



engineering · planning · environmental · construction

701 Xenia Avenue South
Suite 300
Minneapolis, MN 55416
Tel: 763-541-4800
Fax: 763-541-1700

Turn Lane Assessment Memorandum

To: *Darren Laesch, PE, MnDOT District 2*

From: *Jack Corkle, PTP, AICP, WSB & Associates, Inc.*

Date: *May 5, 2016*

Re: *TH 11 Corridor Turn Lane Assessment and Recommendations
WSB Project No. 03063-000*

The purpose of this memo is to assess turn lanes on TH 11 between Greenbush and Roosevelt and to provide recommendations for additional turn lanes along the corridor. The memo is divided into six sections.

Section 1 provides general information on TH 11 and the area in which the study is occurring.

Section 2 provides information on the importance of turn lanes in supporting safety and mobility objectives.

Section 3 provides information on existing turn and bypass lanes on the TH 11 corridor.

Section 4 provides information on the rationale for additional turn lanes. Within this section, existing and future characteristics of the TH 11 corridor are identified, including crash and consistency issues that may be effectively addressed by the addition of turn lanes.

Section 5 provides information on the criteria for additional turn lanes. Within this section, policies and priorities for turn lane construction are identified.

Section 6 identifies potential locations for the construction of additional turn lanes based on the criteria and issues identified in earlier sections of the memo. Lists of recommended locations are provided for right- and left-turn lanes.

1. Study Background Information

TH 11 is the primary east-west route for communities located near the Canadian border including Greenbush, Badger, Roseau, Warroad and Roosevelt (**Figure 1**). It serves an important connection to international border crossings with Canada – including one that is open year-round, 24 hours a day. The corridor is home to two major employers, Polaris and Marvin Windows, as well as the Seven Clans Casino, which is also a larger employer for the area. In addition, Lake of the Woods borders the corridor in Warroad. Much of the area between the communities along the corridor is largely undeveloped, with a smattering of manufactured home communities, contractor yards, agricultural uses, isolated businesses, residential development, and the Roseau Airport.

The corridor study area covers the approximately 60 miles of TH 11 between Greenbush and Roosevelt. As part of the study, existing and future conditions were evaluated and recommendations for improvements along the corridor will be identified for implementation over the next 20 years. This memo focuses on assessing and providing recommendations for additional turn lanes on the corridor.

2. Importance of Turn and Bypass Lanes

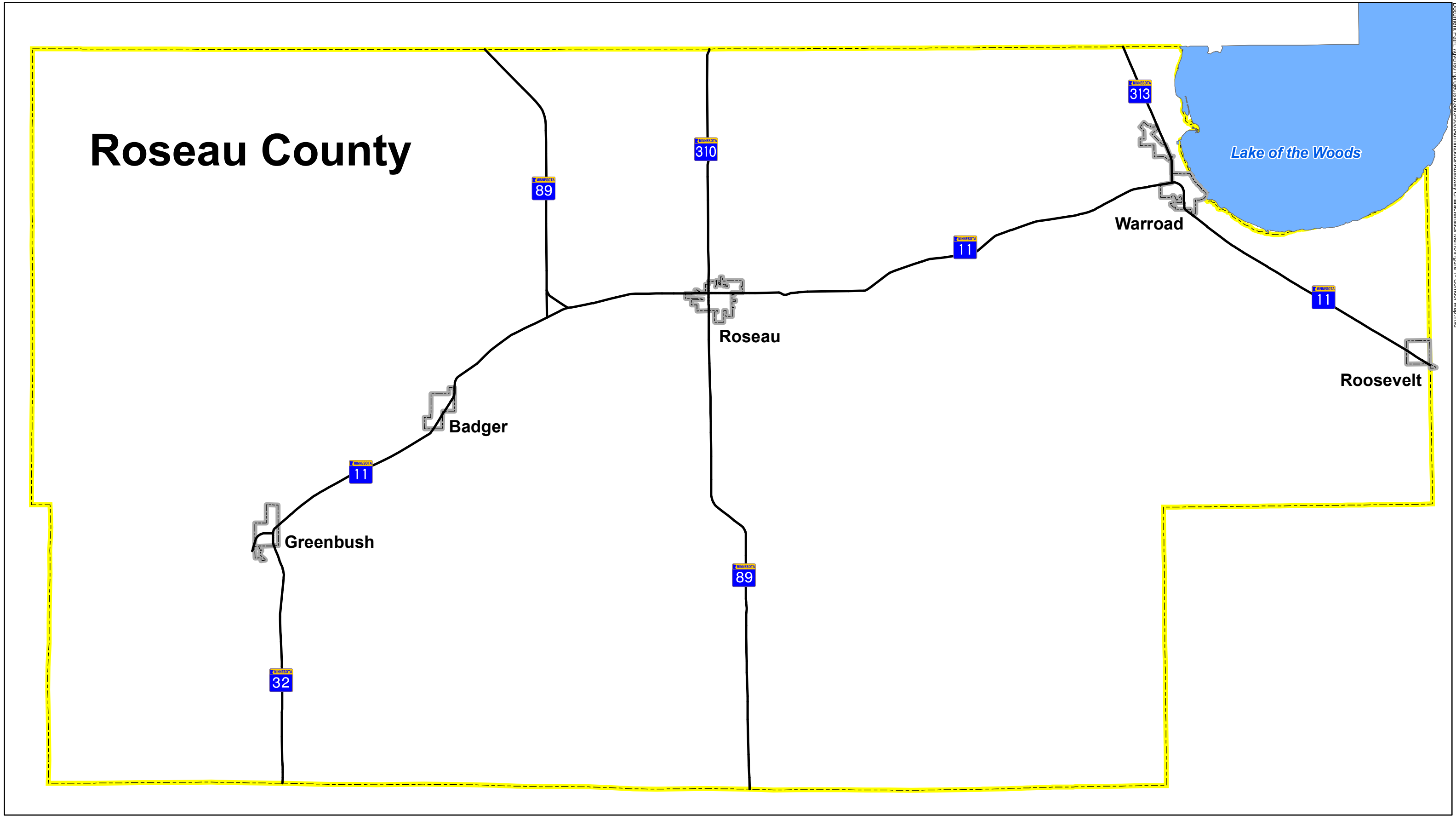
Turn lanes have proven to be an effective measure in reducing crashes on highway facilities as well as enhancing mobility. They are noted in several publications by the Federal Highway Administration, the National Highway Traffic Safety Administration, the Insurance Institute for Highway Safety, the American Association of State Highway and Transportation Officials, the Transportation Research Board and others as an effective counter measure in reducing rear end and angle crashes in both urban and rural environments. They are especially effective in reducing the severity of crashes in locations where travel speeds are higher.

As documented in previous memos, there is little consistency on TH 11 with regard to turn lanes outside of the three-lane sections in Roseau and Warroad, which have a continuous left-turn lane. The inconsistent use of turn lanes can be confusing to motorists and can create situations where drivers may unexpectedly be turning. This can result in rear end crashes, run off the road crashes and sideswipe crashes. Additionally, if left-turning motorists feel rushed because they see the car behind them is not slowing they may turn in front of oncoming traffic, further increasing the likelihood of a crash.

Lack of dedicated turn lanes can also result in inconsistent use of the shoulder. Some right-turning traffic may use the shoulder to decelerate and some may not. Some through traffic may pass left-turning traffic on the shoulder and some will not. This adds to the confusion and cause problems when there are platoons of traffic—you can have motorists making a left turn waiting for oncoming traffic and traffic goes around that driver on the shoulder, only to have someone make a right turn.

All of the above scenarios can be eliminated with the construction of dedicated left- and right-turn lanes.

Bypass lanes, when used appropriately, can also contribute to corridor safety. Bypass lanes are most effective at “T” intersections for left-turns. In these situations they provide motorists with a dedicated area to make a left turn and a space for traffic to go around them without conflicting with other movements. They can contribute to safety problems if left- and right-turns are occurring at the intersection because through and right-turning traffic have to share a space.



Roseau County

Lake of the Woods

Warroad

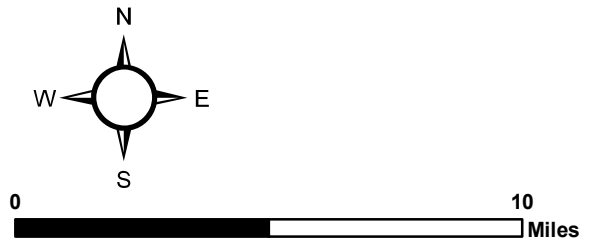
Roseau

Roosevelt

Badger

Greenbush

Figure 1- Corridor Study Area



3. Locations of Existing Turn Lanes and Bypass Lanes

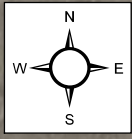
As noted previously, turn lane and bypass lane application on TH 11 is currently inconsistent except for the areas where there is a center left-turn lane in Roseau and Warroad. The tables on the following pages show the location of existing turn lanes on the corridor for public streets as well as a few private driveways. The driveways that have some turn lane configuration are for commercial and residential uses.

Table 1 identifies the location of intersections with dedicated left- and right-turn lanes in at least one direction. A majority of the intersections are “T” intersections. Please note that locations in the three-lane sections of Roseau and Warroad are generally excluded.

Table 1 – Public Streets with Dedicated Left- and Right-Turn Lanes in at Least One Direction

General Area	Intersection/Location	Direction of Travel	Note
Greenbush	TH 11/TH 32	Eastbound	T-intersection – dedicated left- and right-turn lane
Roseau	380th Avenue/18th Avenue NW	Both	
Roseau	15th Avenue NW	Both	T-intersection – Dedicated left- and right-turn lane
Roseau	TH 89/310 and 5th Avenue NW	Eastbound	Dedicated left-turn lane in both directions. Dedicated right-turn lane in eastbound direction. Intersection is signalized.
Roseau	11th Avenue NE	Westbound	Dedicated left-turn lane in both directions. Dedicated right-turn lane in the westbound direction.
Warroad	TH 313/Cedar Avenue NW	Both	At beginning of three-lane section. Intersection is signalized.
Warroad	Gladys Street / private driveway	Both	T-intersection – dedicated left- and right-turn lane
Warroad	Elk Street NW	Both	T-intersection – dedicated left- and right-turn lane
Warroad	Lake Street NW/CR 74 (north junction)	Both	T-intersection – dedicated left- and right-turn lane
East of Warroad	7 Clans Casino (new entrance roadway)	Both	T-intersection – dedicated left- and right-turn lane

Figures 2 -6 show the above locations as well as locations in the three-lane sections with both left- and right-turn lanes in at least one direction.



1 inch = 1,000 feet

-  Left Turn Lane in Both Directions & No Right Turn Lane
-  Left Turn Lane in Both Directions & Right Turn Lane in One Direction
-  Full Compliment of Left & Right Turn Lanes

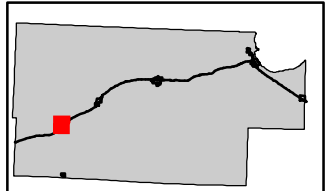
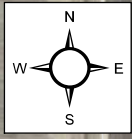


Figure 2
Dedicated Left & Right Turn Lanes
in Greenbush





1 inch = 1,000 feet

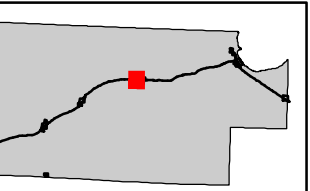


Figure 3 Dedicated Left & Right Turn Lanes in Roseau



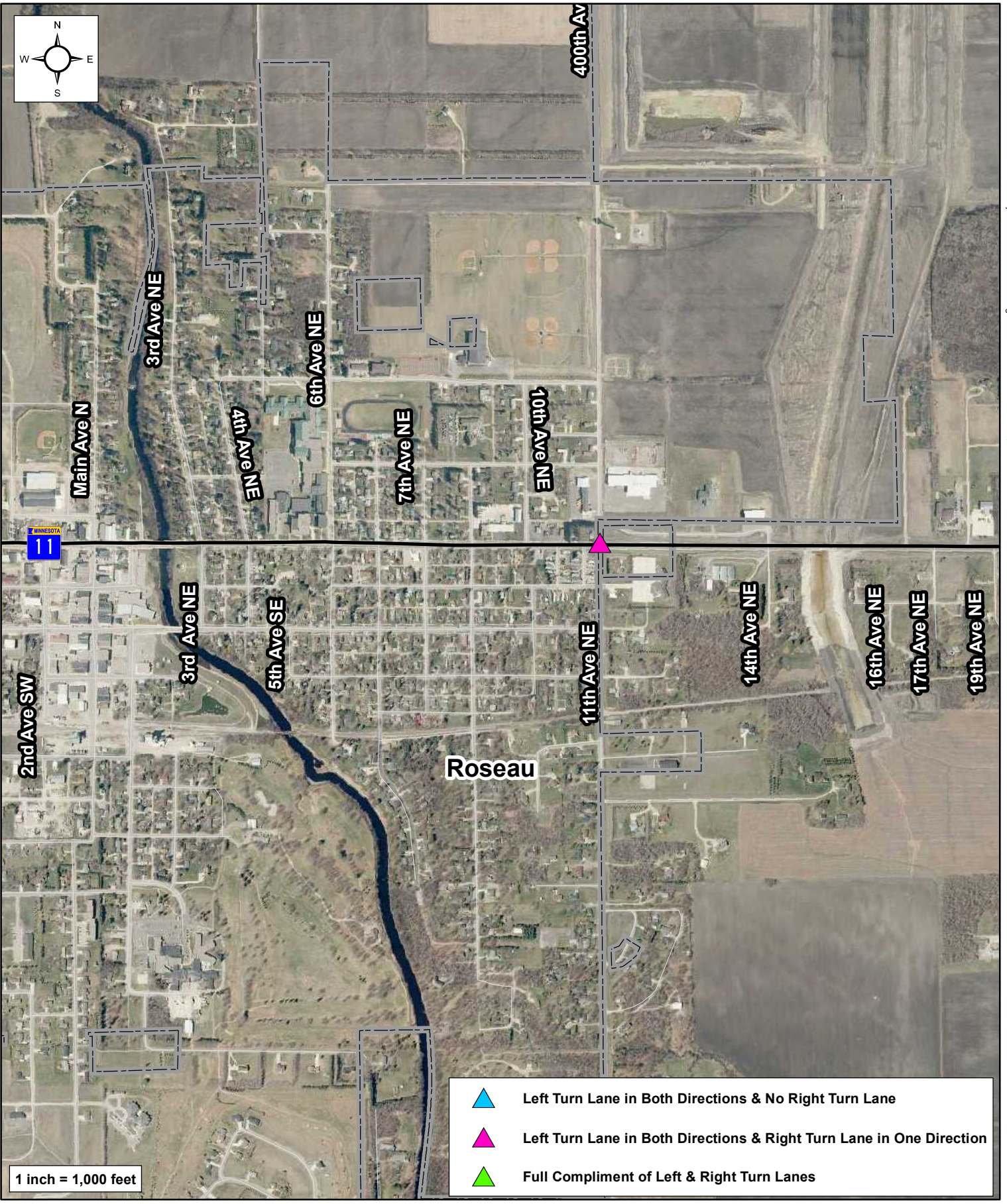
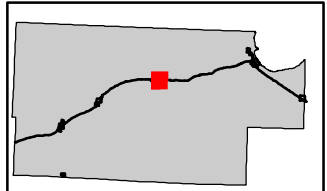


Figure 4
Dedicated Left & Right Turn Lanes
in Roseau



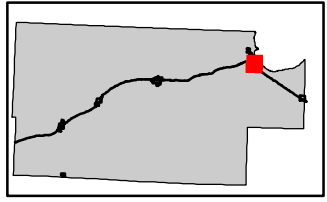


Figure 5
Dedicated Left & Right Turn Lanes
in Warroad



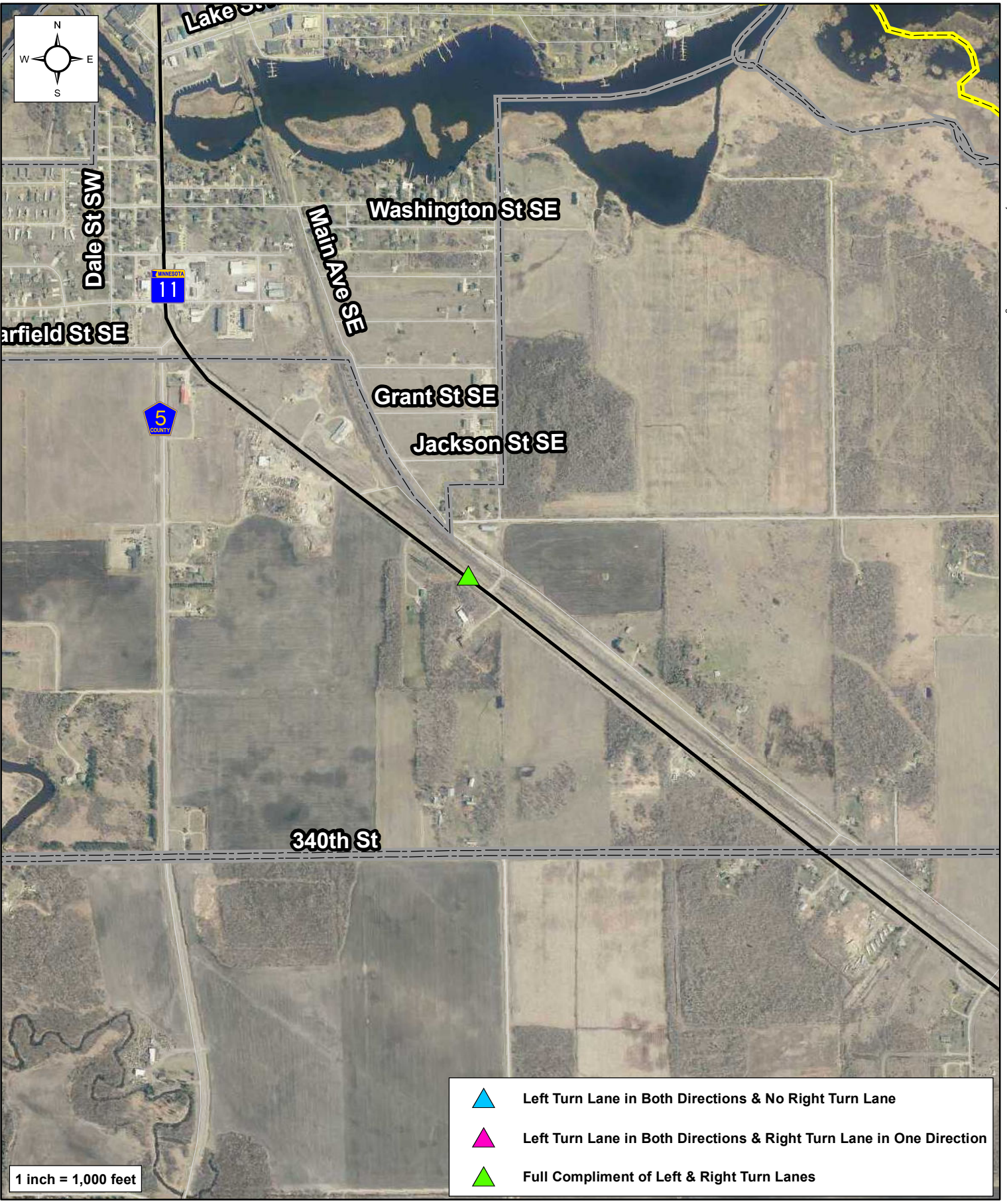
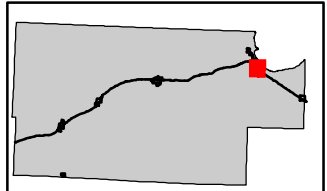


Figure 6
Dedicated Left & Right Turn Lanes
in Warroad



TH 11 Turn Lane Assessment

In addition to locations where there are left- and right-turn lanes, there are some locations with just right-turn lanes. The turn lanes may be on both directions on TH 11 or they may only be in one direction. As can be seen in **Table 2**, there are more locations with a right-turn lane than both a left- and right-turn lane. A majority of the intersections listed in Table 2 only have a right-turn lane in one direction on the corridor. **Table 2** lists the public streets that have a right-turn lane in at least one direction.

Table 2 – Public Streets with a Dedicated Right-Turn Lane in at Least One Direction

General Area	Intersection/Location	Direction of Travel	Note
Greenbush	TH 11/32	Southbound	Location where TH 11 changes direction
Greenbush	CSAH 4	Both	
Badger	East Stokes Avenue	South-/westbound	
Badger	CSAH 2	Both	
Badger	North Main Street	South-/westbound	
Badger	CSAH 26/CR 115	South-/westbound	
Fox	TH 308/CR 119	South-/westbound	
Fox	TH 89	Westbound	
Fox	340th Avenue	Both	
Fox	350th Avenue	Westbound	
Roseau	CSAH 15/360th Avenue	Both	
Roseau	14th Avenue NE	Westbound	
Roseau	Unnamed Rd	Eastbound	
Roseau	CSAH 28	Both	
Roseau	CR 338/420th Avenue	Eastbound	
Roseau	CSAH 31/430th Avenue	Both	
Roseau	440th Avenue	Both	
Salol	CR 129	Eastbound	
Salol	CSAH 9/460th Avenue	Eastbound	Westbound is a shared bypass and right-turn lane.
Salol	480th Avenue	Eastbound	
Salol	Main Street	Eastbound	
Salol	CSAH 13	Both	
Salol	500th Avenue	Both	
Salol	510th Avenue	Eastbound	Westbound is a shared bypass and right-turn lane.
Salol	520th Avenue	Westbound	
Salol	CR 137/530th Avenue	Both	
Warroad	350th Street	Eastbound	Westbound is a bypass and shared right-turn lane with 560th Avenue
Warroad	1st Lakewood Avenue	Westbound	
Warroad	Lakewood Circle	Westbound	
Warroad	Emily Avenue NW	Eastbound	
Warroad	CSAH 5	South-/eastbound	

TH 11 Turn Lane Assessment

As shown in **Table 2**, there are approximately 30 streets which have a right-turn lane. Of the 30 streets, about one-third (10) have a right-turn lane in both directions on TH 11. The rest only have a turn lane in one direction.

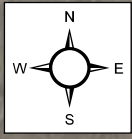
In addition to locations with dedicated right-turn lanes, there are two public street intersections that just have dedicated left-turn lanes. There are no right-turn lanes at these intersections due to space constraints. One of these intersections is Main Avenue North in Roseau and it is a signalized intersection. The other is Lake Street NE/CR 74 (south junction) in Warroad, and there is only a left turn lane in the south-/eastbound direction. This intersection is signalized.

Along with public street access locations, there are a limited number of private driveways, both residential and commercial, that have a dedicated right-turn lane in at least one direction of travel outside of the three-lane sections in Roseau and Warroad. Three of the five access points are for manufactured home communities and the other two are at commercial establishments. **Table 3** lists these locations.


Table 3 – Private Entrances with a Dedicated Right-Turn Lane Outside of the Three-Lane Sections

General Area	Intersection/Location	Direction of Travel	Note
Roseau	East of CSAH 15/360th Avenue on the north side of TH 11	Westbound	Pioneer Farm and Village
Salol	East of Main Street on the north side of TH 11	Westbound	Grain elevator
Salol	East of 500th Avenue on the south side of TH 11	Eastbound	Timberline Mobile Home Park - Western and eastern access points. Middle entrance does not have one. Eastern access has a bypass lane in the westbound direction.
Salol	East of 520th Avenue on the south side of TH 11	Eastbound	Woodland Trailer Park
Warroad	West of 570th Avenue on the south side of TH 11	Eastbound	North Ridge Storage

Figures 7 – 13 show the locations with a right-turn lane in at least one direction for both public streets and for private driveways.



1 inch = 1,000 feet

-  Public Street Right Turn One Direction
-  Public Street Right Turn Both Direction
-  Private Driveway Right Turn

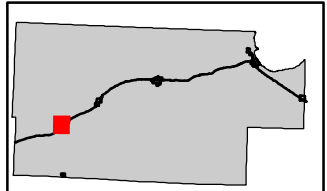
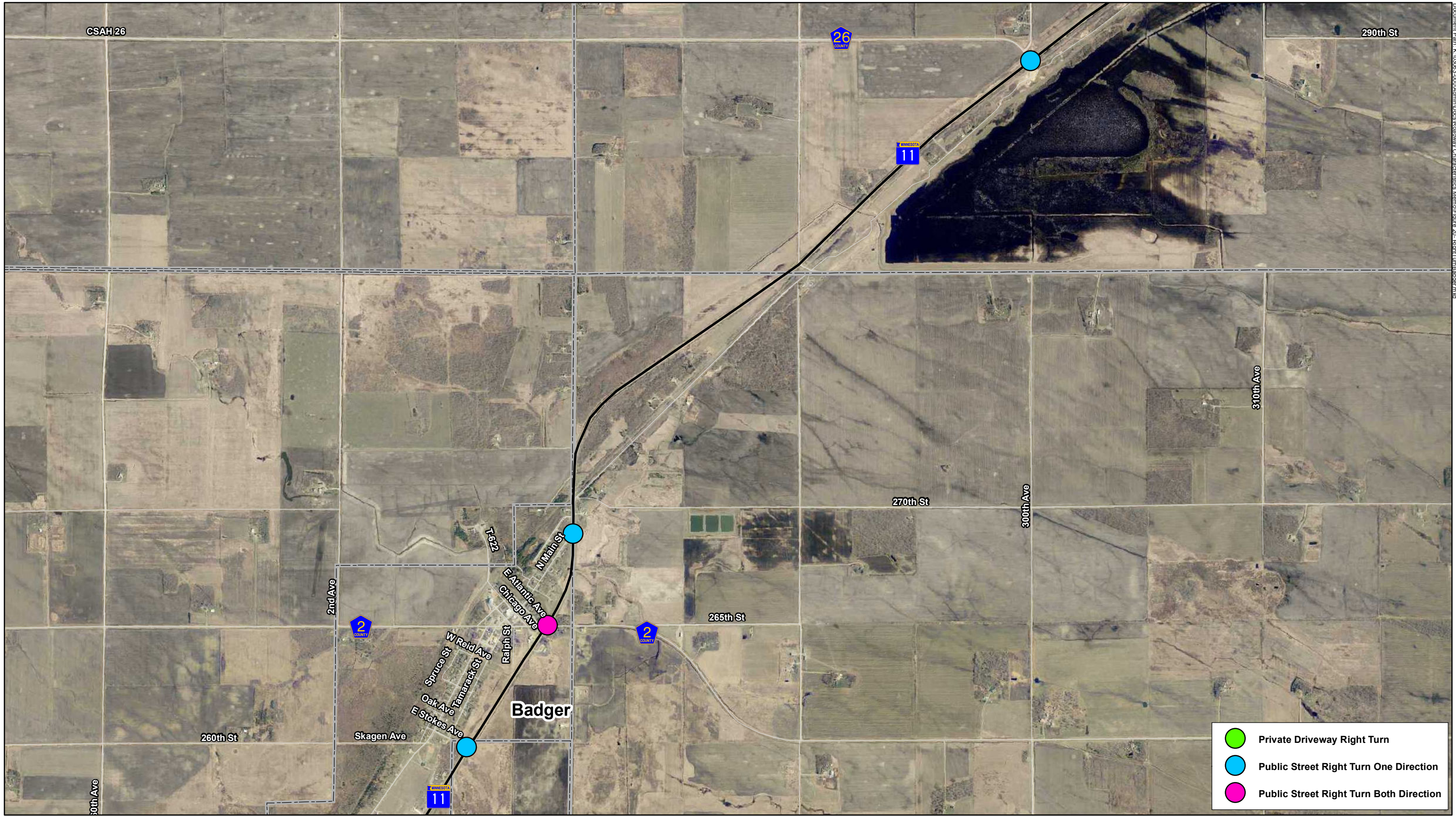


Figure 7 Right - Turn Lanes Greenbush





- Private Driveway Right Turn
- Public Street Right Turn One Direction
- Public Street Right Turn Both Direction

1 inch = 2,000 feet

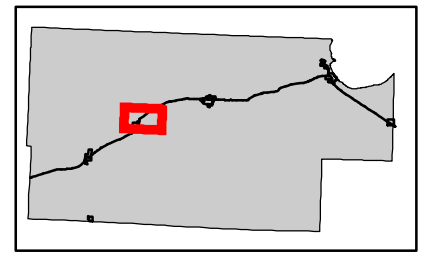
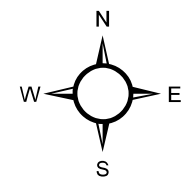


Figure 8
Right Turn Lanes
Badger





Document Path: K:\030963_2000Admin\Drawings\Characteristics\Map\Figure 21 - Right Turn Fox.mxd

1 inch = 1,250 feet

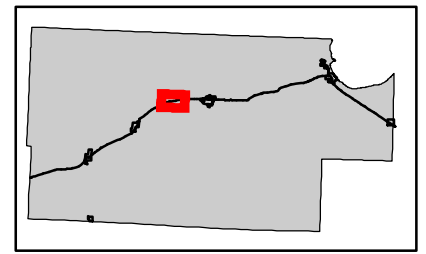
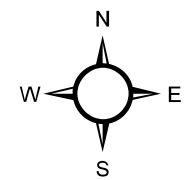
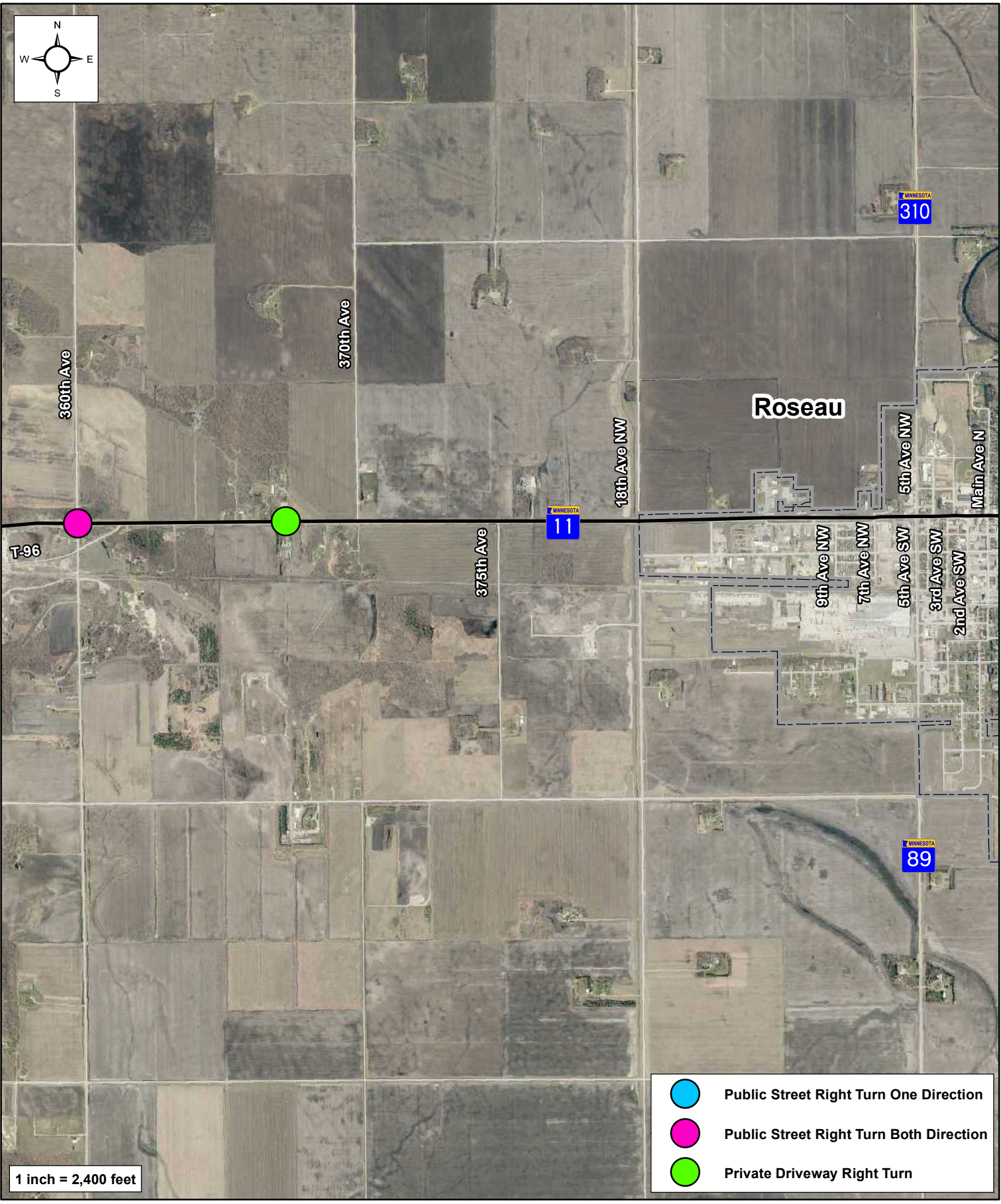
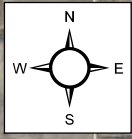


Figure 9
Right -Turn Lanes
Fox





1 inch = 2,400 feet

-  Public Street Right Turn One Direction
-  Public Street Right Turn Both Direction
-  Private Driveway Right Turn

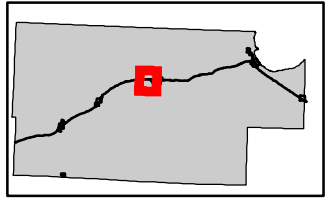


Figure 10
Right - Turn Lanes
Roseau



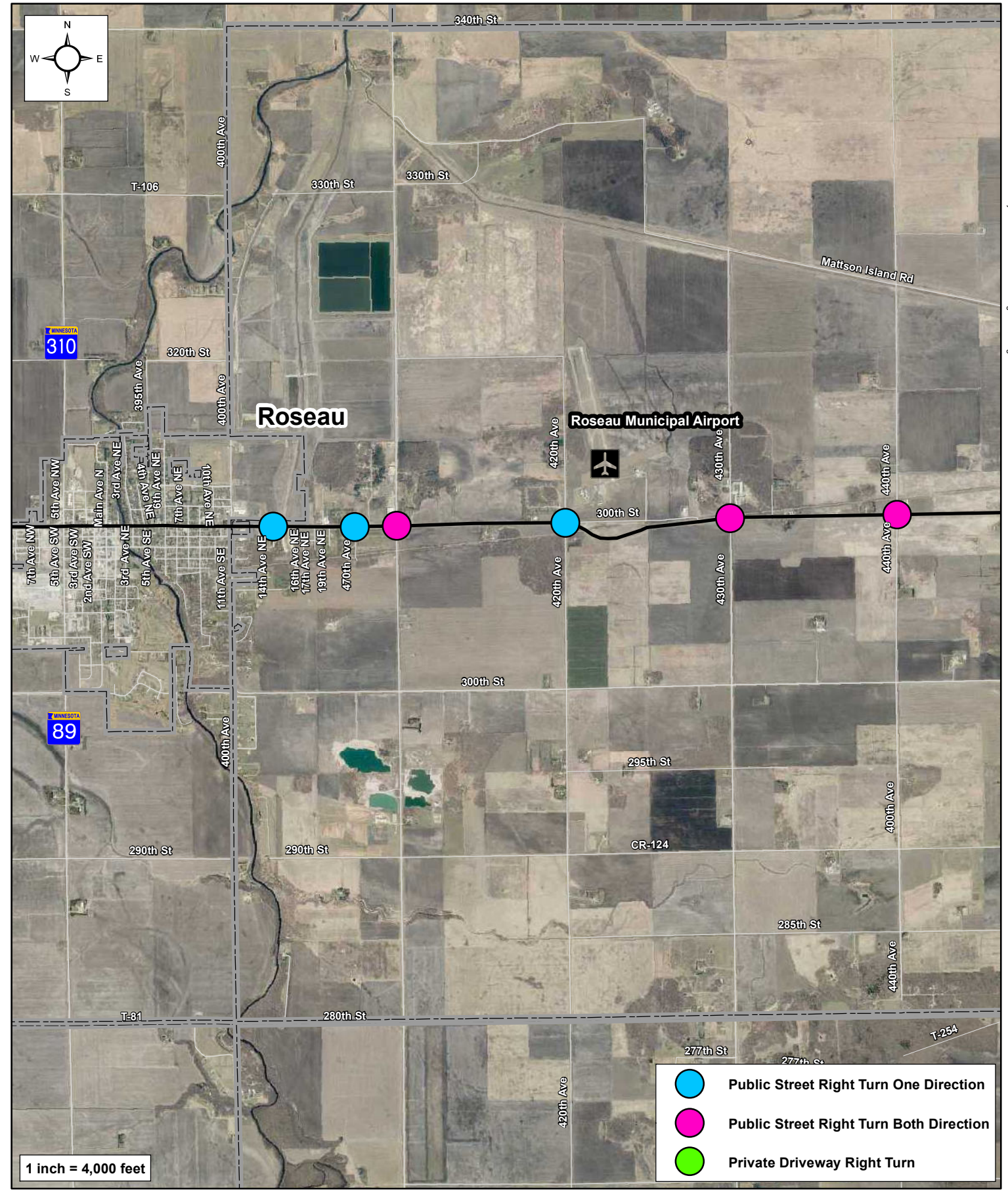
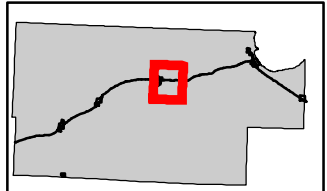
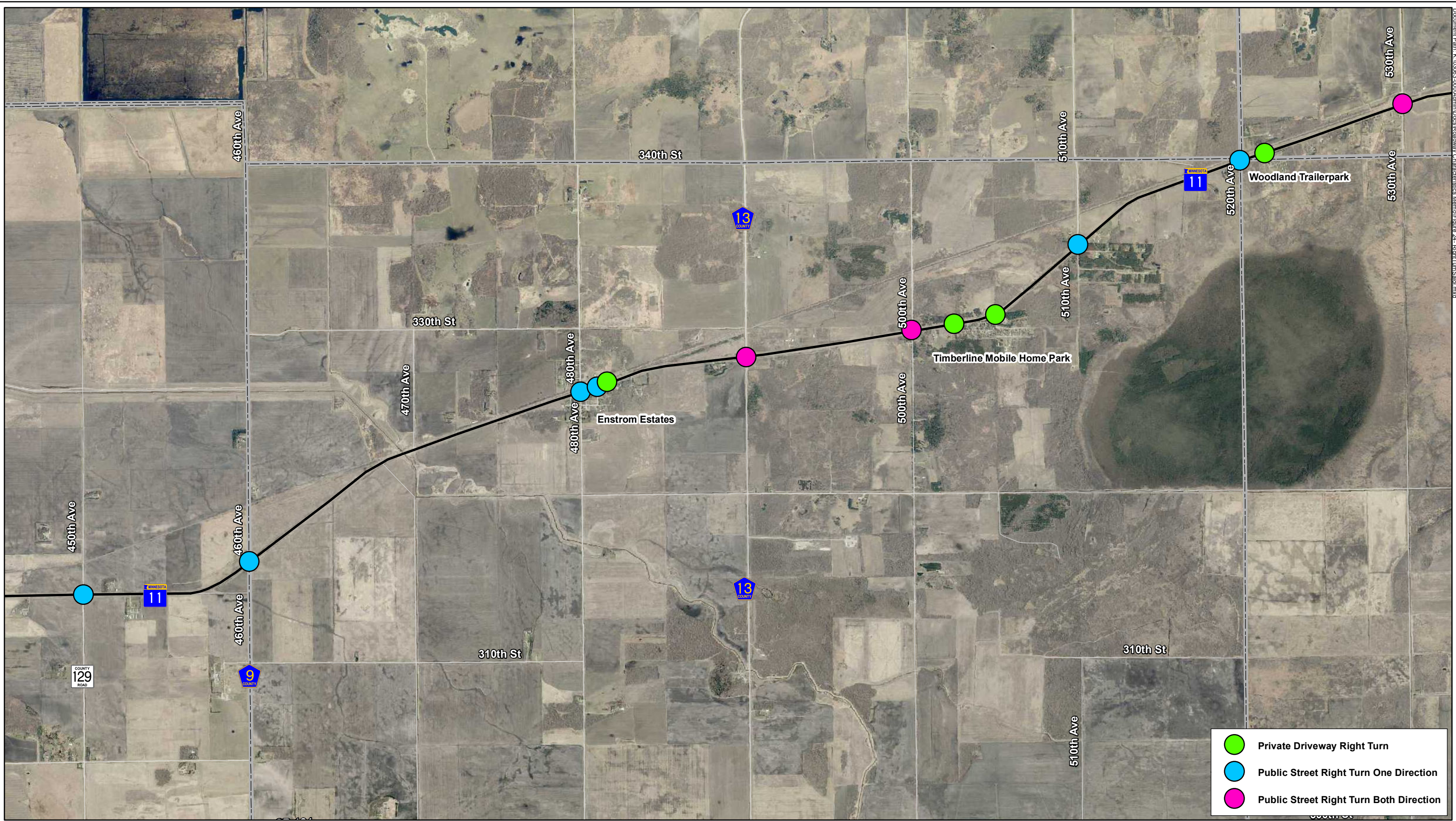


Figure 11
Right - Turn Lanes
Roseau





1 inch = 2,800 feet

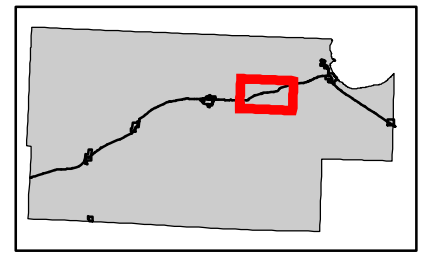
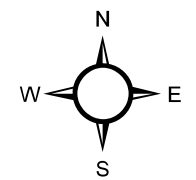
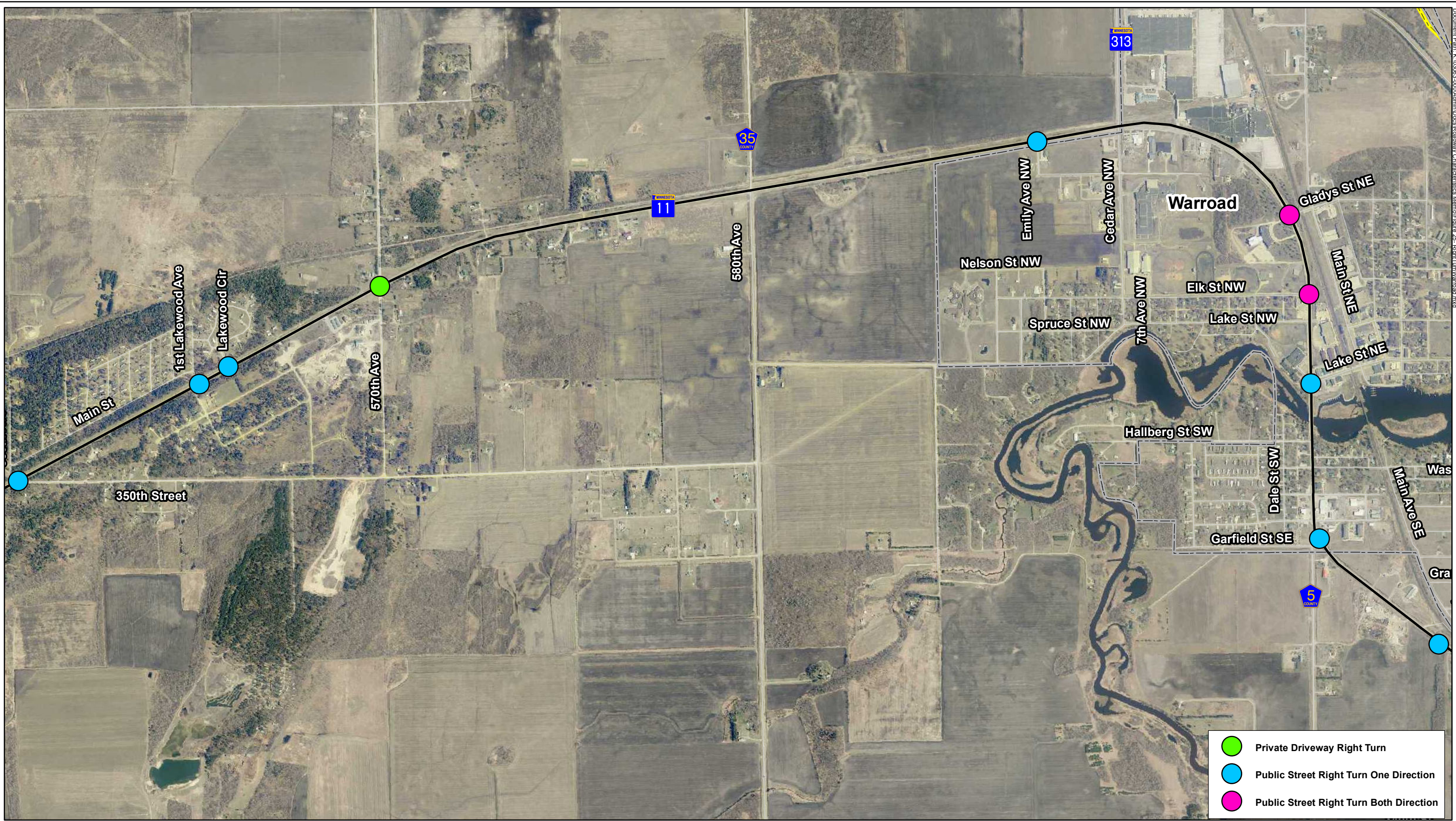


Figure 12
Right -Turn Lanes
Salol





1 inch = 1,250 feet

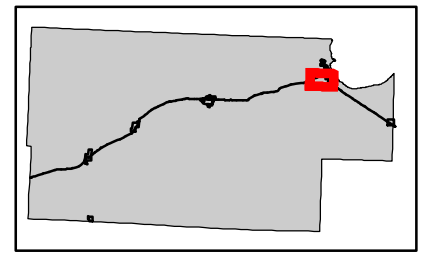
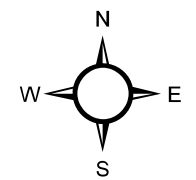


Figure 13
Right -Turn Lanes
Warroad



TH 11 Turn Lane Assessment

As previously noted, there are a few bypass lanes on TH 11 that help facilitate turning movements on the corridor. **Table 4** identifies the location of bypass lanes and notes the direction of travel in which the bypass lane is used.

Table 4 – TH 11 Bypass Lane Locations

General Area	Intersection/Location	Description	Direction of Travel
Roseau/Salol	CSAH 9/460th Avenue	Shared bypass and right-turn	Westbound
Salol/Warroad	East of 500th Avenue – Timberline Mobile Home Park	Bypass lanes at two of the three entrances – eastern two	Westbound
Salol/Warroad	510th Avenue	Shared bypass and right-turn	Westbound
Salol/Warroad	East of 520th Avenue – Woodland Trailer Park	Bypass lane	Westbound
Salol/Warroad	550th Avenue	Shared bypass and right-turn	Both
Salol/Warroad	350th Street	Shared bypass and right-turn	Westbound
Salol/Warroad	570th Street	Shared bypass and right-turn	Both
Salol/Warroad	CSAH 35	Shared bypass and right-turn	Both

As listed in **Table 4**, and shown on **Figures 14–16**, a majority of the bypass lanes are concentrated in the area between Salol and Warroad, with an additional one between Roseau and Salol. As a note—there is a bypass lane on TH 32 at the intersection with TH 11 in Greenbush. It is not included in the maps because it is on TH 32; however, it does assist traffic operations at the intersection.

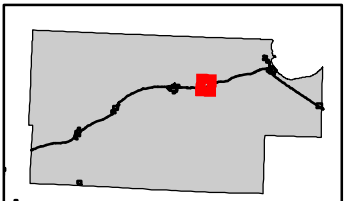
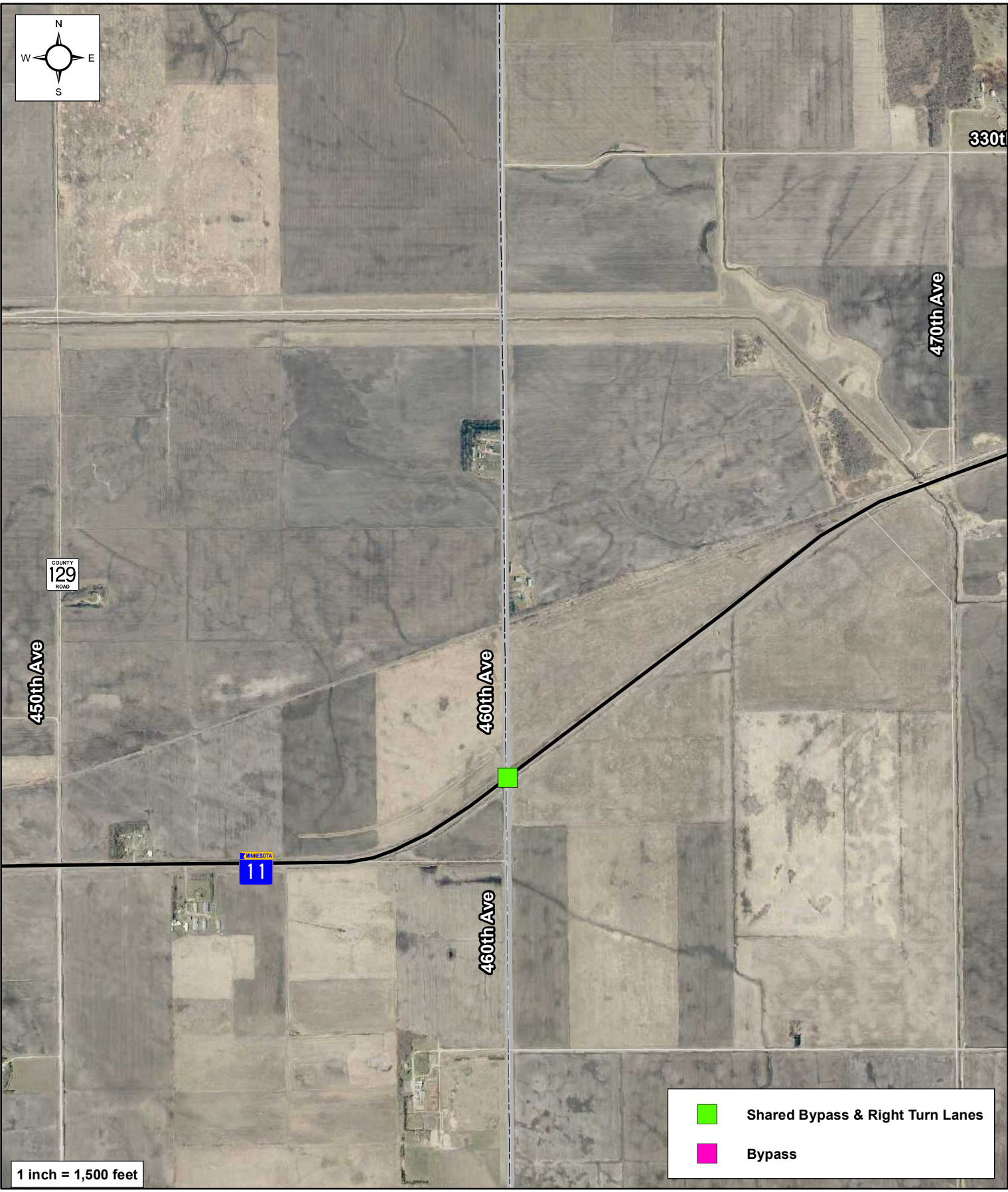
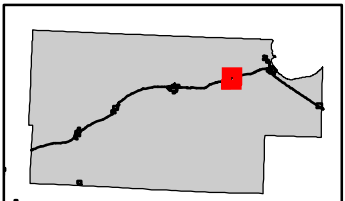


Figure 14
Bypass Lane between Roseau & Salol





Figure 15
Bypass Lane between Salol & Warroad
500th Avenue to 520th Avenue





1 inch = 1,200 feet

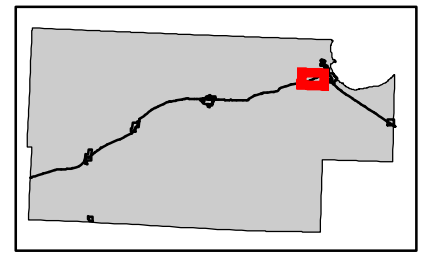
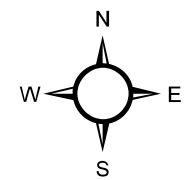
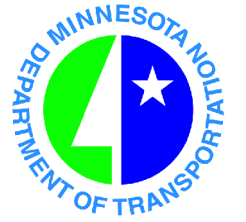


Figure 16
Bypass Lane between Salol & Warroad
550th Avenue to CSAH 35



4. Rationale for Additional Turn Lanes

There are four primary reasons to consider constructing additional turn lanes or bypass lanes on TH 11. First, as described above, turn lanes are inconsistently applied in areas outside of the three lane sections in Roseau and Warroad. This inconsistency affects driver expectations and can create situations in which drivers may unexpectedly be turning. This can result in rear end crashes, run off the road crashes, and sideswipe crashes.

Second, TH 11 is on a skew in much of the corridor, which results in many intersections that are at acute angles. Acute turns require additional turning time as compared to right angle turns. This extends the amount of time that turning vehicles are in conflict with through vehicles.

A third issue relates to the vehicle mix along the corridor. As has been documented in previous memos, many segments in the corridor have more than 5 percent of heavy commercial vehicle (semitrailer truck) traffic. With large manufacturers (i.e., major freight generators at Polaris and Marvin) utilizing the corridor, along with connections to international border crossings, TH 11 carries a high number of trucks. In considering turn lanes, the vehicle mix is important because it is more difficult for trucks to slow for turning traffic. Additionally, trucks take longer to make turns, which leads to the need for larger gaps in oncoming traffic in order to make left turns, resulting in longer delays for vehicles approaching a turning truck from behind.

The fourth primary rationale for considering additional turn lanes is related to the active rail lines in the study area. A spur of the Minnesota Northern railroad is active between Greenbush and Roseau. This rail line varies in its proximity to TH 11, but there are some segments where it is 100–200 feet from the highway. The Canadian National (Wisconsin Central) rail line is also present east of Warroad. This rail line runs parallel to TH 11 and is typically 100–200 feet northeast of the highway. Due to the railroads' proximity to TH 11, storage space on some of the cross streets may be limited, and traffic attempting to turn from TH 11 onto the cross street may need to wait for an extended period of time for the train to pass and the cross street to clear.

5. Criteria for Additional Turn Lanes

To strategically address the issues described in Section 4, turn lane criteria were reviewed to guide the identification of locations where it may be appropriate to construct dedicated turn lanes. There are several sources that can be used to determine the need for turn lanes. At MnDOT, engineering judgement is considered in a number of cases, along with recommendations from guidance documents such as the Road Design Manual and Access Management Manual.

Road Design Manual:

- In urban areas, right- and left-turn lanes should be considered whenever construction is economically feasible (5-3.01.01).
- In urban areas, for preservation projects, left-turn lanes should be provided if feasible at nonpublic access locations generating high traffic volumes, at locations where crash locations confirm the existence of a hazard, and at locations determined by the District Traffic Engineer in consideration of crashes, capacity and traffic volumes (5-3.01.01).

TH 11 Turn Lane Assessment

- In urban areas, for preservation projects, right-turn lanes should, if feasible, be provided at all public road intersections and other locations as determined by the District Traffic Engineer in consideration of crashes, capacity and traffic volumes (5-3.01.01).
- Continuous left-turn lanes for urban areas have no rigid design criteria – but generally should be considered in the following: when shifting from rural to suburban or urban areas; generally used with lower speeds; volumes should not be excessive for the facility type; center turn lane should generally be 14 feet wide; if the roadway is being reconstructed, realign opposite side driveway entrances if feasible; and pavement markings should be developed by the District Traffic Engineer (5-3.01.05).
- Continuous right-turn lanes may be considered in locations where driveways are closely spaced. They should not be longer than a quarter of a mile and speeds must be greater than 30 miles per hour, with heavier volumes and high turning demands (5-3.01.07).
- In rural areas, right-turn lanes should be considered when the projected ADT is over 1,500, the design speed is 45 miles per hour or higher at all public road access points; if industrial, commercial or substantial trip generating land use is to be served; or if the access serves more than 10 residential units (5-4.01.02).
- In rural areas, left-turn lanes should be provided when the access is to a public road, an industrial tract or a commercial center (5-4.01.02).
- In rural areas, if a left-turn lane is not warranted or if the construction of a left-turn lane is not practical (due to right of way, environmental constraints, etc.), a bypass should be considered. Preferably only at “T” intersections. Four-legged intersections should only consider a bypass lane after all other solutions have been found impractical and the cross street volume is low (5-4.01.02).

As can be seen from the information above, the Road Design Manual is conservative with regard to the construction of dedicated right- and left-turn lane construction. Guidance from this document suggests that turn lanes should be constructed at all public streets in rural areas, along with selected locations for commercial, residential and industrial uses. In urban areas they are to be considered whenever feasible.

MnDOT Access Management Manual:

MnDOT’s Access Management Manual is less conservative than the Road Design Manual and identifies higher thresholds on the need for dedicated turn lanes. Highlights from the Access Manual are listed below:

- Right-turn treatment versus a right-turn lane: the guidelines indicate that a right-turn lane may not be needed if a right-turn treatment can be provided (widening of the shoulder, removing conflicting striping and shoulder rumble strips, prohibiting on street parking in urban areas and/or adding pavement thickness to the shoulder) instead.
- Turn lanes should be provided at public street connections and driveways in accordance with the MnDOT Road Design Manual – Section 5-3 (Please note: section 5-4 is not referenced. This section is the Road Design Manual recommendation for turn lanes on rural two-lane highways) and the guidance below:

TH 11 Turn Lane Assessment

- Left-turn lanes: a left-turn lane should be provided when there is a site-specific geometric or safety concern as indicated by the turn-lane warrants 1-8 or if the traffic volume levels meet warrant 9.
 - Right-turn lanes: a right-turn lane should be provided when there is a site-specific geometric or safety concern as indicated by the turn-lane warrants 1-8 or if the traffic volume levels meet warrant 9.
 - Bypass lanes: a left-turn bypass lane may be considered when a left-turn lane is warranted but where its construction is not practical. The bypass lane is for use at “T” intersections where no other public street connection or driveway will be located in the bypass lane or corresponding tapers.
 - Right-turn/bypass lanes at four-legged intersections: should only be used after all other solutions have been found impractical and where the cross-street volume is low.
- Turn lane warrants for undivided highways:
- Warrant 1: Passing lane/climbing lane – at high volume driveways (>100 trips per day) and all public street connections located on highway segments where passing lanes or climbing lanes are present in the approach direction.
 - Warrant 2: Limited sight distance/terrain – at all driveways and public street connections with inadequate stopping sight distance or located on short vertical curves or steep grades.
 - Warrant 3: Railroad crossings – at high volume driveways (>100 trips per day) and all public street connections where a railroad is parallel to the highway and where the potential exists for vehicles delayed by a train to back up into the through lanes of the highway, creating both safety and operational problems.
 - Warrant 4: Signalized intersections – at all signalized public street connections and driveways.
 - Warrant 5: Heavy-vehicle traffic – at all driveways and public street connections high-speed highways (posted speed ≥ 45 mph) where the heavy-vehicle turning volume is 15 or more vehicles per hour for at least eight hours a day for four months or more per year.
 - Warrant 6: School entrances – at public and private school driveways on high-speed highways used by school traffic.
 - Warrant 7: Crash history – at high-volume driveways (>100 trips per day) and all public street connections that demonstrate a history of crashes of the type suitable to correction by a turn lane or turn-lane treatment, or where adequate trial of other remedies has failed to reduce crash frequency.
 - Warrant 8: Corridor crash experience – on highway corridors that demonstrate a history of similar crash types suitable to correction by providing corridor-wide consistency in turn-lane use.
 - Warrant 9: Vehicular volumes – at high-volume driveways (>100 trips per day) and all public street connections on high-speed highways (posted speeds ≥ 45 mph) that satisfy the following:

2-Lane Highway AADT	Cross Street/Driveway ADT	Turn Lane Requirement
> 1,500	>100	Right-turn lane warranted
1,500 – 2,999	>1,500	Left-turn lane warranted
3,000 – 3,999	>1,200	Left-turn lane warranted
4,000 to 4,999	>1,000	Left-turn lane warranted
5,000 to 6,499	>800	Left-turn lane warranted
≥6,500	101 – 400	Left-turn lane or bypass lane
≥6,500	>400	Left-turn lane warranted

Highway AADT one year after opening; posted speed of 45 mph or higher

Under the warrant analysis outlined by the Access Management Manual, right-turn lanes would be recommended at all public street locations as well as private driveways that generate 100 trips or more per day. In general, this would equate to 10 home sites, a typical commercial use and some industrial uses. This is generally consistent with the Road Design Manual.

However, the construction of left-turn lanes outlined by the Access Management Manual would require most side street cross volumes to be significantly higher than they currently are on TH 11 in order to construct a dedicated turn lane. A few additional locations would be suggested as meeting the threshold due to their proximity of the adjacent rail lines on the corridor. This varies from the Road Design Manual, which would indicate that in rural areas, left-turn lanes should be provided at all public streets – regardless of volumes – if they are feasible to construct.

6. Turn Lane Recommendations

Because MnDOT has to function within a budget and cost constraints practices outlined in the Road Design Manual cannot always be implemented. Instead the more conservative approach outlined in the Access Management Manual is generally identified for potential turn lane locations. The following sections outline recommendations for right- and left-turn lanes.

Right-Turn Lanes

Based on the criteria described under Section 5, right turn lanes are recommended for public streets as well driveways that are likely to generate 100 trips per day. See **Table 5** for a list of locations for potential right turn lanes.

Table 5 – Potential Right-Turn Lane Locations

#	General Area	Cross Street/ Driveway Location	Direction of Travel on TH 11	Rationale	Notes
1	Greenbush	Forsness Road/CR 76	South	Public Street	
2	Greenbush	Central Avenue W	West/South	Public Street	

TH 11 Turn Lane Assessment

#	General Area	Cross Street/ Driveway Location	Direction of Travel on TH 11	Rationale	Notes
3	Greenbush	7th Street/Oak Lane	Both	Public Street	Alleys are between the roadways – not enough room to provide turn lanes for road and alley
4	Greenbush	5th Street South and North	Both	Public Street	Alleys are between the roadways – not enough room to provide turn lanes for road and alley roadways
5	Greenbush	4th Street South and North/CR 7	Both	Public Street	Alleys are between the roadways – not enough room to provide turn lanes for road and alley. Driveways along TH 11 for commercial use (bank and restaurant may make turn lane challenging for 4th Street North/CR 7.
6	Greenbush	Main Street South and North	East	Public Street	Turn lane for Main Street North hampered by 1st Street North proximity and railroad proximity.
7	Greenbush	Driveway 100 ft north of TH 32 junction	North	Commercial driveway	Challenging due to inclusion in bypass lane
8	Greenbush	Driveway 450 ft north of TH 32 junction	North	Commercial driveway	
9	Greenbush	Driveway 1,000 ft north of TH 32 junction	North	Commercial driveway	Recommend closing northern driveway – access available to the south
10	Greenbush	210th Avenue	Southwest	Public Street	T intersection
11	Greenbush	220th Street	Southwest	Public Street	T intersection
12	Greenbush	CR 149	Southwest	Public Street	T intersection
13	Greenbush	230th Avenue	Both	Public Street	
14	Badger	CR 111/250th Avenue (west junction)	Southwest	Public Street	T intersection
15	Badger	CR 111 (east junction) / 260th Avenue	Southwest/northeast	Public Street	
16	Badger	S Main Street/250th Street	Southwest	Public Street	T intersection
17	Badger	270th Avenue	Both	Public Street	
18	Badger	M-19	Southwest	Public Street	

TH 11 Turn Lane Assessment

#	General Area	Cross Street/ Driveway Location	Direction of Travel on TH 11	Rationale	Notes
19	Badger	Driveway 1,800 ft south of E. Stokes Avenue	Southwest	Commercial driveway	Location of right turn lane should be determined – both will not be needed – too close (see next entry).
20	Badger	Driveway 1,500 ft south of E. Stokes Avenue	Southwest	Commercial driveway	Location of right turn lane should be determined – both will not be needed – too close (see previous entry).
21	Badger	Driveway 1,000 ft south of E. Stokes Avenue	Southwest	Commercial/ residential driveway	
22	Badger	Driveways 600 ft south of CR 2	Southwest	Commercial driveway	Driveway/turn lane should be at southern location due to proximity of CSAH 2. Location to be determined (see next entry).
23	Badger	Driveway 300 ft south of CR 2	Southwest	Commercial driveway	Driveway/turn lane should not be at this location due to proximity of CSAH 2. Location to be determined (see previous entry).
24	Badger	280th Avenue	Northeast	Public Street	T intersection
25	Badger	Lenmark Lane	South	Public Street	T intersection; within taper of right turn lane for North Main Street
26	Badger	T-82/Old Highway 11 (west junction)	North	Public Street	T intersection
27	Badger	CR 3	South	Public Street	Feasibility needs to be determined – spacing concerns, curves, sight visibility
28	Badger	CR 114/290th Avenue/280th Street	Both	Public Street	
29	Badger	T-420	Northeast	Public Street/ Rail	T intersection; 100 ft from rail line
30	Fox	T-82/Old Highway 11 (east junction)	East	Public Street	T intersection
31	Fox	310th Avenue	East/west	Public Street	
32	Fox	TH 308/CR 119	East	Public Street	
33	Fox	330th Avenue	Both	Public Street	

TH 11 Turn Lane Assessment

#	General Area	Cross Street/ Driveway Location	Direction of Travel on TH 11	Rationale	Notes
34	Fox	Driveway 2,000 ft west of 350th Avenue	West	Commercial driveway	
35	Fox	Driveway 1,500 ft west of 350th Avenue	West	Commercial driveway	
36	Fox	350th Avenue	East	Public Street	
37	Roseau	T-96	East	Public Street	T intersection – to be reviewed – does not serve much and other access is possible
38	Roseau	Driveway 2,100 ft west of CSAH 15	East	Commercial driveway	Review to determine which driveway should have turn lane – are both necessary?
39	Roseau	Driveway 1,400 ft west of CSAH 15	East	Commercial driveway	Review to determine which driveway should have turn lane – are both necessary?
40	Roseau	T-96 (east junction)/ 310th Street	East	Public Street	T intersection
41	Roseau	370th Avenue	Both	Public Street	
42	Roseau	375th Avenue	East	Public Street	T intersection
43	Roseau	14th Avenue NE	East	Public Street	
44	Roseau	16th Avenue NE	West	Public Street	T intersection. Only serves 2 residences - consider need.
45	Roseau	17th Avenue NE	East	Public Street	T intersection
46	Roseau	18th Avenue NE	West	Public Street	T intersection
47	Roseau	19th Avenue NE	East	Public Street	T intersection
48	Roseau	420th Avenue	West	Public Street	
49	Roseau	310th Street (west junction)	West	Public Street	T intersection
50	Roseau	310th Street (east junction)	West	Public Street	T intersection
51	Salol	CR 129	West	Public Street	
52	Salol	480th Avenue	Southwest	Public Street	
53	Warroad	544th Avenue	East	Public Street	T intersection. Serves less than 10 residences.
54	Warroad	545th Avenue	East	Public Street	T intersection. Serves less than 10 residences.
55	Warroad	549th Avenue	West	Public Street	
56	Warroad	Driveway 500 ft east of 550th Avenue	East	Commercial driveway	Further evaluation – 2nd driveway for eastbound traffic – spacing too close for both.
57	Warroad	555th Avenue	East	Public Street	T intersection. Serves less than 10 residences

TH 11 Turn Lane Assessment

#	General Area	Cross Street/ Driveway Location	Direction of Travel on TH 11	Rationale	Notes
58	Warroad	349th Street	East (west junction)	Public Street	Loop road
59	Warroad	349th Street	East (east junction)	Public Street	Loop road – turn lane development challenging with access spacing.
60	Warroad	Pine Ridge Road (west junction)	Northeast	Public Street	
61	Warroad	Pine Ridge Road (east junction) or Private Driveway	Northeast	Public Street or Private Driveway	
62	Warroad	Driveway 1,900 ft west of CR 35/580th Avenue	East	Commercial driveway	Auto repair business
63	Warroad	Hallberg Street SW	South	Public Street	T intersection. Off of bridge – unlikely to be feasible unless bridge is rebuilt.
64	Warroad	Riverview Drive SE	North	Public Street	T intersection. Feasibility an issue with spacing at Washington Street SE
65	Warroad	Washington Street SW	Both	Public Street	Feasibility an issue in south/east direction due to spacing.
66	Warroad	Lincoln Street SE	Both	Public Street	Feasibility an issue with driveway spacing for both approaches
67	Warroad	Driveway 200 ft south of Lincoln Street SE	South	Commercial driveway	These three entries are for two gas stations located just north of Garfield Street – turn lanes are likely not feasible with the amount of access and spacing with roads
68	Warroad	Driveway 50 ft north of Garfield Street SE	North	Commercial driveway	
69	Warroad	Driveway 50 ft north of Garfield Street SE	South	Commercial driveway	
70	Warroad	Garfield Street	Both	Public Street	North/west feasible – other direction is not with driveways and roadway spacing
71	Warroad	Driveway 1,000 ft south of CSAH 5	Southeast	Industrial driveway	This turn lane shares the same owner as the next entry.
72	Warroad	Driveway 1,600 ft south of CSAH 5	Southeast	Industrial driveway	Not sure if needed – depends upon traffic circulation – should be using the more northerly/westerly entrance.

TH 11 Turn Lane Assessment

#	General Area	Cross Street/ Driveway Location	Direction of Travel on TH 11	Rationale	Notes
73	Warroad	340th Street	Both	Public Street Rail on north side	Short stacking distance with railroad – about 80 feet.
74	Warroad	Driveway 700 ft south of 340th Street	Southeast	Private driveway	Manufactured home community
75	Warroad	610th Avenue	Both	Public Street Rail on north side	Short stacking distance with railroad – about 80 feet.
76	Warroad	CSAH 12	Both	Public Street Rail on north side	Short stacking distance with railroad – about 80 feet.
77	Swift	630th Avenue	Both	Public Street Rail on north side	Short stacking distance with railroad – about 80 feet.
78	Swift	CR 134/320th Street	Both	Public Street	
79	Swift	CR 2	Both	Public Street	
80	Swift	650th Avenue	Southeast	Public Street	T intersection
81	Swift	CSAH 34	Northwest	Public Street	T intersection
82	Swift	660th Avenue	Both	Public Street	
83	Swift	T-530	Southeast	Public Street	T intersection. Serves limited number of residences – consider if needed.
84	Roosevelt	CR 140/670th Avenue/Tangnes Trail	Both	Public Street Rail on north side	Short stacking distance with railroad – about 100 feet.
85	Roosevelt	680th Avenue	Southeast	Public Street	T intersection
86	Roosevelt	Driveway 950 feet west of 690th Avenue	Southeast	Residential driveway	Serves small cluster of manufactured homes
87	Roosevelt	690th Avenue	Northwest	Public Street	T intersection.
88	Roosevelt	Driveway 700 feet west of 697th Avenue	Southeast	Commercial/ residential driveway	Location has three driveways – recommend turn lane for western driveway. Linked to next two entries.
89	Roosevelt	Driveway 600 ft west of 697th Avenue	Southeast	Commercial driveway	Linked to previous entry.
90	Roosevelt	Driveway 400 ft west of 697th Avenue	Southeast	Commercial driveway	Linked to previous entry.
91	Roosevelt	697th Avenue	Both	Public Street	
92	Roosevelt	CSAH 17	Southeast	Public Street	

TH 11 Turn Lane Assessment

Opportunities to construct turn lanes should be considered when MnDOT is reconstructing sections of roadway or completing mill and overlay projects. In addition, safety issues related to crashes should also be a factor in prioritizing improvements outside of regular construction activities.

Please note – the potential turn lanes identified in this section do not take into account bigger projects along the corridor that may reduce access, convert sections of the corridor to three-lanes, etc.

Left-Turn Lanes

Four of the general criteria described in Section 5 above were considered in developing a list of recommended locations for left turn lanes. These include traffic volumes (ADT), proximity to a parallel rail line, three-year crash rates higher than the statewide average, and locations with correctable crashes (i.e. those crash types that could be made less likely with the addition of turn lanes). Based on these criteria, a list of potential left-turn lane locations was developed. See **Table 6** for this listing. For driveways and public street connections with inadequate stopping sight distance or those located on short vertical curves or steep grades, the addition of turn lanes will be considered as part of the District’s pavement management process. Sight distance will also be considered when assessing the addition of turn lanes at locations when plans are developed.

As can be seen in **Table 6**, very few roadways on TH 11 meet MnDOT’s thresholds for left-turn lanes based upon traffic volumes. A majority of the rural public street intersections are township and city roadways that have low traffic volumes. Additionally, because much of the county’s developed area is concentrated along TH 11, there are few intersecting county roadways outside of the three-lane sections in Roseau and Warroad that have higher traffic concentrations. As a result, there are relatively few left-turn lanes identified for the corridor based on volumes. Rail proximity is a bigger issue, especially in the eastern portion of the corridor. In the area between Warroad and Roosevelt, TH 11 very closely parallels the railroad, leaving little room for stacking cars. Construction of turn lanes on intersecting roadways in this area can help provide adequate storage and stacking when longer trains come through.

Table 6 – Potential Left-Turn Lane Locations

#	General Area	Cross Street/ Driveway Location	Direction of Travel on TH 11	Rationale	Notes
1	Greenbush	CSAH 4/210th Street	Northeast	Rail	100 ft from rail line
2	Badger	CSAH 2/University Ave	Both	Crash Rate	
3	Badger	CR 114/290th Avenue	Southwest	Rail	100 ft from rail line
4	Badger	T-420	Southwest	Rail	100 ft from rail line
5	Fox	TH 89	East	Crash Rate	
6	Warroad	CSAH 5	North	ADT	
7	Warroad	340th Street	Southeast	Rail	100 ft from rail line
8	Warroad	610th Avenue	Southeast	Rail	100 ft from rail line
9	Warroad	CSAH 12	Southeast	Rail	100 ft from rail line
10	Swift	CSAH 34	Southeast	Crash Rate/Rail	T intersection
11	Roosevelt	CR 140/670th Avenue	Southeast	Rail	100 ft from rail line
12	Roosevelt	690th Avenue	Southeast	Rail	100 ft from rail line

TH 11 Turn Lane Assessment

Opportunities to construct turn lanes should be considered when MnDOT is reconstructing sections of roadway or completing mill and overlay projects. In addition, safety issues related to crashes should also be a factor in prioritizing improvements outside of regular construction activities. For left-turn lanes this would include the intersection of CSAH 2 in Badger, TH 89 near Fox and CSAH 34 between Warroad and Roosevelt.

Please note – the potential turn lanes identified in this section do not take into account bigger projects along the corridor that may reduce access, convert sections of the corridor to three-lanes, etc.

Need Priorities

With all of the access points on the TH 11 corridor it can be challenging to prioritize locations for dedicated turn lanes, especially since the Road Design Manual would suggest that their construction is warranted at all public streets along the corridor and should be considered at other locations such as industrial and commercial centers and locations where multiple residential units are served by a driveway. Unfortunately, funding constraints and the magnitude of existing access on TH 11 suggest that this is not going to be feasible in the short-term and would be challenging to achieve even over the long-term.

An approach that can be taken would be to combine the recommendations laid out in the Road Design and Access Management Manuals. Because right-turn lanes are significantly less expensive than left-turn lanes, a recommendation could be made that would include constructing right-turn lanes at all public street locations as outlined in the Road Design Manual and use the Access Management Manual Warrants for construction of the more expensive left-turn lanes. Following the Road Design Manual for right-turn lanes would provide consistency in terms of driver expectations when approaching public street locations given the amount of access on the corridor. Using the Access Management Manual for the left-turn lanes, would focus priorities on those locations that have rationale beyond being a public street location. While using the warrants outlined in the Access Management Manual for construction of left-turn lanes does not result in consistency that may be readily apparent to drivers, it follows a process that can be easily documented and show prioritization.

Highest Priority – Safety Problem Locations

Priorities would first take into consideration locations with safety problems. Locations with high crash and/or severity rates (above statewide average) or have crashes that are correctable with turn lane construction would be the highest priority for constructing left- and/or right-turn lanes. Additional consideration, with input from the traffic engineer would consider turn-lanes at locations with Type A or Fatal crashes regardless of the number of crashes and crash/severity rates.

Based on safety information for the most recent three-year history, turn lanes would be recommended at the following locations outside of the three-lane sections:

- TH 11 & CSAH 2/University Avenue in Badger – Left-turn lanes
- TH 89 – “Y” area west of Roseau – Left-turn lanes
- CSAH 34 – between Warroad and Roosevelt – Left- and right-turn lanes

Crash data for the corridor should be reviewed regularly to ensure that additional locations for turn lanes are considered for safety reasons.

TH 11 Turn Lane Assessment

High Priority – Railroad Stacking Distance

Another priority for turn lane construction should include locations where there is the potential for train and vehicle traffic to conflict. Where the stacking distance between TH 11 and the railroad is 100 feet or less, there is potential for traffic to back up on TH 11. Locations where this occurs include:

- CSAH 4/210th Street in Greenbush – Left- and right-turn lanes
- CSAH 2/University Avenue in Badger – Left-turn lanes
- T-420 in Badger – Left- and right-turn lanes
- 340th Street in Warroad – Left- and right-turn lanes
- 610th Avenue in Warroad – Left- and right-turn lanes
- CSAH 12 in Warroad – Left- and right-turn lanes
- 630th Avenue in Warroad – Right-turn lanes
- CSAH 34 in Swift/Roosevelt – Left- and right-turn lanes
- CR 140/670th Avenue in Roosevelt – Left- and right-turn lanes
- 690th Avenue in Roosevelt – Left- and right-turn lanes

If a left-turn lane is not feasible due to costs and/or environmental constraints a bypass lane should be considered at “T” intersections.

High Priority – Left-Turn Lane Volume Warrants

Another priority for turn lane construction would include locations where cross street volumes meet the thresholds for left-turn lanes. While data was not collected as part of this study, volumes from MnDOT traffic flow maps were consulted. Most roadways that do not have posted volumes would be anticipated to have lower traffic since they are not state aid routes. Additionally, a majority of the city streets that would have higher traffic volumes that are not on the State Aid System are within the three-lane roadway sections of the corridor, which have dedicated left-turn lanes. The only location outside of the three-lane section, where cross street volumes are available, that suggests a warrant for a left-turn lane is:

- CSAH 5 in Warroad

If a left-turn lane is not feasible due to costs and/or environmental constraints a bypass lane should be considered at “T” intersections.

Medium Priority – Right-Turn Lanes as Part of Roadway Preservation/Rehabilitation Projects

This recommendation would be for construction of right-turn lanes at all public street locations as part of roadway preservation projects in the non-three-lane sections. A list of these roadways is available above. There are approximately 80 locations where right-turn lanes would be considered.

It should be noted that sight distance, feasibility, spacing, etc. should be reviewed by the District Traffic Engineer as part of the review and recommendation process during the preservation/rehabilitation project development.

TH 11 Turn Lane Assessment

Medium Priority – Left-Turn Lanes as Part of Roadway Preservation/Rehabilitation Projects

For public street and commercial/industrial/residential driveway locations that do not meet crash, railroad or volume thresholds (based on traffic flow maps) for the construction of dedicated left-turn lanes, the District Traffic Engineer should review sight distance and freight turning movements during the preservation/rehabilitation project development. Updated crash data for the most recent three-year history should also be reviewed for correctable crashes and crash/severity rates.

If a left-turn lane is not feasible due to costs and/or environmental constraints a bypass lane should be considered at “T” intersections.