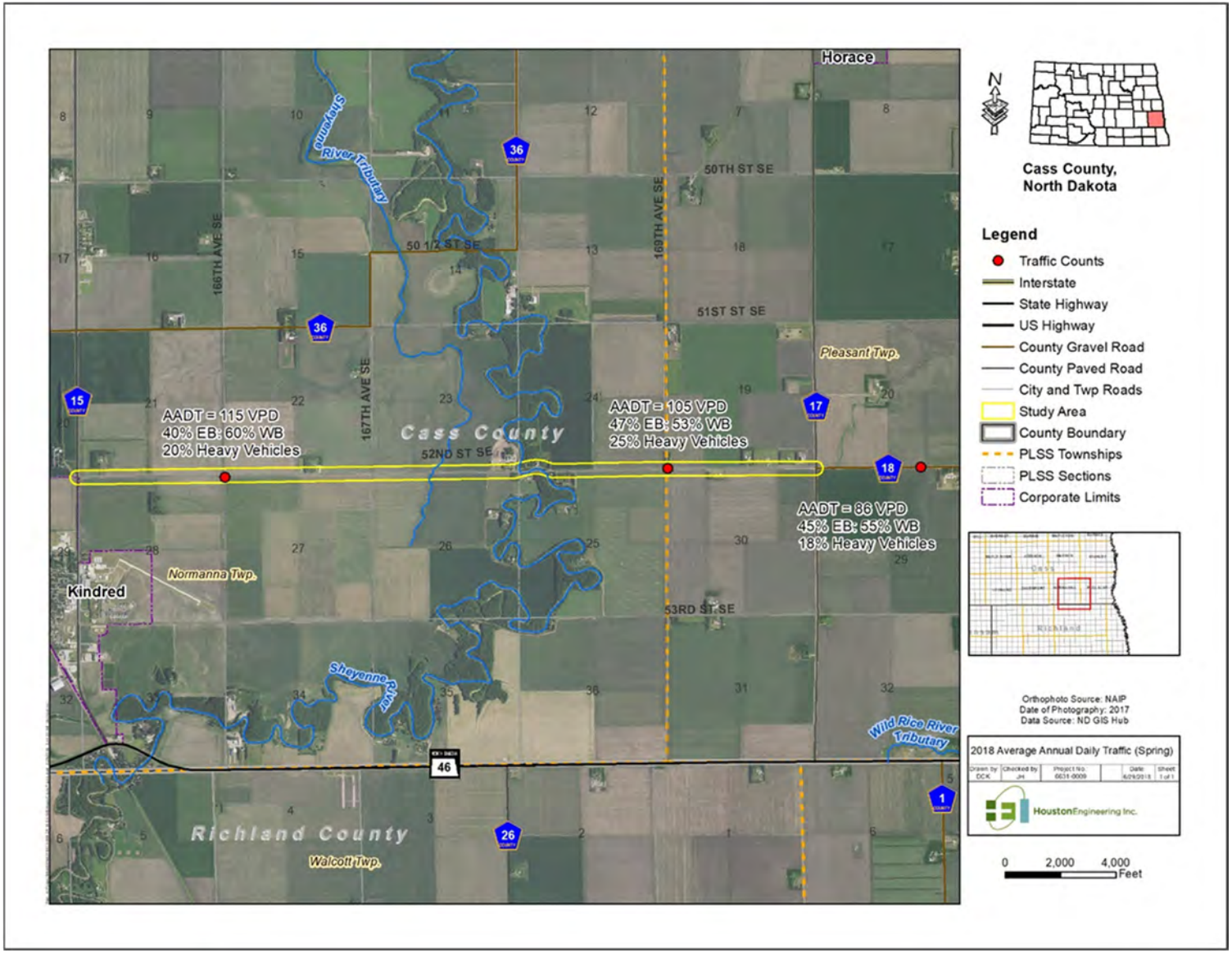

Figure 5. 2018 Average Annual Daily Traffic Volumes (Spring 2018)

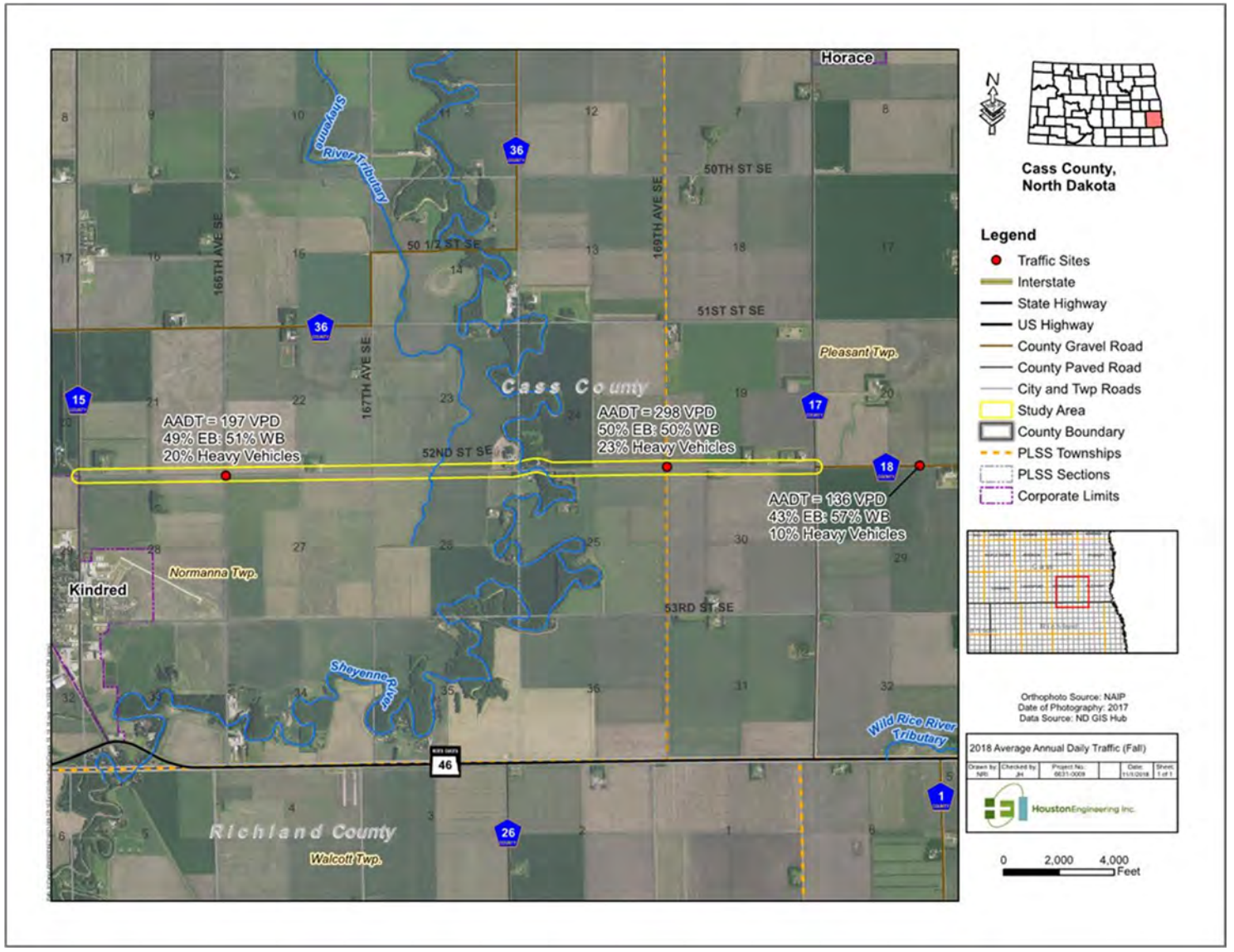

Figure 6. 2018 Average Annual Daily Traffic Volumes (Fall 2018)

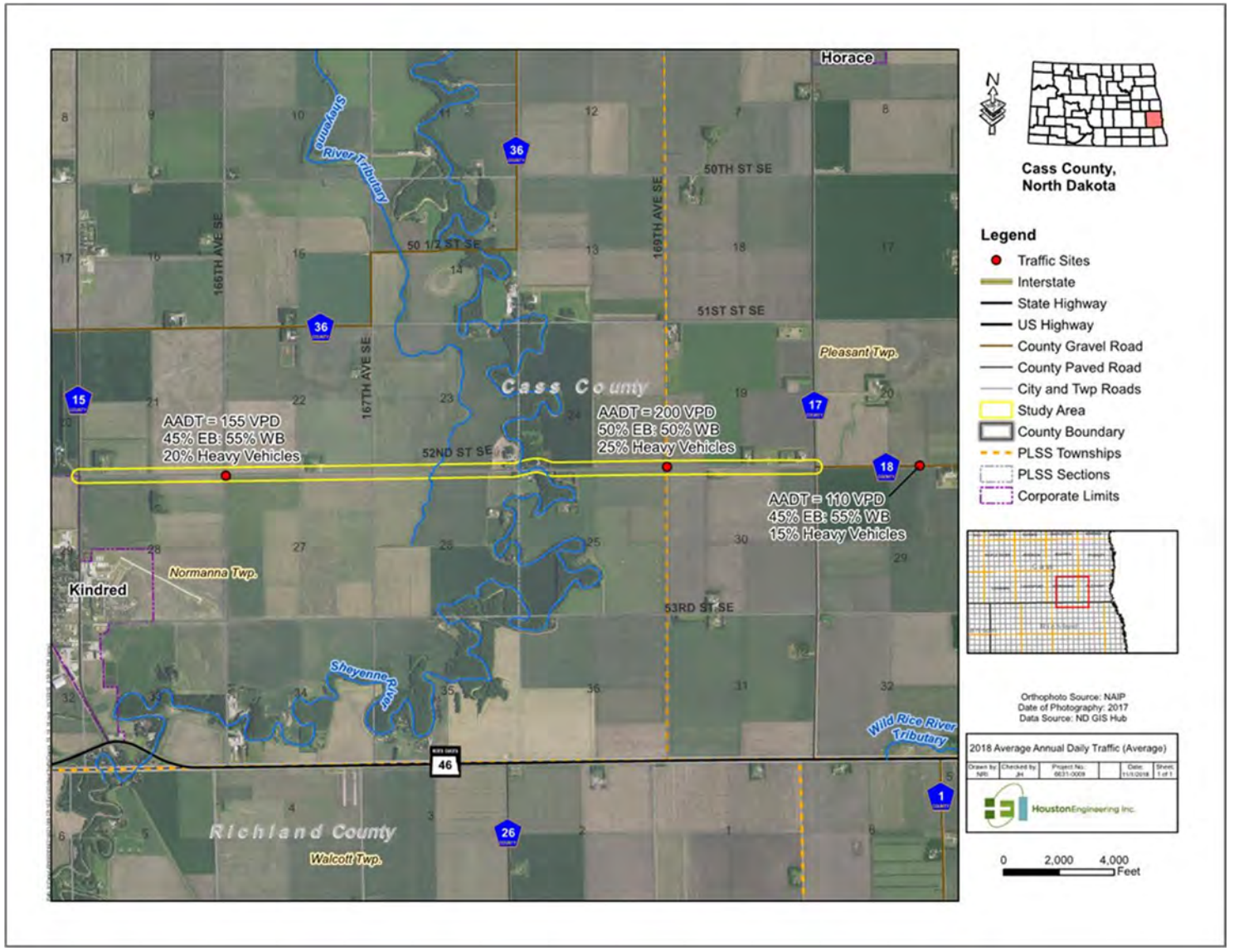

Figure 7. Average Annual Traffic Volumes (Average of Spring and Fall 2018)

3.7 TRAFFIC SAFETY PERFORMANCE FOR 2013 TO 2017

The data and information used in the traffic safety section was provided by the Metro COG from a data set that was received from the NDDOT. The data included all traffic crashes in the Metro COG planning boundary for the years 2013 to 2017. The software program ArcGIS was used to select crashes for the study area based on a selection buffer of 250 feet from 52nd Street SE, as shown in Figure 8. The NDDOT and Department of Public Safety maintain criteria for what constituted a reportable traffic crash, and some very minor non-injury crashes may not be considered a reportable traffic crash.

There was a total of six traffic crashes in the study area from 2013 to 2017. The crash locations and severity are included in Figure 8. Additional information for the crashes are included in the following Table 1 to Table 4. The corridor had one fatal crash, two injury crashes, and three property damage only crashes from 2013 to 2017 as shown in Table 1. The crash severity by year is shown in Table 2 and the only year with more than one crash was 2014. Typically, fatal and injury crashes occur when vehicles collide either head-to-head or at various angles to each other, of which the right-angle crash is typically the angle manner of collision with the highest potential of injury. Included in Table 3 are the crash severities by the manner of collision. The corridor experienced three angle crashes with two being right angle crashes; resulting in one a fatal crash and one property damage only crash. The study corridor is assumed to have a proportion of the traffic volumes that consists of vehicles travelling to or from the Kindred Public School system buildings in Kindred.

Due to the potential of teen-age drivers travelling on the road, the driver ages of vehicles involved in crashes along the corridor were included in Table 4 to provide information on any patterns that emerged involving younger drivers or drivers of a certain age range. Please note that each driver in a crash is listed and more than one driver may be included in a crash. The 0 to 16 and 17 to 24 age ranges were grouped together so that all teen-age drivers along with younger drivers were included in one group for analysis. Based on the data in Table 4, three of the nine drivers involved in crashes were between 0 and 24 years of age which represents 33 percent of the total drivers. The 0 to 24 and 35 to 44 age ranges had three drivers involved in crashes which was the highest of all ranges.

The fatal crash that occurred along the corridor was further examined to determine if any roadway or traffic control attributes may have been a contributing factor. Based on a review of the information available about the crash, a vehicle failed to yield at a yield sign to another vehicle on 52nd St. SE and a right-angle crash occurred between a passenger vehicle and a semi-truck. Based on the information available, it does not appear that any roadway or traffic control attributes contributed to the crash.

Table 1. Crashes by Year ('13 to '17)

2013	1
2014	3
2015	1
2016	1
2017	0

Table 2. Crash Severity by Year ('13 to '17)

	Crash Severity					
YEAR	Fatal	Major Injury	Minor Injury	Possible Injury	Property Damage Only	TOTAL
2013	0	0	0	0	1	1
2014	1	0	0	1	1	3
2015	0	0	0	0	1	1
2016	0	0	1	0	0	1
2017	0	0	0	0	0	0
TOTAL	1	0	1	1	3	6

Table 3. Manner of Collision and Severity ('13 to '17)

	Crash Severity					
Manner of Collision	Fatal	Major Injury	Minor Injury	Possible Injury	Property Damage Only	TOTAL
Angle (Not Specific)	0	0	0	0	1	1
Non-Collision w/ Motor Vehicle	0	0	1	1	1	3
Right Angle	1	0	0	0	1	2
TOTAL	1	0	1	1	3	6

Table 4. Crash Severity by Age ('13 to '17)

	Injury Severity					
AGE	Fatal	Major Injury	Minor Injury	Possible Injury	Property Damage Only	TOTAL
0 to 16	0	0	1	0	0	1
16 to 24	0	0	0	0	2	2
25 to 34	0	0	0	0	1	1
35 to 44	1	0	0	1	1	3
45 to 54	0	0	0	0	0	0
55 to 64	1	0	0	0	1	2
65 to 74	0	0	0	0	0	0
75+	0	0	0	0	0	0
TOTAL	2	0	1	1	5	9

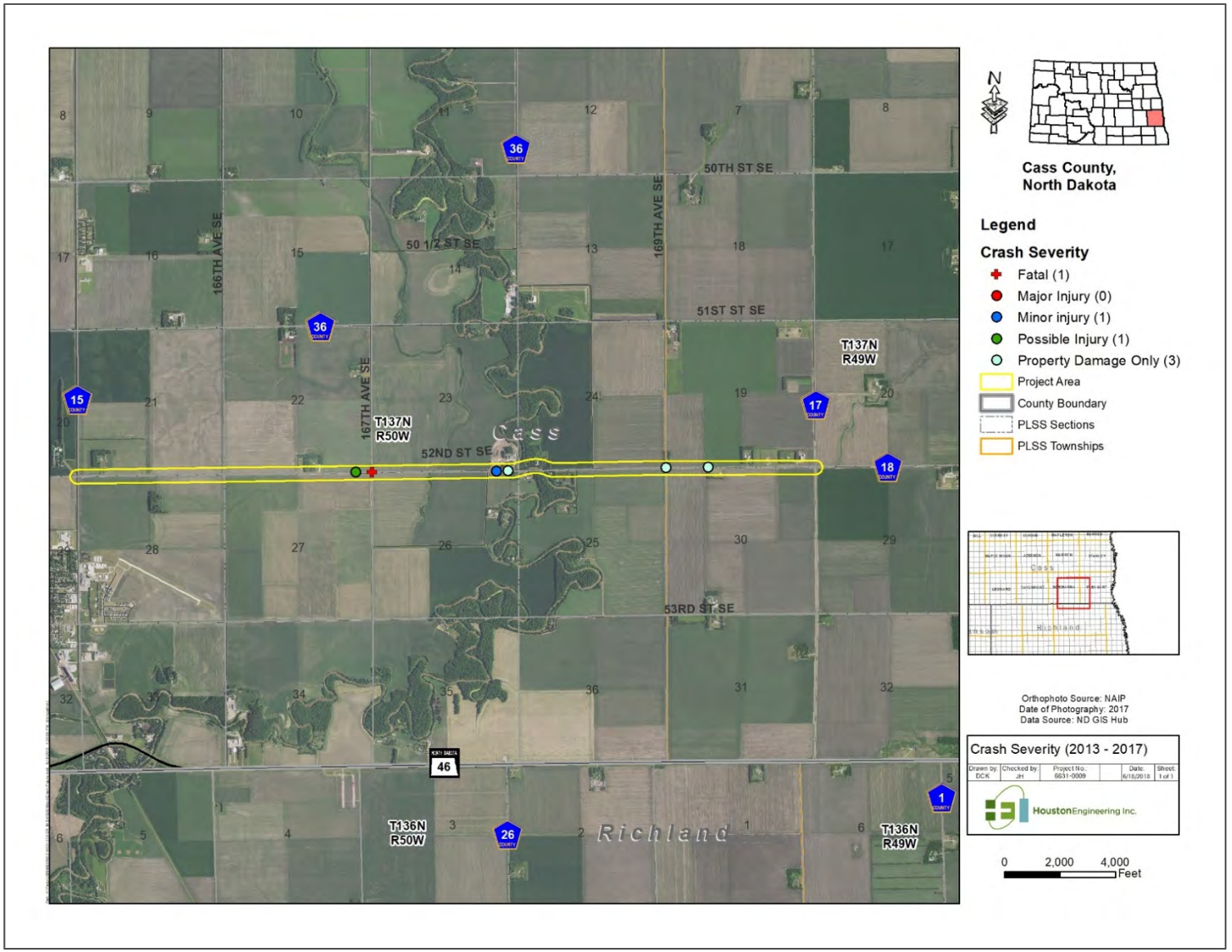

Figure 8. 2013 to 2017 Crash Locations

4 FUTURE CONDITIONS ANALYSIS

4.1 FUTURE LAND USE

4.1.1 CASS COUNTY

The *Cass County Comprehensive and Transportation Plan* (the Comprehensive and Transportation Plan) was recently updated in May of 2018. The Comprehensive and Transportation Plan contained information on Cass County's future population and community growth out to the year 2045. Several important items for this report such as household information, school growth, and the expansion of cities' developed areas were referenced from the Comprehensive and Transportation Plan. The Comprehensive and Transportation Plan will be referenced throughout the document with information included in several of the upcoming sections.

4.1.1.1 FUTURE POPULATION

The Comprehensive and Transportation Plan provided the population forecasts for several jurisdictions in Cass County. Provided in Table 5 are the historical and future populations for Cass Country at-large, the City of Horace, and the City of Kindred. As shown in Table 5, both Cass County and Horace are expected to have significant population growth. The growth for the City of Horace is most likely due to the expansion from the urban areas of Fargo and West Fargo in to the jurisdiction of the City of Horace. The City of Kindred is expected to have limited growth in the future years and reach a population of around 800 people in 2025 and remain at that population through the year 2045.

Table 5. Future Population Estimates

Jurisdiction	1990	2000	2010	2015	2020	2025	2030	2035	2040	2045
Cass County	102,874	123,138	149,778	168,930	189,900	206,620	221,350	233,940	244,460	251,940
Horace	662	915	2,430	2,620	5,070	8,190	8,940	9,500	9,820	10,040
Kindred	569	614	692	728	773	798	805	799	802	797

4.1.1.2 HOUSEHOLDS

Included in the Comprehensive and Transportation Plan were historical and future household numbers for Cass County and the Cities of Horace and Kindred. The historic and future household values are shown in Table 6. Similar to the population growth trends in Table 5, Cass County and the City of Horace are expected to see significant growth with the number of households while the City of Kindred will see limited growth through the forecasted period.

Table 6. Future Household Estimates

Jurisdiction	1990	2000	2010	2015	2020	2025	2030	2035	2040	2045
Cass County	42,407	53,790	63,899	70,480	78,160	83,820	89,280	95,520	96,750	99,960
Horace	216	311	810	840	1,730	2,710	2,980	3,190	3,360	3,520
Kindred	246	267	267	270	280	280	280	290	300	300

According to the Comprehensive and Transportation Plan, the average household size for an owner-occupied residence is 2.65 people and 1.89 people for a renter-occupied residence. The information

provided for households also included age ranges for the householders. It is expected that a younger householder in the 25 to 44-year-old range to have a higher likelihood of having school-aged children currently or in the near future. Based on a map provided in the Comprehensive and Transportation Plan that is based on the year 2010 census data, both the Cities of Kindred and Oxbow's median age is in the 25 to 44-year-old category. It is also important to note that one in four households in Cass County have children.

4.1.1.3 LAND ACREAGE DEVELOPMENT AND GROWTH

In order for a city to grow, land and utility services must be available. The Comprehensive and Transportation Plan categorized four different types of communities in Cass County; Metropolitan Cities, Urban Residential Communities, Rural Center, and Rural Residential Clusters. The City of Kindred was classified as a Rural Growth Center and the City of Oxbow was classified as a Rural Residential Cluster. The difference between a Rural Center and a Rural Residential Cluster is that the Center has resources, such as available land, potential utility expansion, and other similar items, that will allow for future growth whereas the Cluster has limited potential for future growth.

4.1.1.3.1 CITY OF KINDRED

The City of Kindred currently has available lots for single family residential in the Newport Ridge development. According to the City, this is the only new development that is formally planned in the City. The Newport Ridge development is located just south of the airport and when completed will have approximately 69 developable lots. The development is currently 25 percent occupied with mostly single-family residential homes of which some feature access to the airport taxiway. Based on anticipated future growth for the City, it is expected that if additional residential lots are needed, they will be developed near the new high school on the north side of the City.

4.1.1.3.2 CITY OF OXBOW

The City of Oxbow is expected to be surrounded in a ring dike due to the impacts of the Fargo-Moorhead Diversion project. The City has prepared zoning plans and locations for single family residential development in anticipation for a ring dike. The zoning plan shows future development being completely within the area protected by the dike. It is expected that the City of Oxbow will not grow beyond the area enclosed by the ring dike and the only future growth will be what is included in the full-build plans of the City. The City currently is at approximately 75 to 85 percent of all single-family lots being developed with approximately 20 to 25 residential lots still available for single-family development.

4.1.1.3.3 KINDRED PUBLIC SCHOOL DISTRICT

The Kindred Public School District completed a demographic study that provides information on the population of cities in the school district and the number of students from those cities and other rural areas throughout the district. The school district has a projected 2018-2019 school population (Kindergarten through 12th Grade) of 758 students. The student population is aggregated into the following three categories for 2018 and 2019 school year:

K through 6th Grade Total Enrollment	419 students (Average of 60 per class)
7th and 8th Grade Total Enrollment	126 students (Average of 63 per class)
9th through 12th Grade Total Enrollment	213 students (Average of 54 per class)

The demographic study also provides the number of students from each city that attended during the 2017-2018 school year. The total number of students from the Oxbow-Bakke area was 86 or 11.4 percent of the total school enrollment. The nine-year trend for enrollment from the Oxbow-Bakke area has decreased about 33 percent or about 3 percent per year. Based on information obtained from developers and realtors in the Oxbow area, several of the householders that have recently moved to Oxbow are in the 25- to 44-year old age range that typically will have children currently attend or attend school in the future. This may change the trend of enrollment for the Kindred School District from the Oxbow area. The student location numbers and trends are included in the traffic forecasts for this report.

4.2 FUTURE IMPACTS OF FARGO-MOORHEAD DIVERSION

4.2.1 FLOODING IMPACTS

The study area for this project is not located within the protected area of the Fargo-Moorhead Diversion and is typically referred to as being on the "wet" side of the diversion. The flooding impacts with the diversion for 10-year, 20-year, and 100-year storm events are shown in Figure 9. The roadway elevations shown in Figure 9 are based on the existing roadway elevations and will be considered with proposed roadway profile elevations in the Alternative Analysis phase of this project. As shown in Figure 9, 52nd Street SE holds back water that drains from the south to the north and creates flooding in area fields to the south of 52nd Street. The historic impacts to the roadway due to significant flooding events is shown in Figure 10. The information for Figure 10 was provided by Cass County based on their records and was verified by modeling information that was available from previous Cass County flooding projects. The information included in Figure 9 and Figure 10 will provide a base for any analysis included in the Alternative Analysis phase.

4.2.2 IMPACTS TO AREA ROADWAYS

Reviewing the most recent information available for the Fargo-Moorhead Diversion, 52nd Street SE in the study area will not be impacted by the construction of the diversion. The roadways in the area of this project that will be impacted are all to the north and east of the study area. County Road 18 east of Interstate 29 will be raised to allow access to Oxbow once the ring dike has been constructed.

4.3 FUTURE AREA ROADWAY IMPROVEMENTS

The current Cass County Transportation Plan was reviewed to determine if any area roadway, bridge, and drainage structure improvements are planned in the next five years. According to the Transportation Plan, no roadway, bridge, or drainage structure improvements are planned in the area. As previously mentioned, there will be some roadway improvements due to the construction of the Fargo-Moorhead Diversion. The North Dakota Department of Transportation (NDDOT) Statewide Transportation Improvement Program (STIP) document for 2018 to 2021 was reviewed and no significant construction project will take place on North Dakota 46.

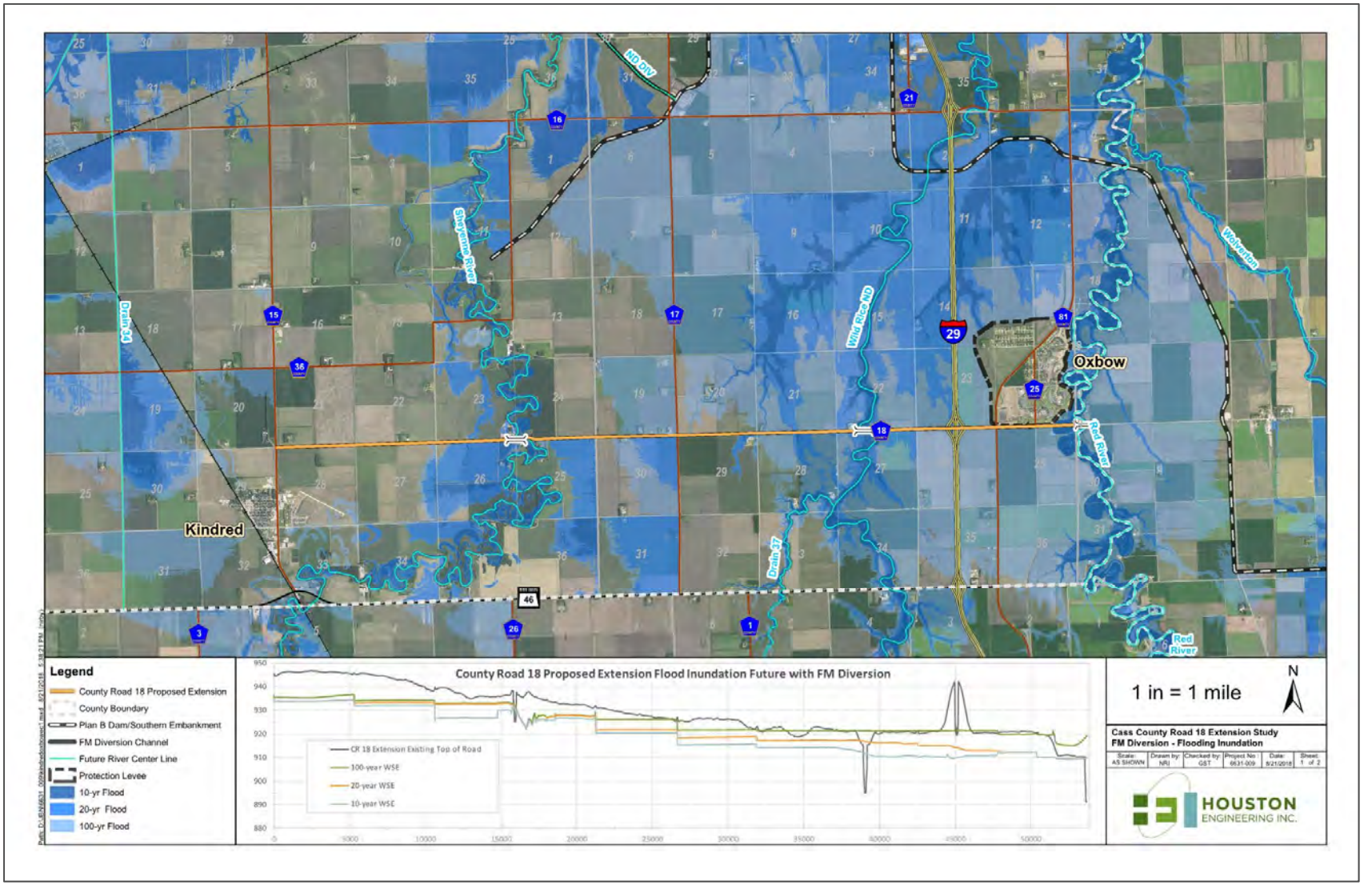

Figure 9. 10-Year, 20-Year, and 100-Year Flood Events

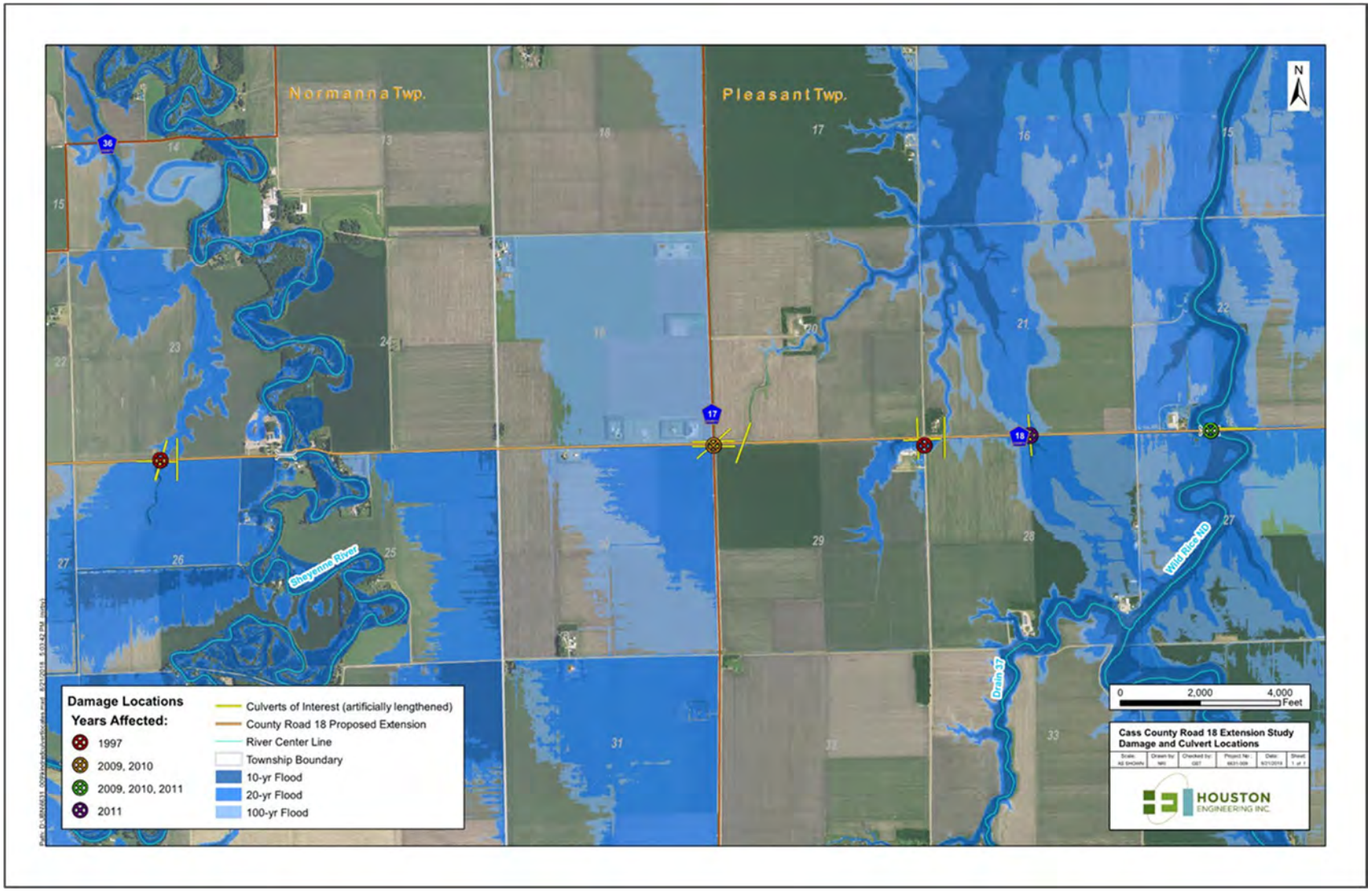

Figure 10. Historic Flood Damage Areas

4.4 FORECASTED TRAFFIC VOLUMES

4.4.1 METHODOLOGY

The location of 52nd Street SE is rural with farms and residents typically located everyone one to two miles along the roadway. The City of Kindred is within one mile of the far west end of the roadway. No other cities or proposed developments are located near the roadway. Traditional trip generation and traffic forecasting relies on known existing and future development within analysis zones to determine the trips that will be generated by the development. Once the number of trips is known, the trips are assigned to roadways serving the analysis zone. With the rural location of this roadway and very limited development planned for the future, the traditional methodology for forecasting traffic volumes was adjusted to determine the traffic forecasts for this roadway. A step-based methodology is provided below with further explanation following:

Step 1. Determine existing base traffic volumes along area roadways and at the CR18 and North Dakota 46 (ND46) Interchanges
Step 2. Determine existing traffic patterns and directional distribution
Step 3. Determine traffic growth rates based on historic traffic data
Step 4. Review Cities of Oxbow and Kindred land use information for future traffic volume growth
Step 5. Determine future traffic roadway assignment based on travel times for each alternative
Step 6. Review and balance traffic forecasts, as needed.

The 52nd Street SE corridor is located such that the only sizable trip generators in the area, Cities of Kindred and Oxbow, are able to serve as a cordon boundary along with Interstate 29, ND 46, and the north City Limits of Kindred. Several NDDOT traffic count sites are located at the ramps and cross road of the interchanges and along Cass County Road 15 and ND 46. The traffic volumes at the boundary points allow for accurately determining where traffic using 52nd Street SE is originating and ending. Steps 1, 2, and 3 of the methodology were based on North Dakota Department of Transportation (NDDOT) historic traffic data. Some of the area roadway historic annual average traffic growth rates are included in Figure 11 with 2018 traffic volumes. Once this information was determined, the existing base traffic information was complete.

The information needed for step 4 was readily available from the Cities on each of the City websites or from their city engineer. The percentage of developed lots for the current year 2018 were determined for each development in the City and then the expected growth due to a full-build out of the development was determined. Both Cities have limited existing lots available with populations that are expected to grow and stabilize by 2025 so a full-build out was assumed for all forecasting. For step 5, several NDDOT traffic count sites are located on the roadways serving both cities, which allowed for basing the trip assignments off the current travel patterns for each City. The current developed households were used to determine an approximate rate of trips that were used for forecasting future traffic volumes based on the anticipated growth.

Two main factors were used in determining the future traffic assignments for each alternative to be considered; travel time and roadway surface type. It is generally assumed that when travelers would be provided an opportunity to choose 52nd Street SE for travel versus an alternative route, the travel time would have to be shorter for 52nd Street SE or the condition of the roadway would have to be improved from an aggregate surface to a paved surface to attract a significant number of vehicles. The travel time

between CR 18 interchange and the City of Kindred is shown in Table 7. As shown in Table 7, the I-29 and ND 46 route has a shorter travel time and is a paved surface and is expected to attract more traffic than 52nd Street SE. Once future traffic volumes are determined for each alternative, the forecasts were reviewed for balance forecasted traffic volumes.

Table 7. Travel Times Between CR 18 Interchange and City of Kindred

Route via	Distance (miles)	Free Flow Time (minutes)	Intersection Delay (minutes)	Total Travel Time (minutes)
52nd Street/CR 18	9.4	14.0	2.0	**16.0**
I-29/ND46	12.1	14.0	1.0	**15.0**

4.4.2 ROADWAY SECTION ALTERNATIVES

For the traffic forecasting, three general alternatives were considered for the improved 52nd Street SE; No-Build (Existing) Section, Aggregate County Typical Section, Paved County Typical Section. The design criteria for the roadway alternatives was not a consideration as the roadway width, ditch foreslopes, etc. would at least meet the County's minimum criteria and not have a significant impact on travelers choosing a route. The speed limit for 52nd Street SE for each of the three alternatives was kept at 55 miles per hour with 0.5 miles at 25 miles per hour. The paved roadway surface was assumed to be attract more traffic volume due to the consistent surface (i.e. no impacts from wet weather, aggregate washboarding, etc.) for the travelling public.

- No-Build Alternative
- Aggregate Surface Alternative
- Paved Surface Alternative

4.4.3 TRAFFIC FORECASTS

The traffic forecasts for all three roadway alternatives was completed for the future years 2025 and 2045 based on the average of the spring and fall 2018 traffic counts. The traffic forecasts are included in Figure 12 and Figure 13 for 52nd Street SE. It is expected that some of the additional traffic volume on 52nd Street SE would be due to vehicles using an improved roadway section from County Road 15 and 17.

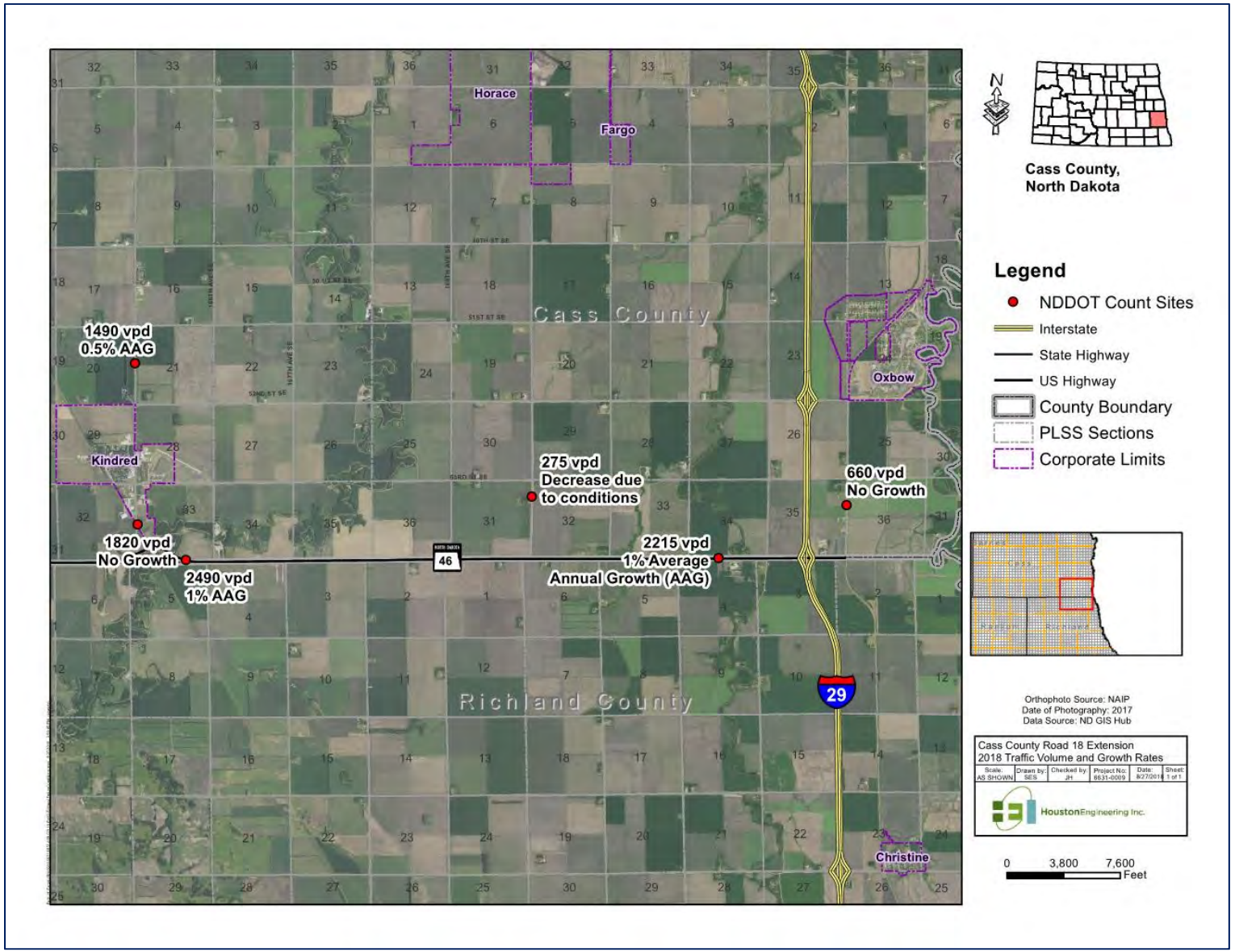

Figure 11. Historic Traffic Growth Rates

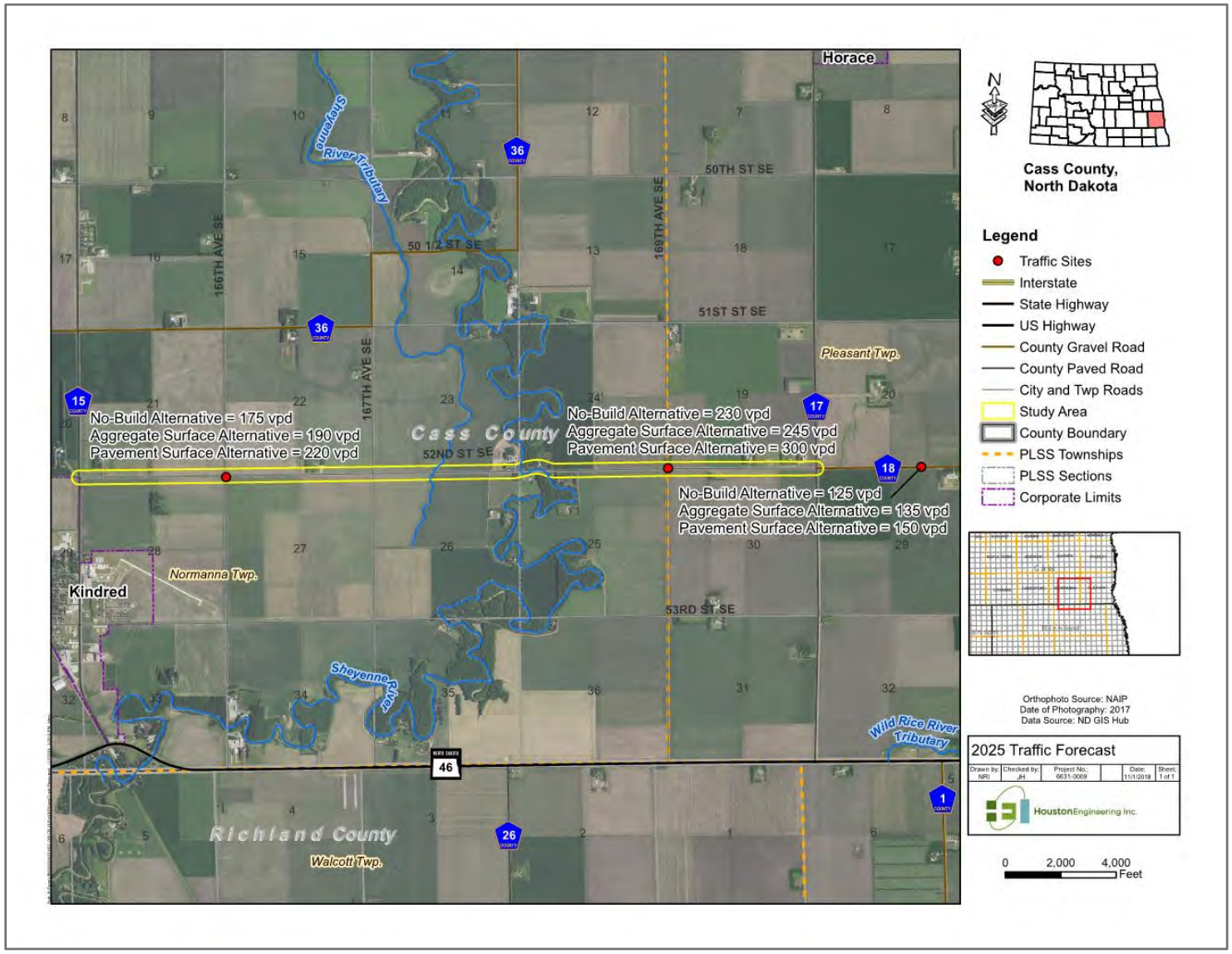

Figure 12. 2025 Traffic Forecasts

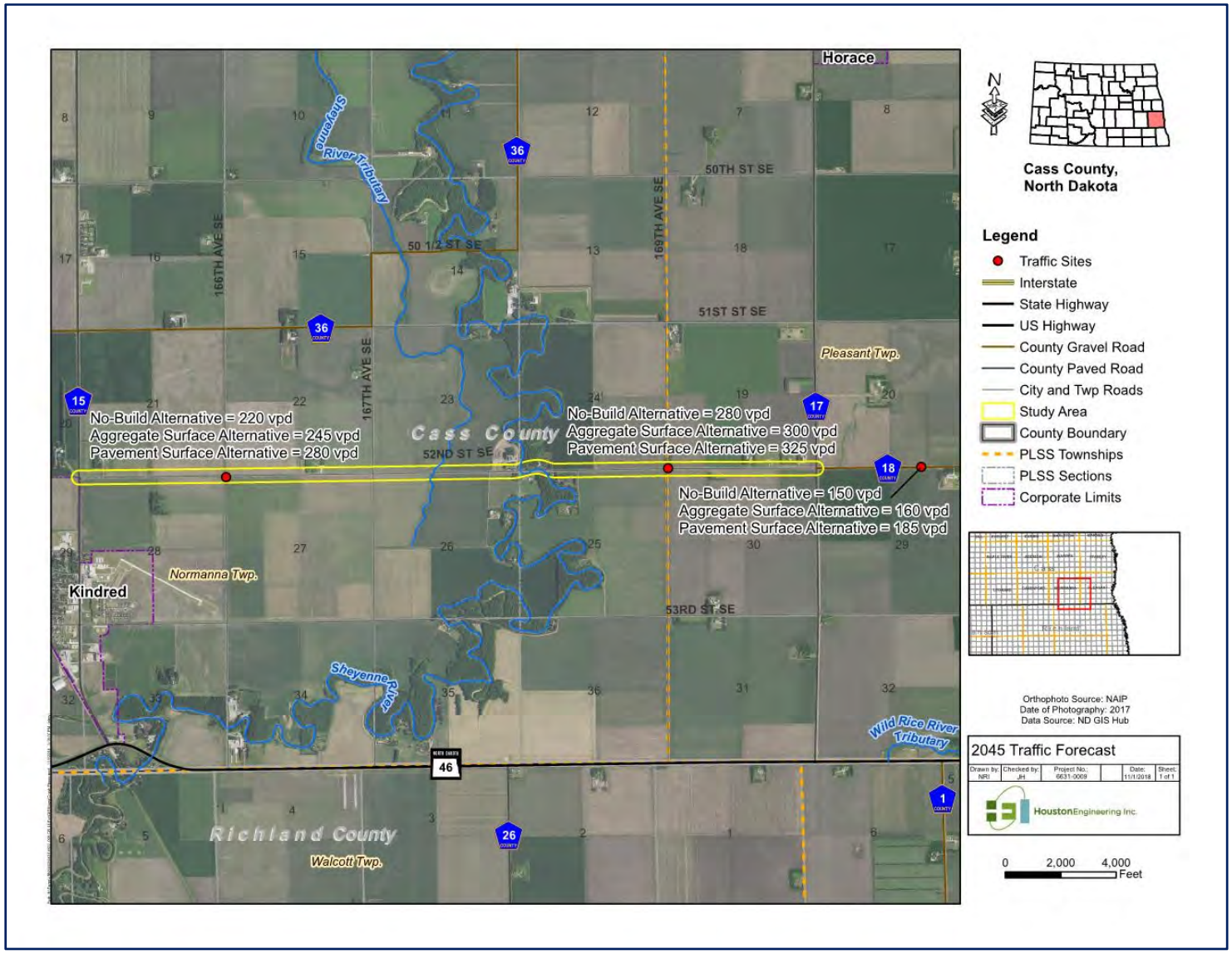

Figure 13. 2045 Traffic Forecasts

5 PURPOSE AND NEED

5.1 PROJECT PURPOSE

The purpose of this project is to study the feasibility of extending CR 18 from CR 17 to CR 15 and transitioning ownership to a county roadway and the roadway typical section to meet county roadway standards. As a part of this project, existing and future needs, as well as, necessary improvements to the study corridor are being analyzed in order to provide recommendations and alternatives to decision makers regarding the future of this corridor. As an outcome of this study, the intent is for CR 18 to become a functionally classified roadway if 52nd Street SE is converted from a township roadway to a county roadway.

The goals associated with this project are as follows:

- Study the county roadway network connection for CR 18 between CR 17 and CR 15 to maintain a roadway network that allows users to travel on a standard roadway cross-section to Kindred and between CR 15 and Interstate 29.
- Provide recommendations/alternatives for a roadway that maintains a suitable driving surface throughout the year and accommodates traffic mix consisting of passenger cars, heavy trucks, and agriculture implements.
- Provide recommendations/alternatives that will minimize the potential for crashes along the corridor.
- Support the goals and objectives of the *Cass County Transportation and Comprehensive Plan*

The sections that follow describe the existing conditions summary along the project corridor and the needs of the project.

5.2 EXISTING CONDITION SUMMARY

5.2.1 ROADWAY TYPICAL SECTION AND ATTRIBUTES

Within the project study area, 52nd Street SE is an aggregate roadway with a width of 28 to 30 feet and open ditch drainage. The Normanna and Pleasant Townships maintain 52nd Street SE with annual aggregate resurfacing at a variable rate between 150 cubic yards per mile (CY/mile) and 365 CY/mile. The typical sections for the existing 52nd Street SE and CR 18 are shown in Figure 2. Driveway and field access locations along both 52nd Street SE and CR 18 typically have corrugated metal pipe culverts for drainage. Flood protection measures have been implemented on the east end of the study area. The measures include levees and sluice gates installed on the north side of the roadway. Approximately 0.75 miles west of the Sheyenne River bridge, two transverse corrugated metal pipe culverts cross 52nd Street SE providing conveyance for a tributary of the Sheyenne River. The 52nd Street corridor speed limit is 55 miles per hour (MPH) except for reduced speed zones of 40 MPH approaching the Sheyenne River bridge and 25 MPH immediately adjacent to the bridge.

The 52nd Street SE intersection with CR 15 has two-way stop-control on the 52nd Street SE approaches and the intersection with CR 17 is controlled by a yield sign on the 52nd Street SE approach and stop sign on the CR 18 approach. Several north-south township roadways intersect with 52nd Street SE throughout the project study area. The north-south township roadways are typically yield controlled with yield signs

at the intersections with 52nd Street SE. Additional access locations along 52nd Street SE are typically at driveway approaches or field locations. The spacing and locations of the access points along the corridor are acceptable, but some may need to be slightly relocated or combined if any improvements to the roadway are made.

5.2.2 BRIDGE ACROSS THE SHEYENNE RIVER

According to the most recently available National Bridge Inventory (NBI) report from 2015, the overall condition of the existing bridge crossing the Sheyenne River is "Good" with the superstructure and substructure both being categorized "Very Good". The sufficiency rating of the bridge according to the NBI report is a 99.7. The channel bank is beginning to slump, and the embankment protection devices have widespread minor damage according to the NBI report. The bridge was included in *Cass County Comprehensive and Transportation Plan*'s "Cass County Bridge Condition Average" figure with a bridge condition average range of 7.1 to 8.0 out of 10, and in the "2037 and beyond" construction phase for replacement.

5.2.3 EXISTING UTILITIES IN STUDY AREA

The study area does contain electrical, fiber optic, telephone, and rural water utilities. A utility locate and survey were not conducted for this study. Any utility information provided in this report and study are for information purposes only and are not intended to be used for design or construction. Based on a review of existing above ground utility structures along the corridor, several of the underground utilities run parallel to 52nd Street SE in the backslope of the north ditch of the roadway. Throughout the corridor, fiber optic and telephone underground lines are located north of the roadway and cross beneath the roadway to service residences on the south side of the roadway. Overhead electric utilities are typically located along the north field edges and run most of the eastern half of the project terminating just west of the bridge. There are also short runs of overhead electrical utilities serving the two western most residential and commercial locations within the study area. The overhead electrical lines do cross 52nd Street SE at three locations within a 0.5 mile stretch from the Sheyenne River bridge to the east. At the location of the Norman Lutheran church, the overhead power lines are located on the south side of the roadway directly across from the church. There are valve locations for Cass County Rural Water located north of 52nd Street SE in the study area.

5.2.4 EXISTING LAND USES WITHIN THE STUDY AREA

The Cass County existing land use plan contained within the *Cass County Comprehensive and Transportation Plan* provides the existing land uses in the study area that are based on the seven land use categories used in Cass County. Along the 52nd Street SE corridor in the study area, the primary land use is "agriculture" with a few areas of "single family residential", "farm exempt", and "ag with residential". The residential land uses are located near the Sheyenne River Bridge and at the east end of the study area. There is also a "commercial/industrial/multi-family residential" land use area for a manufacturing facility located 1.5 miles east of the intersection with CR 15. The Norman Lutheran church, located just east of the Sheyenne River bridge, is classified as a "single-family residential" in the land use plan. The very west 0.75 miles of 52nd Street SE is included in the City of Kindred's Extraterritorial Area.

5.2.5 EXISTING ENVIRONMENTAL FEATURES

The project study area has the Sheyenne River and the Sheyenne River tributary for flowing water. There are three primary locations for palustrine wetlands located in sections 23 and 26 of the Normanna Township. The locations that are within the roadway ditch section that are classified as wetlands are located in the section from the Sheyenne River bridge to the west approximately a 0.5 mile.

5.2.6 FLOODING IMPACTS

The study area for this project is not located within the protected area of the Fargo-Moorhead Diversion and is typically referred to as being on the "wet" side of the diversion. The flooding impacts with the diversion for 10-year, 20-year, and 100-year storm events are shown in Figure 9. The roadway elevations shown in Figure 9 are based on the existing roadway elevations and will be considered with proposed roadway profile elevations in the Alternative Analysis phase of this project. As shown in Figure 9, 52nd Street SE holds back water that drains from the south to the north and creates flooding in area fields to the south of 52nd Street. The historic impacts to the roadway due to significant flooding events is shown in Figure 10. The information for Figure 10 was provided by Cass County based on their records and was verified by modeling information that was available from previous Cass County flooding projects.

5.2.7 IMPACTS TO AREA ROADWAYS

Reviewing the most recent information available for the Fargo-Moorhead Diversion, 52nd Street SE in the study area will not be impacted by the construction of the diversion. The roadways in the area of this project that will be impacted are all to the north and east of the study area. County Road 18 east of Interstate 29 will be raised to allow access to Oxbow once the ring dike has been constructed.

5.2.8 TRAFFIC SAFETY PERFORMANCE

There was a total of six traffic crashes in the study area from 2013 to 2017. The corridor had one fatal crash, two injury crashes, and three property damage only crashes from 2013 to 2017. The corridor experienced three angle crashes with two being right angle crashes; resulting in one a fatal crash and one property damage only crash. Based on the data collected for this study, three of the nine drivers involved in crashes were between 0 and 24 years of age which represents 33 percent of the total drivers. The 0 to 24 and 35 to 44 age ranges had three drivers involved in crashes which was the highest of all ranges.

The fatal crash that occurred along the corridor was further examined to determine if any roadway or traffic control attributes may have been a contributing factor. Based on a review of the information available about the crash, a vehicle failed to yield at a yield sign to another vehicle on 52nd St. SE and a right-angle crash occurred between a passenger vehicle and a semi-truck. Based on the information available, it does not appear that any roadway or traffic control attributes contributed to the crash.

5.3 NEEDS FOR THE PROJECT

5.3.1 SYSTEM CONNECTIVITY

The existing Cass County roadway system provides for consistent and connected roadways throughout the County to allow travel between cities and towns. The existing CR 18 is located from the interchange of Interstate 29 west for 4.5 miles to the intersection with CR 17. Existing CR 18 does not continue to the west as a County roadway. The extension of CR 18 between CR 17 and CR 18 would provide an additional system connection and linkage to the City of Kindred and also between CR 15 and CR 17.

A goal of this study is to provide system connectivity for the County roadway system.

5.3.2 INSUFFICIENT ROADWAY SURFACE CONDITIONS DUE TO SUBGRADE

During the spring and fall seasons, the township roadway experiences freeze-thaw temperature fluctuations that lead to rutting and an insufficient roadway surface for travelers along the roadway. As reported by local residents and travelers of 52nd Street SE, the existing roadway cross-section doesn't shed water during rain and snow events and creates muddy and slick roadway surface conditions. The roadway surface drainage issues created by the cross-section are partially due to the subgrade being deficient to maintain the roadway maintainer graded crown of the roadway. The townships have previously reported issues with maintaining a crown after the roadway maintenance crews have graded the roadway with additional aggregate surfacing.

A goal of this project is to provide recommendations/alternatives for a roadway surface that remains consistent in surface condition and cross-section through addressing any issues with the subgrade conditions.

5.3.3 MINIMIZE THE POTENTIAL FOR CRASHES ALONG THE CORRIDOR

The section of roadway included in this study has experienced six crashes during the study period. Of the six crashes, three were angle crashes at intersections throughout the study area. Several local residents and travelers of the roadway have commented on horizontal sight distance issues at the intersections due to standing crops or trees. The proposed roadway ROW is approximately 50 to 84 feet wider than the current ROW on the roadway. It is expected that the wider ROW would provide an improved horizontal sight distance at the intersections. The remaining three crashes along the corridor where non-collisions with motor vehicles running off the roadway. It is unknown if the foreslopes and backslopes of the roadway currently meet *Roadside Design Guide* standards for cross slopes. The proposed roadway typical section will provide sufficient fore- and backslopes to meet the *Roadside Design Guide* standards.

A goal of this project is to provide recommendations/alternatives for a roadway alignment and typical section that meets all design and safety requirements and minimizes the potential for crashes along the corridor.

5.3.4 SUPPORT THE GOALS AND OBJECTIVES OF THE CASS COUNTY TRANSPORTATION AND COMPREHENSIVE PLAN

A summary of the issue, opportunity, and recommendation of a County Road 36/County Road 18 Extension was included in the *Cass County Transportation and Comprehensive Plan*. The Transportation and Comprehensive Plan includes consideration of a County Roadway connecting Kindred to the CR 18 interchange with Interstate 29.

A goal of this project is to support the goals and objectives of the *Cass County Transportation and Comprehensive Plan*.

6 PUBLIC INPUT SUMMARY

6.1 STUDY REVIEW COMMITTEE

The project included a Study Review Committee (SRC) that included committee members from a group of stakeholders and agencies located along the project study area. The SRC members and the stakeholder or agency they represented are listed below. The SRC met four times throughout the project and provided input on the existing and future conditions, alternatives to analyze, public comments, and general project approach.

- Dan Farnsworth – FM Metro COG
- Jason Benson - Cass County
- Tom Soucy – Cass County
- Kyle Litchy – Cass County
- Hali Durand/Barrett Voigt – Cass County
- Tyler Odegaard – Normanna Township
- Dennis Biewer – Pleasant Township
- Mark Hiatt – Pleasant Township
- Michael Johnson – NDDOT
- Richard Duran – FHWA
- Steve Hall – Kindred School District
- Andy Westby – Norman Lutheran Church
- James Nyhof – City of Oxbow

The SRC meeting agendas and notes are in Appendix 8.1 at the end of this report.

6.2 PUBLIC INPUT MEETING

The public input meeting for the project was held on December 4th, 2018 at the Kindred High School from 6:00 pm to 8:00 pm. The Public Notice for the public input meeting was published in the November 26th edition of the *Fargo Forum* newspaper and the November 28th edition of the *Cass County Reporter*. A copy of the affidavit of publication is included in Appendix 8.2 at the end of this report. In addition to the published public notices, public meeting flyers were posted in public gathering places and mailed to all landowners along the project study area. The meeting was also advertised on Metro COG's Facebook site and the CR 18 study website.

The meeting was an open house format with several members of the SRC available for questions and comments. The information available at the meeting included four display boards that provided information on the following items:

- Existing and Proposed Roadway Typical Sections
- Roadway Alignment Alternatives
- Roadway Alignment Alternatives with ROW Impacts
- Roadway Alignment Alternative Hydraulic and Flooding Impacts

The four display boards are included in Appendix 8.3 at the end of this report.

The public was given an opportunity to comment on the study and information provided at the public meeting through comment sheets and post cards provided at the public meeting. Comments were allowed to be left in a comment box at the meeting or mailed to Houston Engineering, Inc. by December 21st, 2018. A copy of the comment sheet and note card provided at the public meeting are shown in

Appendix 8.4 at the end of this report. The public meeting sign-in sheets completed by attendees are in Appendix 8.5 at the end of this report.

For those unable to attend the public meeting in-person, comment opportunities via email and standard mail from the beginning of public input notice to December 21st, 2018

6.3 PUBLIC INPUT MEETING COMMENTS

The comments that were received during or after the public meeting are in Appendix 8.6 at the end of the report. The comments were provided to the SRC and reviewed. The comments were taken into consideration when discussing any of the alignment alternatives or additional items in the study. For any comments that had questions, the question and answer are provided in the following.

Question 1:
If Alt. A – Does County purchase land from owner, Does County take financial responsibility for new/enlarged bridge construction & maintenance? How are land owners reimbursed for encroachment?

Answer: The County will take financial responsibility for the bridge construction and maintenance. Land owners would be compensated for purchased ROW according to the typical procedures of Cass County.

7 ALTERNATIVE ANALYSIS

7.1 ALIGNMENT ALTERNATIVES

The alternatives included in this report were developed with input provided by the SRC members throughout the project and attendees at the public input meeting. The alternatives were developed by taking into consideration the potential impacts of erosion due to the Sheyenne River at areas adjacent to the existing 52nd Street SE roadway and impacts to existing property owners along the roadway. The alternatives included in this report were developed to a planning level and no topographical survey or design level information was used. The alternatives are to be considered preliminary and for information purposes only.

The banks of the Sheyenne River are susceptible to erosion due to water movement. The scope of this study did not allow for geotechnical review or topographical survey of the river and the adjacent land. Near the Sheyenne River crossing in the area of the Norman Lutheran Church, the Sheyenne River bank is eroding and, dependent on future erosion to the river bank, may encroach on the existing 52nd Street SE roadway ROW. The Sheyenne River bank erosion near the 52nd Street SE roadway ROW is a significant consideration in the roadway alignments for the Sheyenne River Crossing and Relocate Church Alternative that are off the existing roadway alignment.

7.1.1 EXISTING ALIGNMENT ALTERNATIVE (THE NO-BUILD ALTERNATIVE)

The Existing Alignment Alternative serves as the no-build alternative for the study. This alternative would include no physical changes to the roadway and continuance of the existing maintenance activities for the roadway. The ownership of the roadway by the Townships or the County does not alter this alignment alternative. The existing 52nd Street SE alignment and typical section are shown in Figure 1 and Figure 2. Also included in Figure 2 is the typical section for existing CR 18 east of the study area.

Three typical sections are shown in Figure 2; one for the existing aggregate surfaced roadway section on 52nd Street SE throughout the study area, CR 18 for the section within 2 miles of CR17, and one for the bridge section across the Sheyenne River. The 52nd Street SE roadway section is currently an aggregate surface with open ditch drainage along both the north and south sides of the roadway. As shown in Figure 2, the roadway, ditch, and ROW widths vary based on the location within the corridor, but the aggregate surface is typically 28 to 30 feet wide. The CR 18 typical section is similar to the 52nd Street SE typical section with a slightly wider aggregate surface of approximately 30 to 32 feet.

7.1.2 EXISTING ALIGNMENT WITH CASS COUNTY TYPICAL ROADWAY SECTION ALTERNATIVE

The Existing Alignment with Cass County Typical Roadway Section Alternative maintains the roadway on the existing alignment, but reconstructs the typical section to the Cass County typical roadway section for either an aggregate or paved roadway. The Cass County aggregate and paved surface typical roadway sections are shown in Figure 14. The roadway alignment for this alternative is shown in Figure 15. The Cass County typical roadway sections' ROW is wider than the existing 52nd Street SE typical roadway section. The driving surface for the county typical aggregate surface roadway section is approximately the same width as the existing aggregate surface of 52nd Street SE and the driving surface for the county typical paved surface roadway is two feet wider than the existing aggregate surface of 52nd Street SE. In

areas that the wider Cass County typical roadway section would impact buildings, landscaping, or other physical property, Cass County will modify the typical roadway section to minimize any impacts to property owners. The typical roadway sections included in Figure 14 are to be considered the County typical roadway section for the Sheyenne River Crossing and Relocate Church alternatives.

Similar to the Existing Alignment Alternative, the Existing Alignment with Cass County Typical Section Alternative may have issues with the Sheyenne River bank eroding near the existing 52nd Street SE roadway ROW.

7.1.3 SHEYENNE RIVER CROSSING ALTERNATIVES

The Sheyenne River Crossing Alternatives were developed in a proactive manner to address any potential erosion issues with the river bank impacting the existing roadway grade and ROW. Cass County stated early in the project that there have been difficulties in finding long-term solutions to river bank erosion issues due to the soil types in Cass County. Many of the prior permanent erosion control solutions implemented by Cass County have not resolved the issue long-term and, in many cases, have resulted in the County reconstructing the roadway alignment in a location with limited potential for erosion issues due to the Sheyenne River.

The previous experiences of the County with erosion issues, in addition to the limited available width for a roadway between the church and the river bank, led the SRC to develop Sheyenne River Crossing Alternatives that realigned a mile of roadway on either side of the crossing to either the north or south. The north and south alternatives are included as Alternative A, Alternative B, and Alternative C. The Sheyenne River Crossing Alternatives would only be constructed if either the Sheyenne River bank erosion issue further expanded to impact 52nd Street SE or at the end of the serviceable life of the Sheyenne River Crossing bridge. Further discussion of the implementation of the Sheyenne River Crossing Alternatives is included in the Implementation Plan Section

Each of the Sheyenne River Crossing Alternatives do include the County typical roadway section on the remaining 52nd Street SE alignment, but it is not shown in each of the figures for the alternatives.

7.1.3.1 SHEYENNE RIVER CROSSING ALTERNATIVE A

The Sheyenne River Crossing Alternative A is shown in Figure 16. Alternative A is the alternative that realigns the roadway the furthest south to cross the Sheyenne River. This alternative would avoid all physical structures and provide access to all land parcels. Additional information of the alternative is available in the following sections of this report.

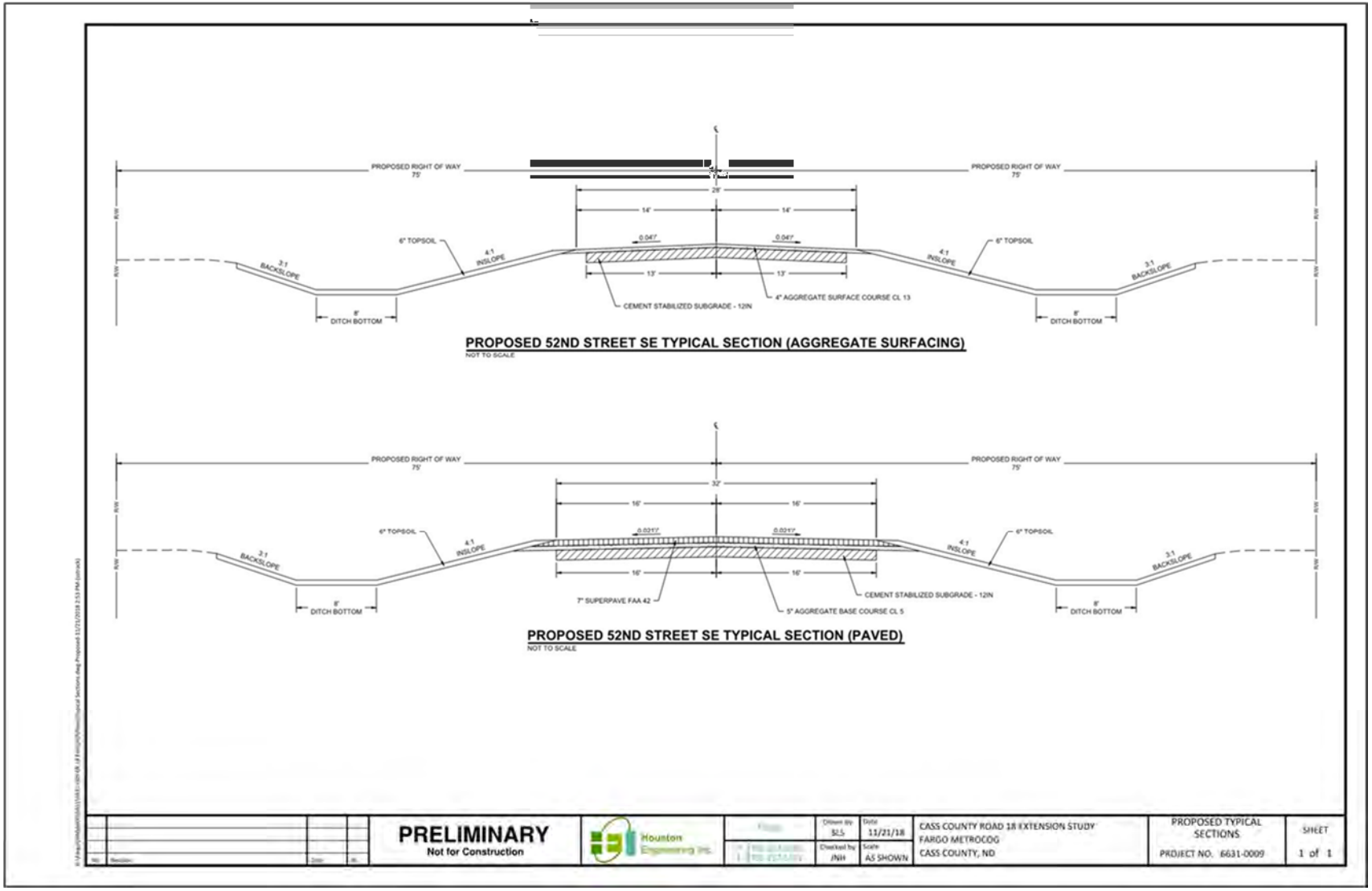

Figure 14. Cass County Typical Roadway Sections

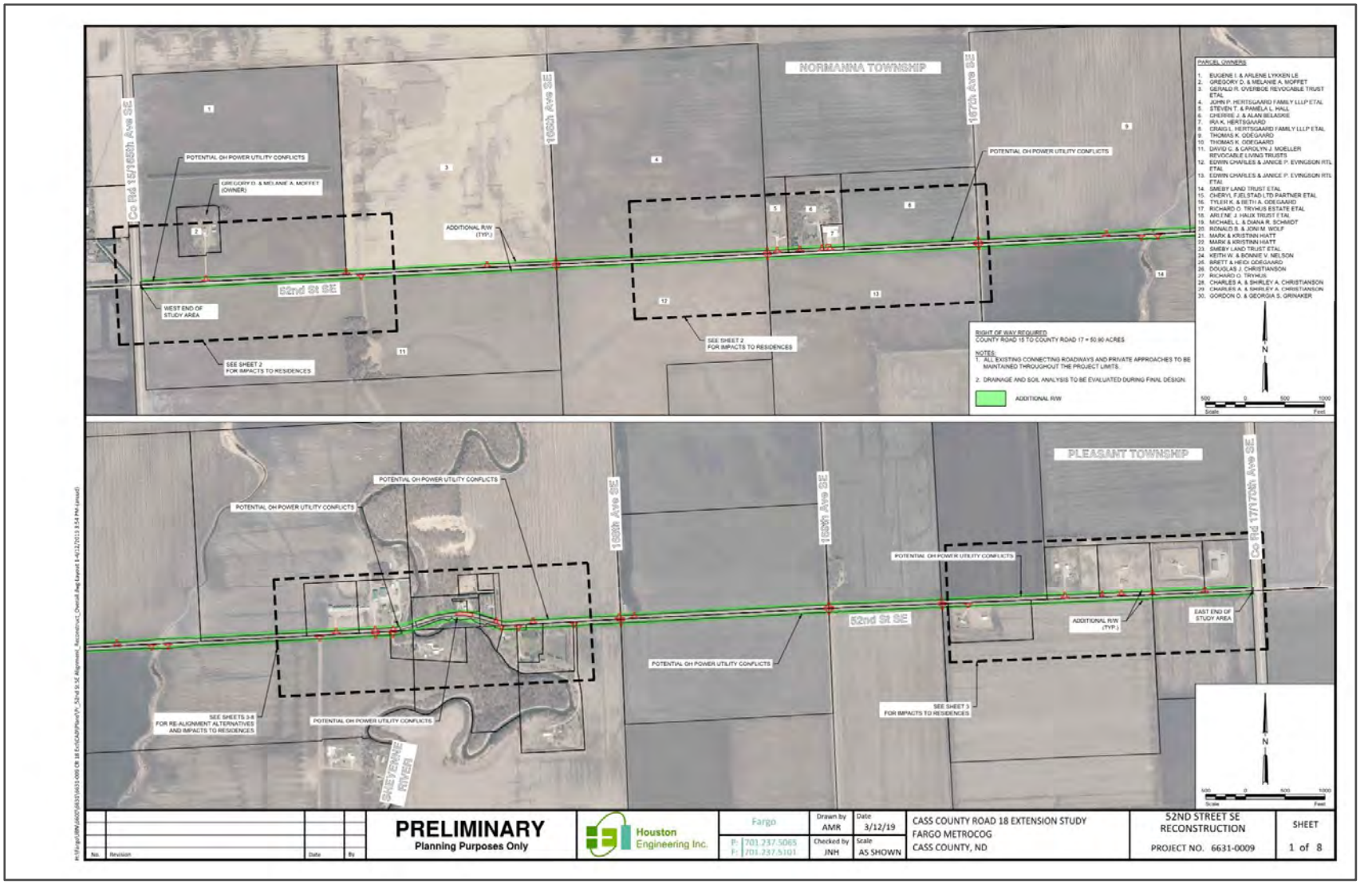

Figure 15. Existing Alignment with Cass County Typical Roadway Section Alternative

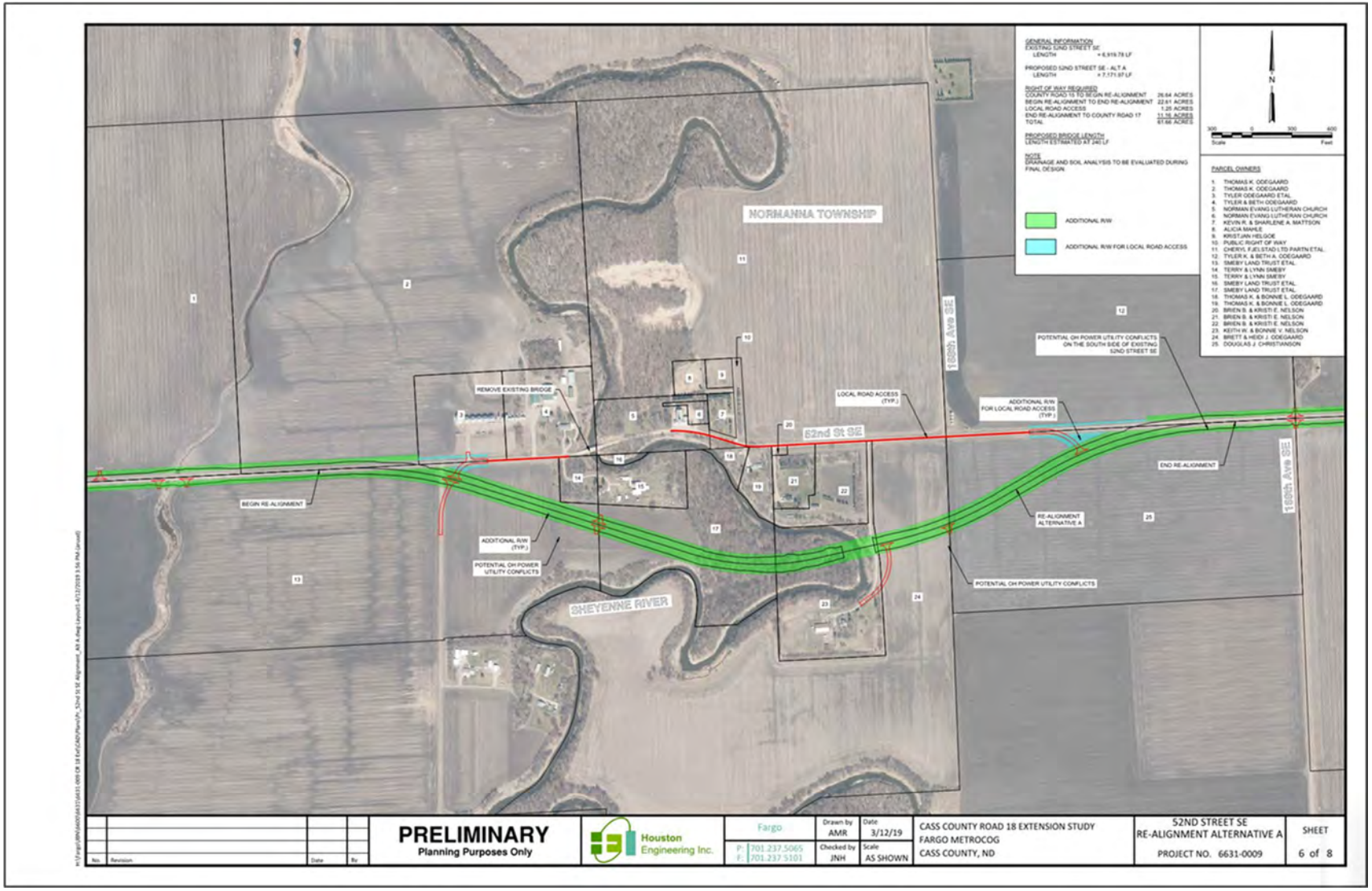

Figure 16. Sheyenne River Crossing Alternative A

7.1.3.2 SHEYENNE RIVER CROSSING ALTERNATIVE B

The Sheyenne River Crossing Alternative B is shown in Figure 17. Alternative B realigns the roadway slightly to the north of the existing alignment east of the Sheyenne River Crossing and to the south of the existing roadway west of the Sheyenne River Crossing. Early in the development process for the alternatives, the SRC decided to include an alternative that minimized the impacts to dividing agricultural land in the area adjacent to the crossing. In order to accomplish the goal of minimizing agricultural impacts, the SRC considered an alignment that may cross existing residential properties and result in property buyouts. The property shown as being purchased for this alternative is shown for informational purposes only and the property owner was contacted and informed of the location of the alignment prior to development of this alternative. If the County assumes ownership of the existing roadway and a Sheyenne Crossing Alternative is needed in the future, the County intends to work with the property owner on an acceptable timeline and agreement for purchase and removal of the property, if this Alternative is selected in future analysis. Additional information on the alternative is available in the following sections of this report.

7.1.3.3 SHEYENNE RIVER CROSSING ALTERNATIVE C

The Sheyenne River Crossing Alternative C is shown in Figure 18. Alternative C is the alternative that realigns the roadway the to the north to cross the Sheyenne River. This alternative would avoid all physical structures and provide access to all land parcels. Additional information of the alternative is available in the following sections of this report.

7.1.4 RELOCATE CHURCH ALTERNATIVE

As previously discussed in this report, the Sheyenne River bank is eroding near the Norman Lutheran Church. Directly across from the Norman Lutheran Church, the top of the Sheyenne River bank is estimated to be approximately 10 feet from the edge of the roadway ROW. The scope of this study did not allow for a topographical survey so the exact location of the top of the river bank in correlation to the roadway is not accurately known. As an additional alternative to be considered, the relocation of the Norman Lutheran Church was included as an alternative. The Relocate Church Alternative is shown in Figure 19.

The Relocate Church Alternative would relocate the church to allow for the proposed roadway alignment centerline to be realigned approximately 90 feet north of the existing alignment centerline. The realignment north would allow for maintaining the existing Sheyenne River Crossing bridge while also providing more offset distance between the Sheyenne River bank and the proposed roadway. Additional information of the alternative is available in the following sections of this report.

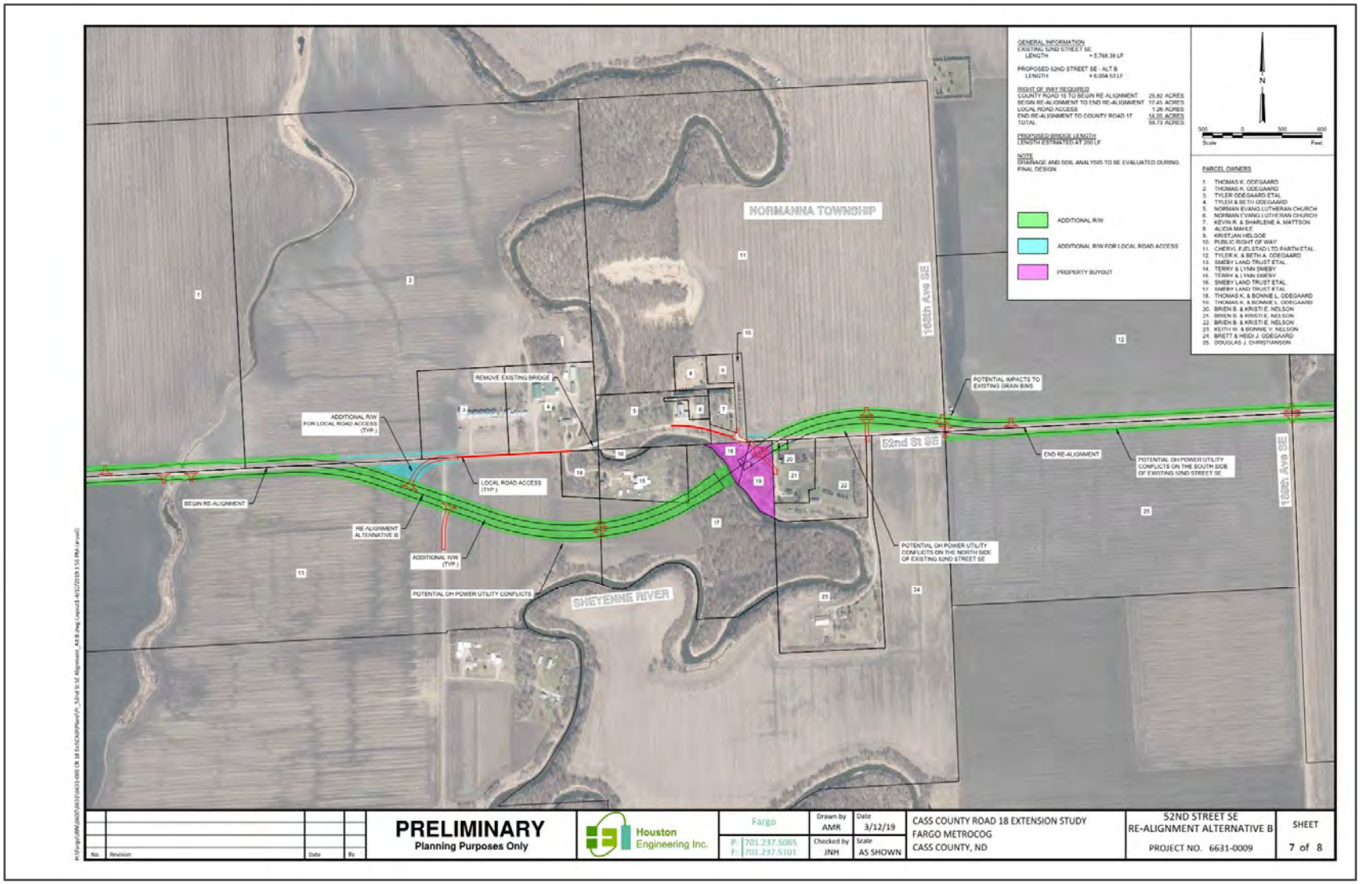

Figure 17. Sheyenne River Crossing Alternative B

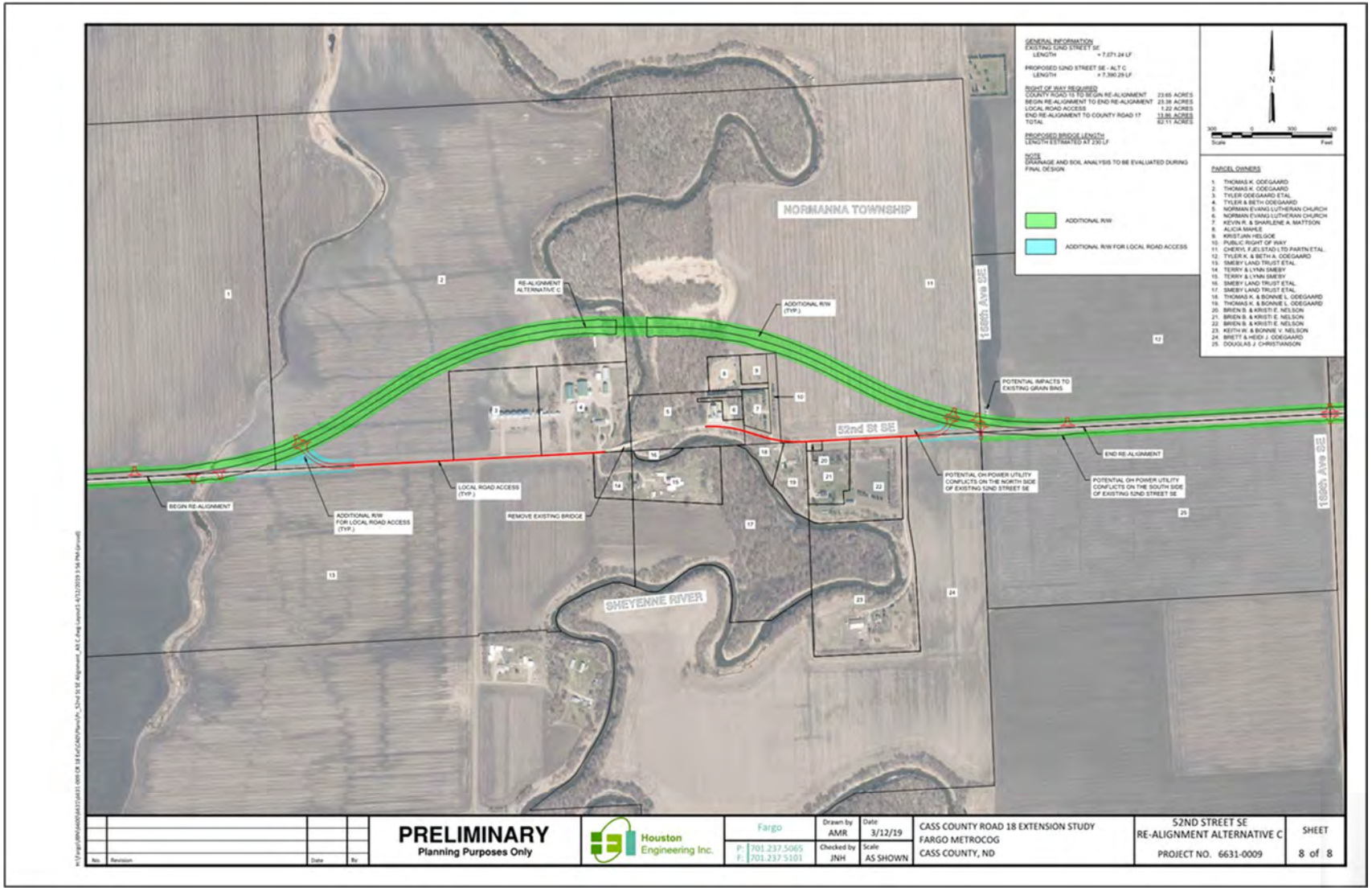

Figure 18. Sheyenne River Crossing Alternative C

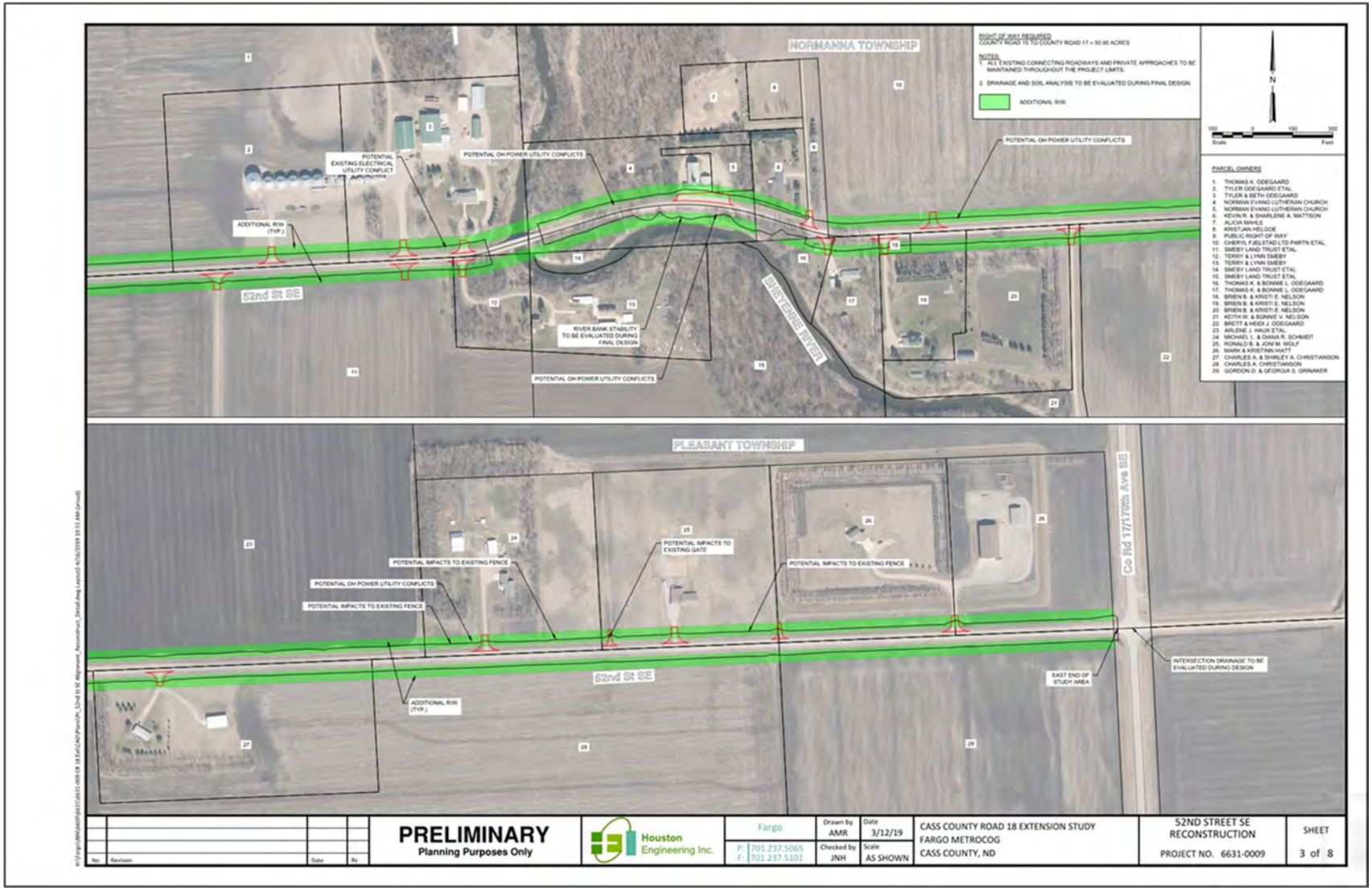

Figure 19. Relocate Church Alternative

7.2 ALIGNMENT ALTERNATIVE OPINIONS OF PROBABLE COST

The total costs of construction for each of the alternatives are included in Table 8. The opinion of probable cost for each alternative included in Table 8 includes reconstruction and ROW acquisition of the entire five miles of roadway in the study area and bridge construction if included in the alternative.

Table 8. Opinion of Probable Cost for Alternatives

Study Alternatives	Aggregate Surface	Paved Surface
Existing Alignment Alternative (No-Build)	$0	---
Existing Alignment with County Typical Section	$2,796,800	$6,628,100
Sheyenne River Crossing Alternative A	$4,793,300	$8,685,500
Sheyenne River Crossing Alternative B	$4,922,250	$8,794,200
Sheyenne River Crossing Alternative C	$4,624,900	$8,535,100
Relocate Church	$3,121,600	$6,967,700

7.3 IMPLEMENTATION PLAN FOR ALTERNATIVES

The 52nd Street SE roadway between CR 15 and CR 17 is currently owned by the Townships. As shown in Figure 1, Pleasant Township owns approximately one mile of the roadway and Normanna Township owns approximately four miles of the roadway. Prior to this study, Normanna Township discussed with Cass County to have the County take ownership of the roadway so that Normanna Township would no longer have to maintain the roadway. As discussed in upcoming sections of this report, Cass County will only take ownership of this roadway if both Normanna and Pleasant Townships agree to transfer ownership of the roadway to the County. The County is not pursuing ownership of 52nd Street SE, but will take ownership if both Townships agree.

The implementation of all the alternatives included in this report are dependent on the transfer of ownership of 52nd Street SE to Cass County. All the alternatives may be considered by the Townships, but it is unlikely that any would be feasible due to budgetary limitations. The implementation time horizon for any of the alternatives is not finite or set by any of the agencies associated with this project. The Study Implementation Plan and Time Horizon are shown in Figure 20. The implementation time horizon would be determined in the “near-term” phase by the Townships. If ownership of the roadway is transferred to the County, the “mid-term” phase time horizon would be dependent on County funding and project programming and the “long-term” phase time horizon would be dependent on the status of the Sheyenne River Bank erosion and reconstruction needs of the Sheyenne River Bridge. Time horizon estimates for implementation of the phases is not feasible to estimate at this point in the study as the timing is largely dependent on the transfer of ownership and other items that are not easily estimated based on information available in this study.

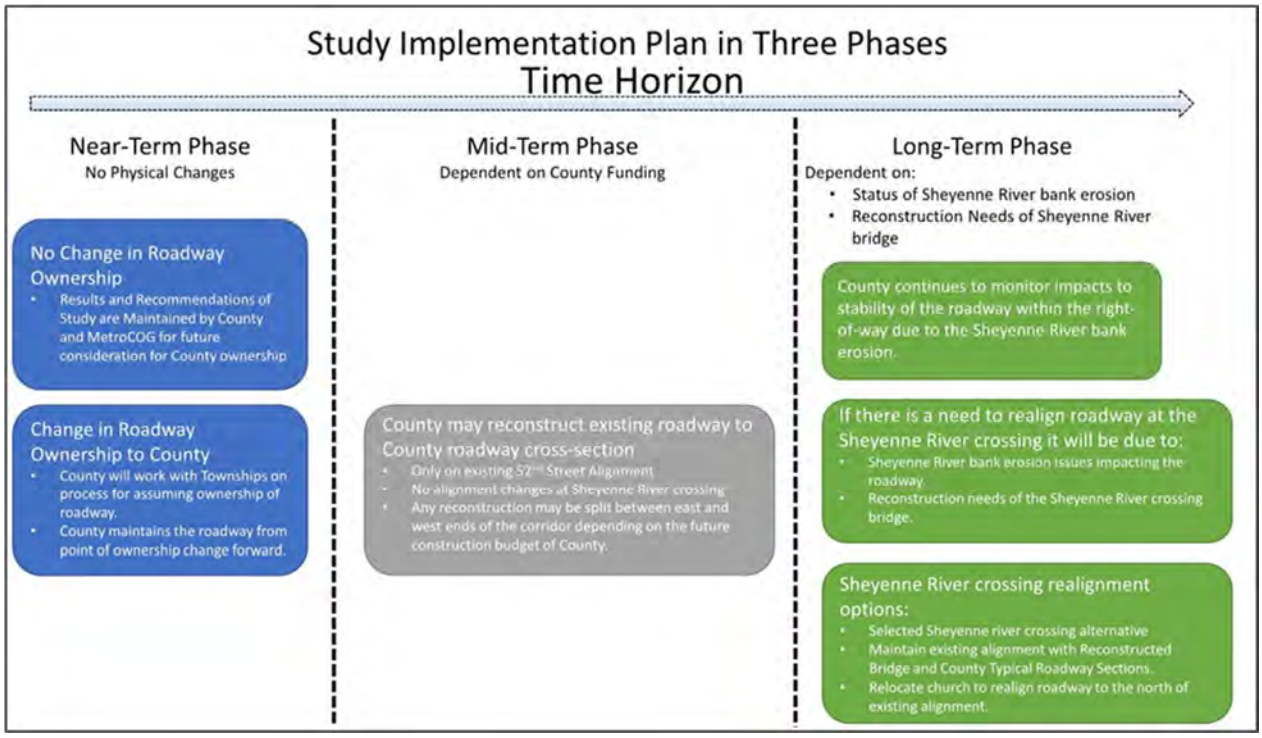

Figure 20. Study Implementation Plan and Time Horizon

The information included in Figure 20 provided further detail on each of the three phases of the implement plan and scenarios within each phase of the implementation plan. As shown in the implementation plan figure, the “near-term” phase would include no physical changes to the roadway and would include similar maintenance of the roadway into the future. The “mid-term” phase would only include typical roadway section or other physical changes on the existing alignment. Any reconstruction during the “mid-term” phase could be split into a number of seasons or phases dependent on funding and landowner coordination. The “long-term” phase of the implementation plan includes the Sheyenne River Crossing Alternatives and the Relocate Church Alternative.

Along with the Implementation Plan for the Alternatives, a Decision Tree was developed to further show the path of decisions that may be made with any future actions. The Decisions Tree for this study is shown in Figure 21. The Decision Tree includes the same time horizon and three phases as the implementation plan, but displays the order and path of decisions to be made on any future project. As shown in the Decision Tree, each of the alternatives included in this report are classified as a “near-term”, “mid-term”, and “long-term” phase decision and action.

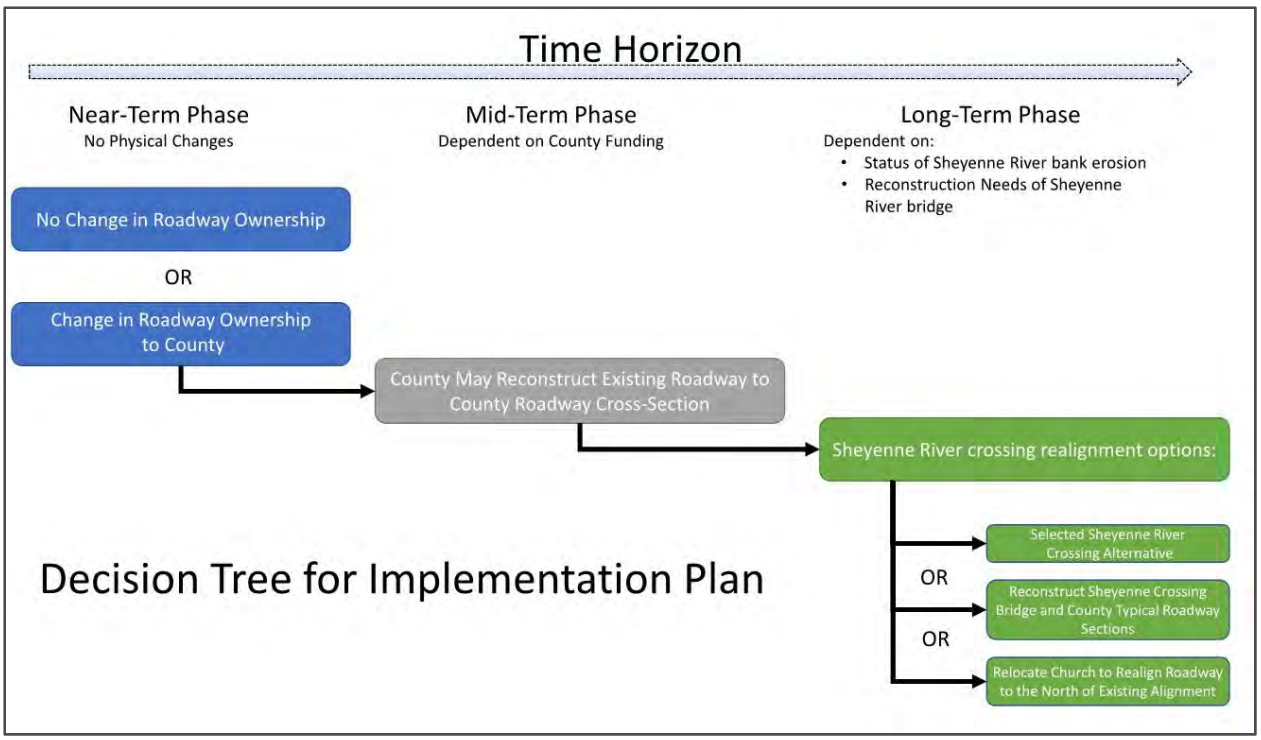

Figure 21. Decision Tree for Future Phases

7.4 ALIGNMENT ALTERNATIVE ATTRIBUTES AND CRITERIA FOR ANALYSIS

Throughout this study and the public input process, several questions were asked about specific alternative attributes and criteria that should be considered for analysis of alternatives. Specific areas of concerns were identified during the public input process; ROW impacts and acquisition, drainage and flooding impacts, and costs of construction. The three items previously mentioned will be further discussed within this section of the report.

7.4.1 RIGHT-OF-WAY IMPACTS AND ACQUISITION

All of the build alternatives included in this report will required different amounts of ROW from adjacent landowners. The County has a defined process that is followed for any ROW acquisition that follows a defined process for appropriately informing and compensating landowners that may be have property that is proposed to be acquired. In addition to the established ROW acquisition process the County follows, the County will work with property owners to minimize any disruption to structures, landscaping or other items that the owner would like to maintain.

The amount of ROW necessary to be acquired for each alternative is shown in the figures included for each alternative. Due to the scope of work for this study, the amount of ROW necessary is only an estimate and not to be considered a design level quantity.

7.4.2 DRAINAGE/FLOODING IMPACTS

7.4.2.1 EXISTING CONDITIONS

Local drainage and flooding have always been concerns in the Red River Valley, especially when roadways are intended to be altered, such as in the alternatives presented in this report. Upstream of this study area, throughout Richland and Cass Counties, the flooding generally originates from either the Sheyenne River or the Wild Rice River. As the capacity of these rivers is exceeded, flood waters tend to break out of the channel banks and flow overland, backing up behind roadways prior to overtopping and continuing to flow from section to section in a northeasterly direction.

Using the existing hydraulic models created for the Fargo-Moorhead Area Diversion Project, existing conditions flooding in the study area was reviewed. The model used for this study simulates 100-year riverine flooding from the Sheyenne River and the Wild Rice River. Near the study site, water breaks out of the west banks of the Sheyenne River and it flows overland to 52nd Street SE, west of the Norman Lutheran Church. Water also breaks out of the Sheyenne River to the east as it cascades north and east along 52nd Street SE. Further to the east, along the existing County Road 18, water breaks out of the Wild Rice River and Drain 37 prior to overtopping County Road 18. Water also overtops County Road 18 at the Wild Rice River structure. The existing conditions flooding was presented at the public meeting and several residents concurred with the overall drainage patterns and overtopping representations.

7.4.2.2 PROPOSED CONDITIONS WITH ALTERNATIVES

From a flooding perspective, future design of County Road 18 should include a detailed hydraulic analysis to minimize impacts from the project. For this study, no detailed design or analysis was conducted, however, the previously created FM Diversion model (existing conditions) was used to simulate the effects of the potential alternatives (A, B, and C) in the vicinity of the Norman Lutheran Church. Figure 22, Figure 23, andFigure 24 present the flooding extents and impacts for the various alternatives.

7.4.2.3 IMPACTS OF THE FARGO-MOORHEAD DIVERSION PROJECT

The FM Diversion Project will not affect the proposed extension of County Road 18 or the Sheyenne River crossing near the Norman Lutheran Church. However, additional flooding depths are expected during diversion operations for the current stretch of County Road 18 near the Wild Rice River. The depth of this flooding is dependent on the frequency of event (50-year, 100-year, etc.), and based on historic records the project will not have ever operated during the growing season. Figure 25 presents expected existing conditions flooding for the 10-, 20-, and 100-year flood events, without the diversion project, and Figure 26 presents flooding with the diversion in place and operating.

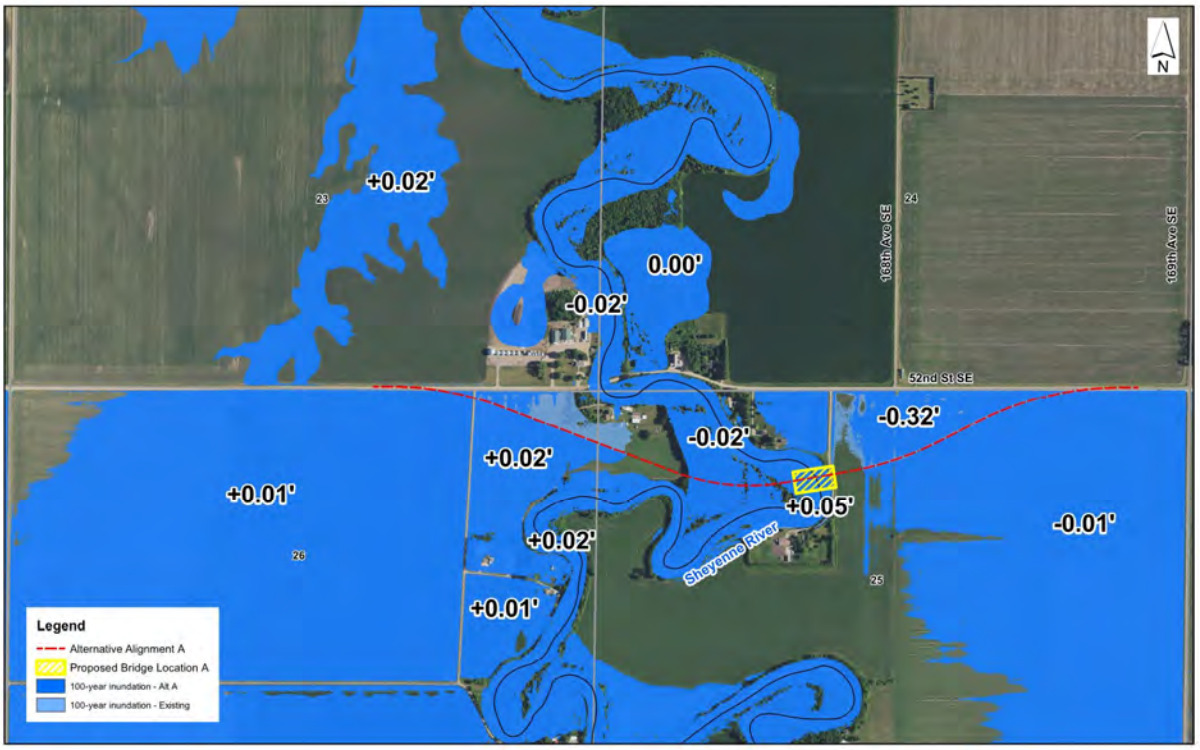

Figure 22. Alternative A Flooding Extent and Impacts

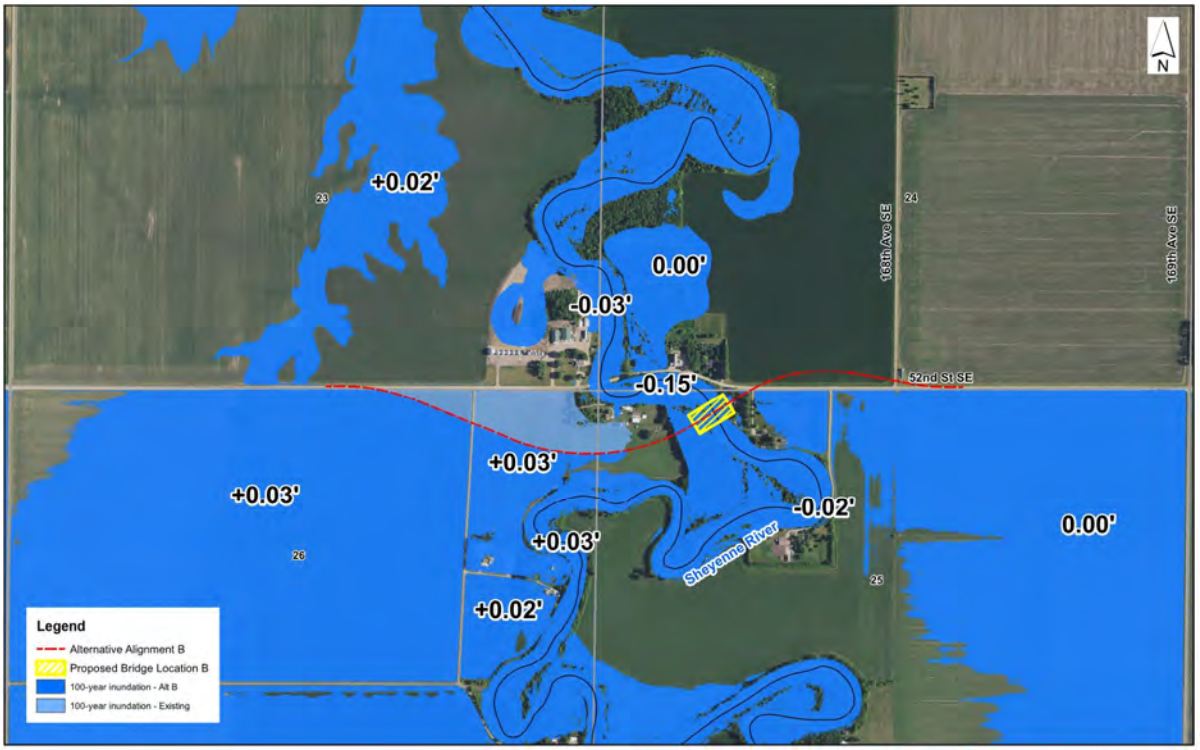

Figure 23. Alternative B Flooding Extent and Impacts

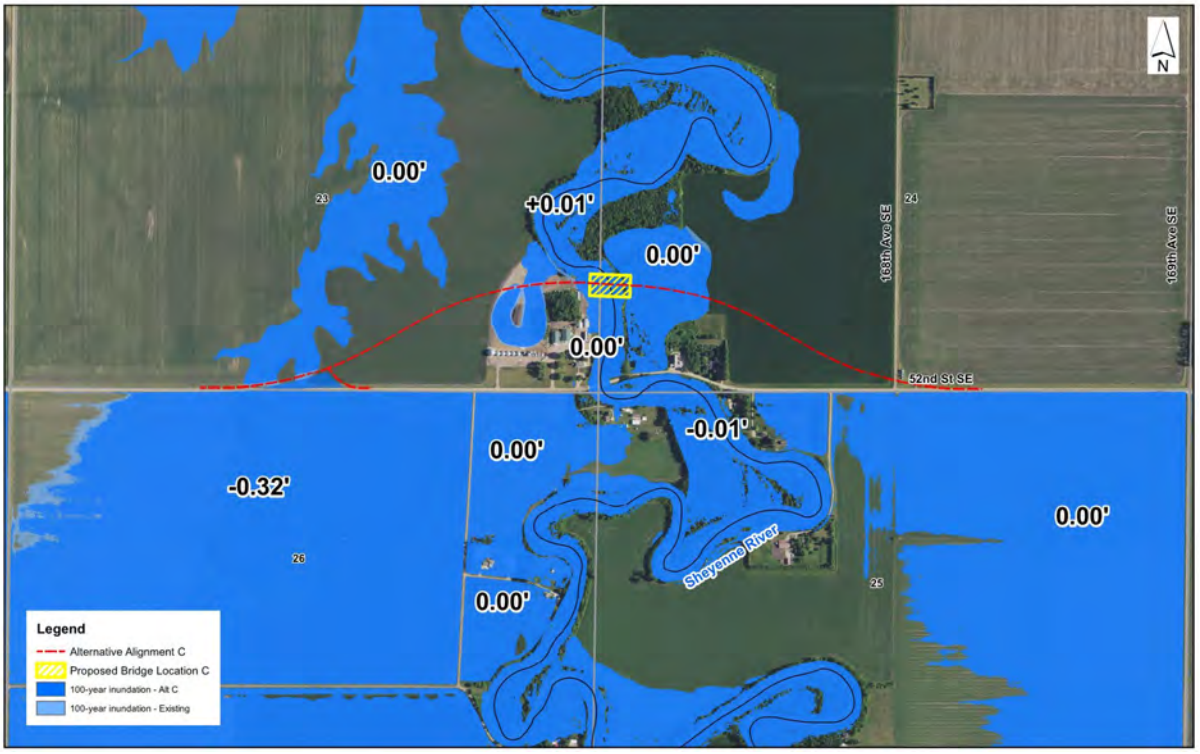

Figure 24. Alternative C Flooding Extent and Impacts

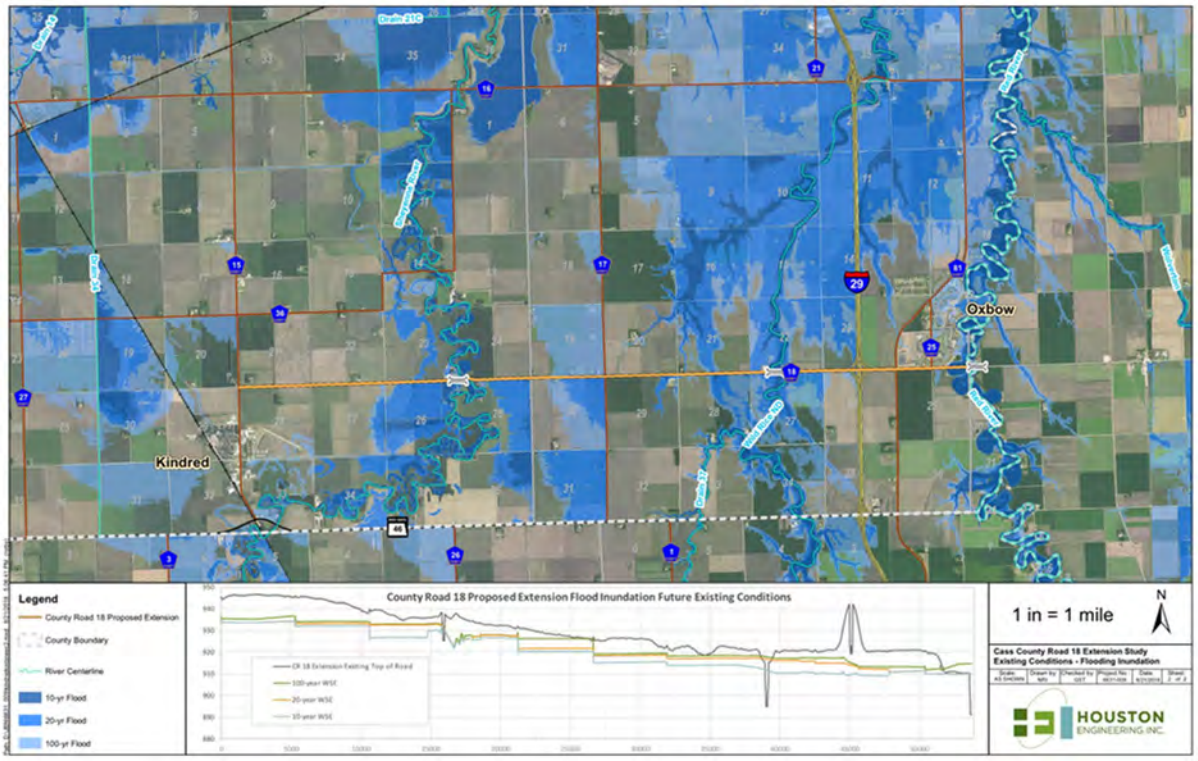

Figure 25. Existing Conditions Flooding without Diversion

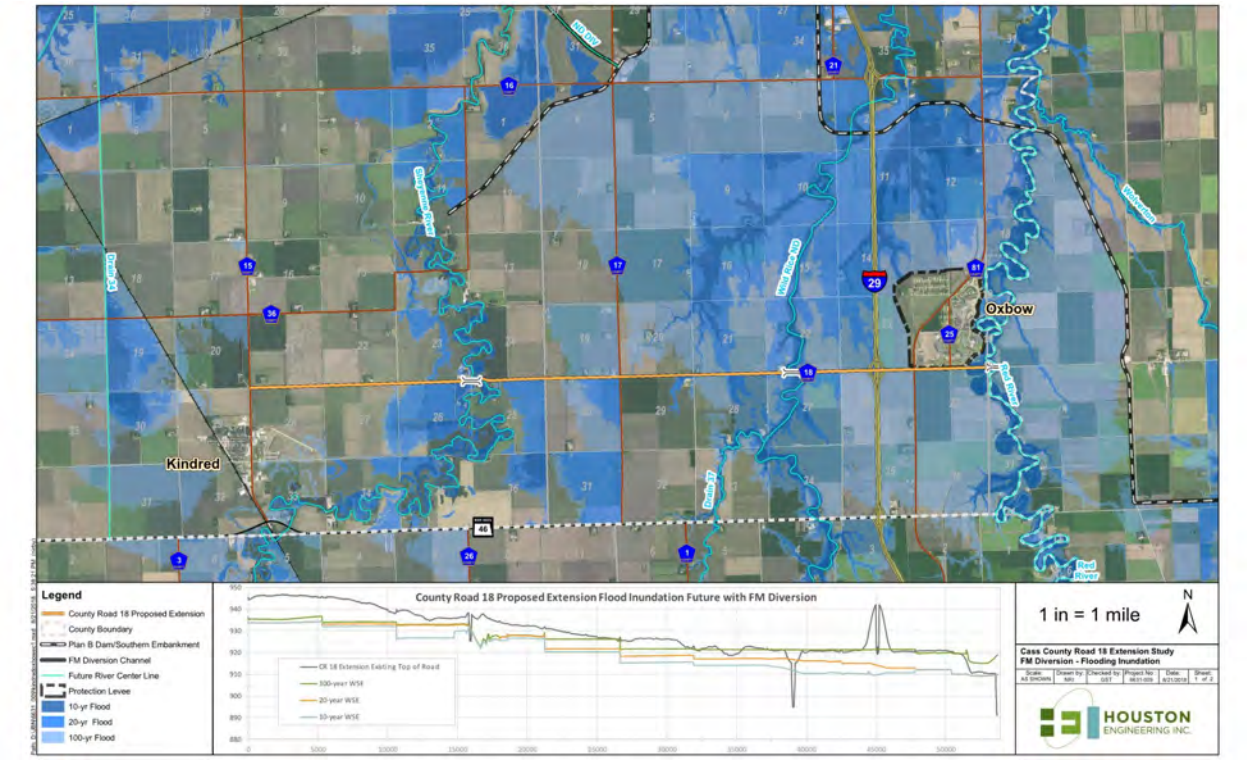

Figure 26. Existing Conditions Flooding with Diversion

7.5 SHEYENNE RIVER CROSSING ALTERNATIVE COMPARISON AND RANKING

Of the alternatives included in this study, only the Sheyenne River Crossing alternative have multiple sub-alternatives that would require selecting one of the alternatives against the other Sheyenne River Crossing alternatives. The SRC decided to determine a ranking of Sheyenne River Crossing alternatives through an online ranking poll. The methodology, comparison, and rankings of the Sheyenne River Crossing alternatives are included in this section.

7.5.1 METHODOLOGY

The selection of a ranking for the Sheyenne River Crossing alternatives was presented to the SRC. The method to determine the ranking that was proposed by the SRC was to complete an online ranking poll for Alternatives A, B, and C. The ranking was only allowed to be completed by SRC members and it was an anonymous poll. The SRC members were allowed two weeks to complete the poll and they could revise their selection up until the two-week deadline

The SRC decided to determine the final ranking of the alternatives by applying three points for a first ranking, two points for a second ranking, and one point for a third ranking. The combined total points for each alternative was used to determine the final overall ranking.

7.5.2 COMPARISON

To assist the SRC members in completing the rankings of the Sheyenne River Crossing alternatives, the information in Table 9 and Figure 27 were provided to each member in a single page document. The SRC members were also provided with the plan view of each alignment alternative for their reference.

Table 9. Sheyenne River Crossing Alternative Comparison

Comparison of Sheyenne River Crossing Alternatives

Roadway Realignment "Alternatives"

Comparison Metrics	Alternative A "South Alignment Crosses Sheyenne 900' South"	Alternative B "South Alignment Crosses Sheyenne 300' South"	Alternative C "North Alignment"
Construction Costs	Aggregate: $4,793,000 Paved: $8,685,000	Aggregate: $4,922,000 Paved: $8,794,000	Aggregate: $4,625,000 Paved: $8,535,000
Right-of-Way Impacts · Only for Crossing	31.2 Acres	28.2 Acres	31.8 Acres
Flooding/Drainage Impacts	Similar to Alternative B	Similar to Alternative A	Changes Properties Impacted from Existing
Agricultural Impacts · Divides Tract of Land	Similar to Alternative C	Least Amount of Segmented Land	Similar to Alternative A
Impacts to Residential and Farm Accesses	Bridge close to Residential Driveway (Nelson Farm)	Minimal Impact	Minimal Impact
Utility Impacts	Minimal Impact	Minimal Impacts on East Side	Impacts on the East Side

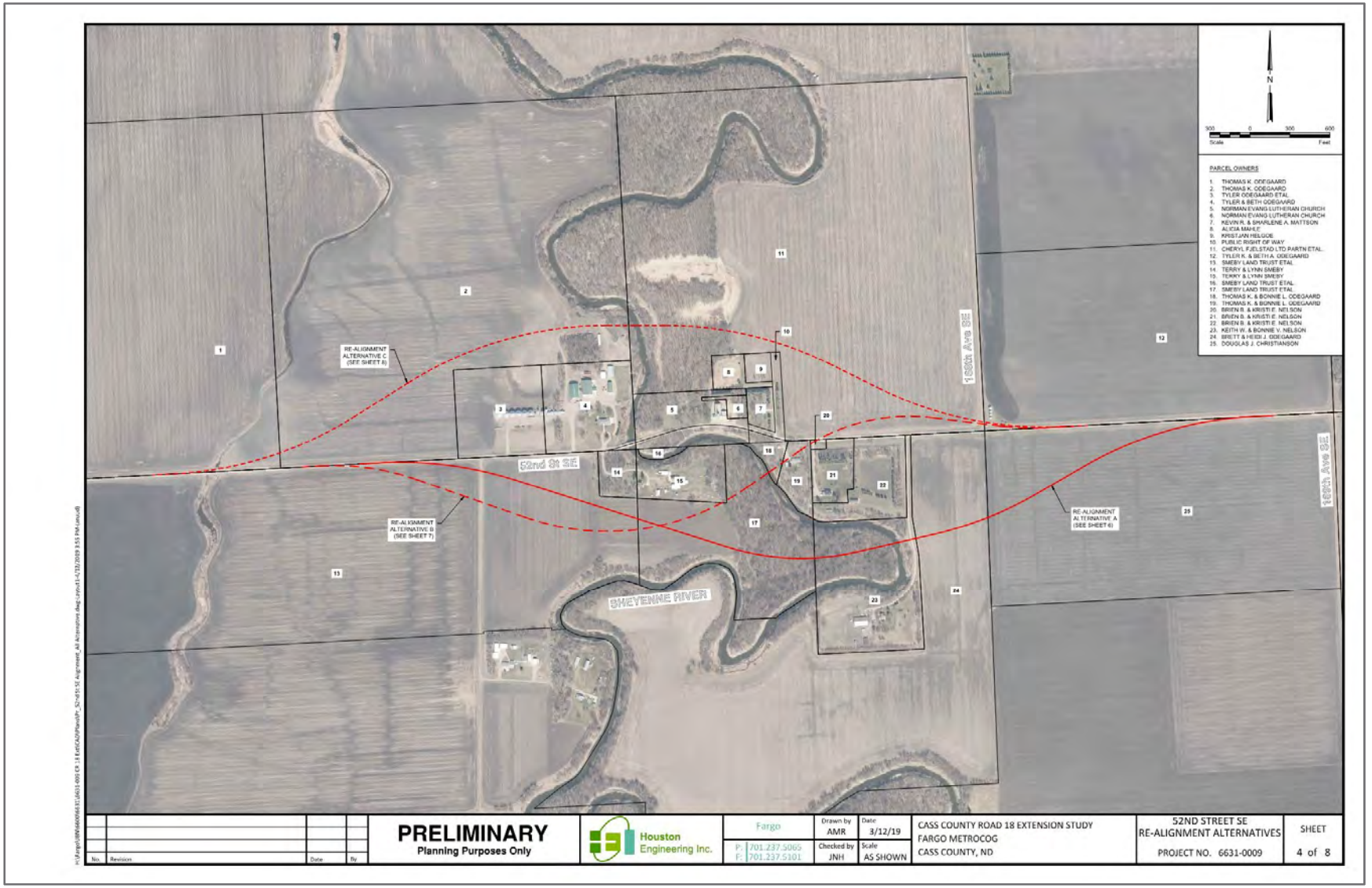

Figure 27. Sheyenne River Crossing Alternatives for Comparison

7.5.3 RANKING OF SHEYENNE RIVER CROSSING ALTERNATIVES

The rankings were completed by eight members of the SRC. A few members chose to abstain from ranking the alternatives for various reasons. A screen grab of the poll website with each participant's ranking is shown in Figure 28. The results of the scoring for the Sheyenne River Crossing alternatives poll is shown in Table 10. Alternative B was ranked first followed by Alternative C ranked second, and alternative A ranked third.

Figure 28. Sheyenne River Crossing Voting by Participant

Table 10. Sheyenne River Crossing Alternative Poll Ranking

Sheyenne River Crossing Alternative	#1 Ranking					#2 Ranking					#3 Ranking					Total	Final Ranking
Alternative A	1	x	3	=	3	2	x	2	=	4	5	x	1	=	5	12	3
Alternative B	4	x	3	=	12	3	x	2	=	6	1	x	1	=	1	19	1
Alternative C	3	x	3	=	9	3	x	2	=	6	2	x	1	=	2	17	2

7.6 ITEMS TO BE COMPLETED FOR THE PROJECT TO MOVE FORWARD

As previously discussed in this report, the 52nd Street SE roadway between CR 15 and CR 17 is currently owned by Normanna and Pleasant Township. As shown in Figure 20 and Figure 21 and discussed in this report, the Townships must initiate any transfer of ownership to Cass County. Cass County did not put a deadline or any time requirements on the Townships to make a decision on transferring ownership to the County, but the Townships would need to initiate the process. In order for the transfer process to be initiated and completed with the County, each Township would need to pass resolutions transferring ownership of each Township's portion of 52nd Street SE to the County. Once the resolutions have been completed by the Townships, the County would complete a resolution to accept ownership of the roadway. Legal and official documents for the transfer of ownership process should be coordinated between the Townships and the County, and not solely based on any information provided in this report. Information provided in this section is for informational purposes only.