

APPENDIX C

ENGINEERING

Stormwater Management Plan

Grading Exhibits

Utilities

Traffic Analysis

South Stoner Prairie Neighborhood Plan

Conceptual Stormwater Management Plan

City of Fitchburg
Dane County, Wisconsin
March 2025

Prepared by:

MSA Professional Services, Inc.
1702 Pankratz Street
Madison, WI 53704
Phone: (608) 242-7779
www.msa-ps.com

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Project Contacts

City of Fitchburg

Deanna Schmidt
City Planner/Zoning Administrator
5520 Lacy Road
Fitchburg, WI 53711
(608) 270-4255
Deanna.Schmidt@fitchburgwi.gov

Brad Sippel
Community Development Planner
City Planner/Zoning Administrator
5520 Lacy Road
Fitchburg, WI 53711
(608) 270-4258
Brad.Sippel@fitchburgwi.gov

MSA Professional Services, Inc. (MSA)

Steve Tremlett, AICP, CNU-A
Planning Team Leader
1702 Pankratz Street
Madison, WI 53704
(608) 242-6621
stremlett@msa-ps.com

Gabe Lujan, PE
Water Resources Engineer
1702 Pankratz Street
Madison, WI 53704
(608) 216-2051
glujan@msa-ps.com

South Stoner Prairie Neighborhood Plan City of Fitchburg

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CHAPTER 1 – INTRODUCTION

1.1 PURPOSE

The conceptual stormwater plan was developed by MSA Professional Services, Inc. (MSA) for the South Stoner Prairie Neighborhood (SSPN) Plan. The conceptual stormwater management plan will discuss key water resource issues and provide a planning-level approach to managing stormwater for the future developed neighborhood.

1.2 BACKGROUND

The SSPN multiple issues related to stormwater management with additional off-site issues that would impact the neighborhood plan. Key issues include the following:

- Surface water runoff drains in two general directions. The runoff draining to the west will travel under Fitchrona Road through two culverts before eventually reaching Badger Mill Creek. The runoff draining to the east will flow into closed depression just outside the SSPN project area. This closed depression is part of a massive internally drained watershed that stretches from the North Stoner Prairie Neighborhood southeast to Brooklyn in the southeast corner of Dane County.
- The larger internally drained watershed consists of multiple closed depressions that have no defined surface overflow routes. Runoff can only leave the closed depressions by infiltrating or if water levels rose high enough, water would discharge south along South Seminole Highway (**Figure 1**).
- The presence of shallow groundwater is seen on the north side of Lacy Road in the North Stoner Prairie Neighborhood, where water levels in a closed depression have remained consistent. While the closed depression immediately east of the SSPN does not have historic standing water there have been years where standing water has been present for prolonged periods during wet years. Shallow groundwater may limit stormwater infiltration.
- Currently, there are two quarries located on the north side of the SSPN. Two reclamation plans for the quarries have been provided to MSA. The western quarry owned by Fitchburg Minerals, LLC is planned to create an internally drained depression that ranges from 50' to 150' deep with an outlet to the west. The eastern quarry owned by Fitchburg Hills LLC is planned to drain by gravity to the east (**Figure 2**).
- There are no regulatory wetlands located in the SSPN project area, but there are wetland indicator soils located just east of the project area.

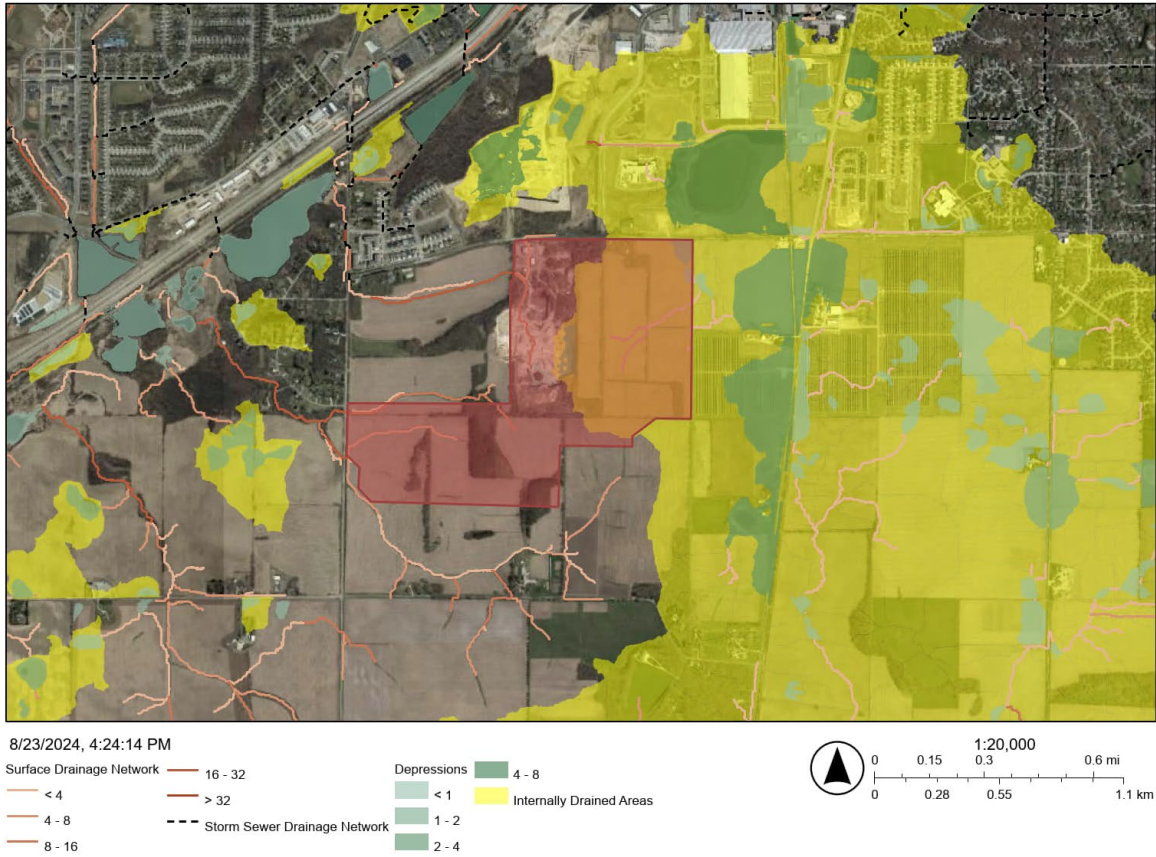


Figure 1. SSPN Internally Drained Watershed and Drainage Routes



Figure 2. Quarry Reclamation Plan.

1.3 STORMWATER PERFORMANCE STANDARDS

As described above, the eastern side of the SSPN drains to a closed depression and the western side drains to Badger Mill Creek, which is not a closed depression. This leads to the SSPN having two different sets of applicable standards for development of this conceptual stormwater management plan. The standards are summarized below.

1.3.1 EAST CLOSED DEPRESSION WATERSHED

Peak Discharge Control

- Control post-development peak discharge to pre-development rates for the 1-year and 2-year, 24-hour storm events (Wisconsin Administrative Code, Chapter NR 151).
- Control post-development peak discharge to pre-development rates for the 1-year, 2-year, 10-year, 100-year, and 200-year, 24-hour storm events (City of Fitchburg Ordinances, Section 30-28(b)(4)).

Volume Control

- The SSPN will need to be added to the urban service area, so an amendment will need to be submitted to the Capitol Area Regional Planning Commission (CARPC) before development can occur.

Infiltration and Flood Protection

- Maintain 100% of the pre-development infiltration (stay-on) volume, with no caps on area required and no exemptions for roads or soil type, based on the 1981 annual rainfall series (City of Fitchburg Ordinances, Section 30-28(b)(6)b).
- Establish a flood protection elevation in the closed depression west of the Badger State Trail equivalent to standing water level that would result from back-to-back 100-year runoff events (Dane County Ordinances, 14.12(2)(g)3).

Water Quality

- Retain 80% of Total Suspended Solids post-development compared to no controls (Section 30-28(b)(1)a of the City ordinance and NR 151).

1.3.2 WEST WATERSHED

Peak Discharge Control

- Control post-development peak discharge to pre-development rates for the 1-year and 2-year, 24-hour storm events (Wisconsin Administrative Code, Chapter NR 151).
- Control post-development peak discharge to pre-development rates for the 1-year, 2-year, 10-year, 100-year, and 200-year, 24-hour storm events (City of Fitchburg Ordinances, Section 30-28(b)(4)).

Infiltration and Flood Protection

- Maintain 90% of the pre-development infiltration (stay-on) volume, with no caps on area required and no exemptions for roads or soil type, based on the 1981 annual rainfall series (City of Fitchburg Ordinances, Section 30-28(b)(6)a and NR 151).

Water Quality

- Retain 80% of Total Suspended Solids post-development compared to no controls (Section 30-28(b)(1)a of the City ordinance and NR 151).

1.4 PROPOSED LAND USE

This conceptual stormwater management plan was developed during the neighborhood planning process. Proposed land use is business park and mixed use on the northern side of the SSPN with varying residential densities throughout the rest of the neighborhood.

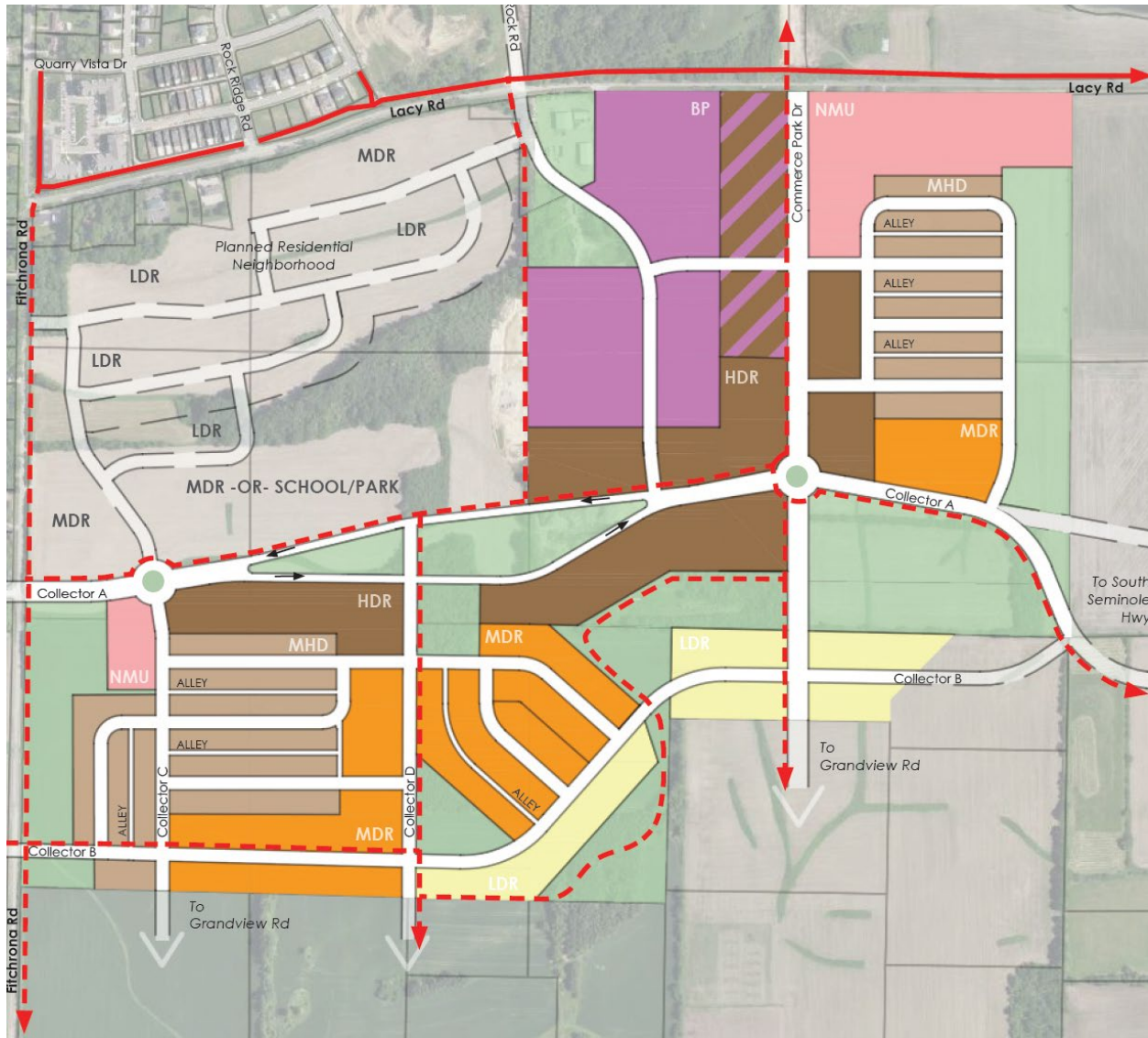


Figure 3. South Stoner Prairie Neighborhood Development Plan.

CHAPTER 2 – METHODS

The performance of the conceptual stormwater management plan was analyzed with multiple models: HydroCAD (Peak Discharge and Runoff Volume), WinSLAMM (Water Quality and Post-Development Infiltration), and Dane County Target Stay-On (Pre-development Infiltration).

2.1 PEAK DISCHARGE

Stormwater peak discharge was evaluated using the HydroCAD-10 model for both pre- and post-development conditions. The model uses standard Soil Conservation Service (SCS) TR-20 runoff hydrograph and curve number procedures, and TR-55 Time of Concentration (Tc) calculations. As required by the ordinance, rainfall events were simulated with the 24-hour MSE4 distribution and rainfall depths from NOAA Atlas 14 (**Table 1**).

Table 1. Dane County 24-hour Rainfall Depths

Recurrence Interval	Rainfall Depth (inches)
1-year	2.49
2-year	2.84
10-year	4.09
100-year	6.66
200-year	7.53

For the purpose of peak discharge ordinance compliance, the pre-development condition was considered to be after the quarries restored to their proposed reclamation plan. Prior to the excavation in the quarries, they were farmed agricultural fields. The proposed reclamation plans for both quarries call for restoration to open grass land, therefore using this land use would be more conservative than using agricultural curve numbers. The neighborhood was divided into pre-development subwatersheds based on existing land surface topography and the proposed reclamation grade of the quarries (**Figure 4**). There are six primary discharge points for the neighborhood:

1. Subwatershed 100, 105, and 110 drain to a culvert crossing Fitchrona Road.
2. Subwatershed 200 and 300 drains to another culvert crossing Fitchrona Road. Subwatershed 300 was delineated based on the quarry reclamation plan.
3. Subwatershed 400 drains northwest along Fitchrona Road into Goose Lake.
4. Subwatersheds 500 and 505 drain to a closed depression west of the Badger Trail.
5. Subwatersheds 600 and 605 drain to the existing stormwater basins that were constructed for the Lacy Road reconstruction project.

Pre-development runoff curve numbers were assigned based on pre-development land use, Hydrologic Soil Group, and the maximum allowable pre-development curve numbers allowed in Dane County and City of Fitchburg ordinances.

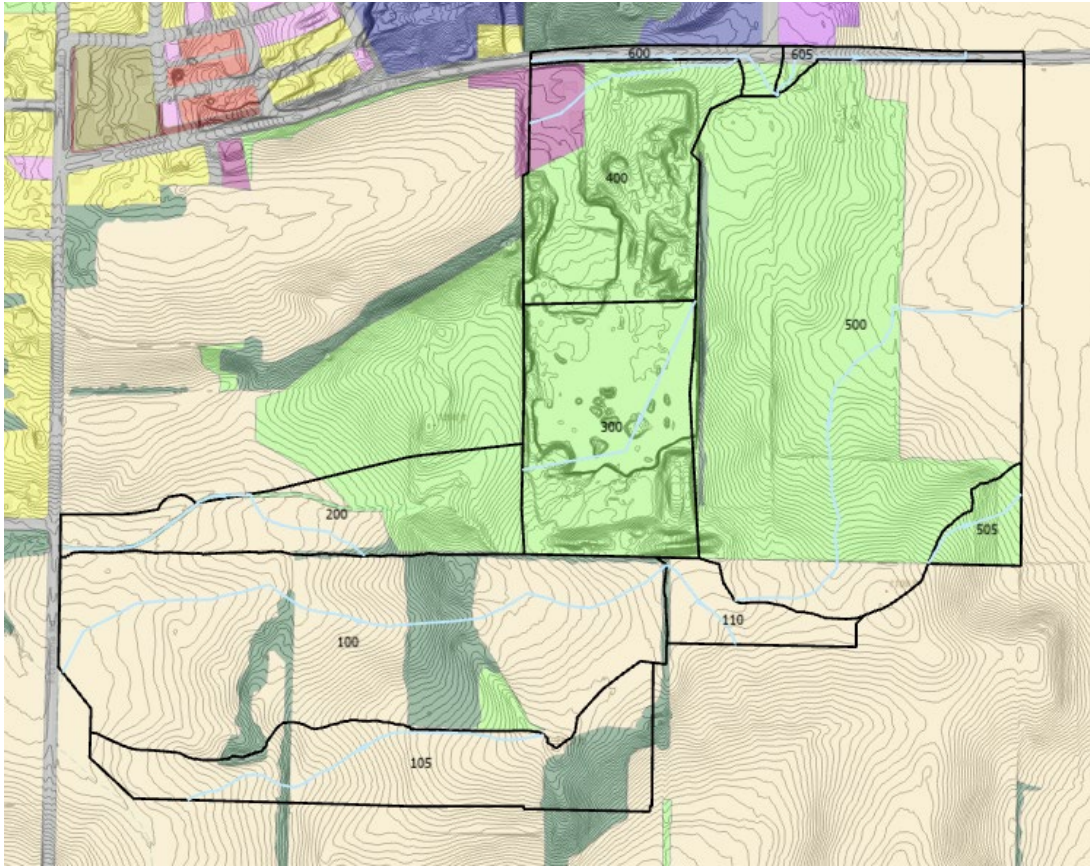


Figure 4. Pre-Development Subwatersheds and Time of Concentration Flow Paths

Post-development subwatersheds and curve numbers are based on the growth model developed during the SSPN planning process (**Figure 5**). For proposed conditions modeling, runoff coefficients were assigned on a lot-by-lot basis assuming impervious areas based on planned land. Runoff Curve Numbers under existing and proposed conditions were completed using weighted average Runoff Curve Numbers based on land use classifications. Runoff Curve Numbers under proposed conditions were evaluated using separate subcatchments for directly connected impervious areas and for pervious areas (this latter subcatchment also includes unconnected impervious areas). Below is a table of impervious areas by land use type and the percentage of impervious areas that are directly connected.

Table 2. Impervious Areas by Land Use Type

Land Use	Street	Driveway	Sidewalk	Roof	Open
HDR	-	10%	10%	35%	45%
MHD	-	10%	7%	30%	53%
MDR	-	10%	3%	25%	62%
LDR	-	10%	3%	12%	75%
NMU	-	25%	10%	55%	10%
BP	-	25%	10%	40%	25%
ROW	51%	5%	7%	-	37%
ROW-Rural	35%	-	-	-	65%
Alley	67%	4%	-	-	29%

Boulevard	50%	-	12%	-	38%
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Table 3. Portion of Impervious Areas that are Directly Connected

Land Use	Street	Driveway	Sidewalk	Roof	WinSLAMM Standard Land Use Name
HDR	N/A	100%	50%	50%	High Density Residential (No Alley)
MHD	N/A	100%	100%	30%	Duplex
MDR	N/A	74.67%	50%	30%	Medium Density Residential (No Alley)
LDR	N/A	71.11%	50%	30%	Low Density Residential
NMU	N/A	100%	50%	50%	-
BP	N/A	100%	50%	50%	-
ROW <i>(All Types Except Rural)</i>	100%	100%	100%	N/A	-
ROW-Rural	0%	N/A	N/A	N/A	-

The total percentage of impervious area within each lot was identified by MSA's site planner, and the distribution of impervious areas by type were prorated accordingly from WinSLAMM standard land use classifications. Land uses that do not have a standard WinSLAMM land use classification was assumed to have 100% connected impervious for driveways/parking lots and 50% connected impervious for sidewalks and roofs.

Impervious percentages for the proposed ROW areas were calculated from City of Fitchburg typical roadway sections. The three proposed ROW widths on site are 24-foot wide, 40-foot wide, and 66-foot wide. ROW (66' wide) assumed to have a 34-foot wide roadway with two 5-foot wide sidewalks. Alley (ROW 24' wide) assumed to have a 16-foot wide roadway with no sidewalks. Boulevard (ROW 40' wide) assumed to have a 20-foot wide roadway with one 5-foot wide sidewalk.

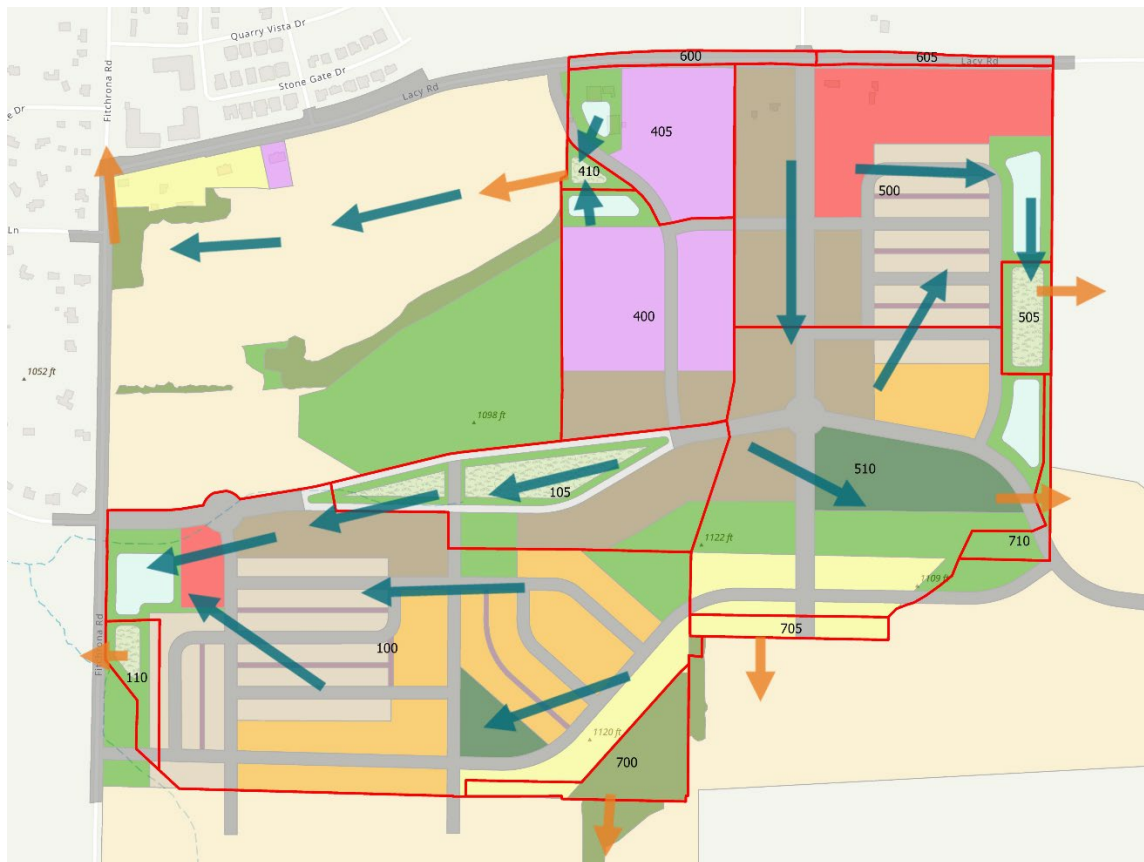


Figure 5. Post-Development Subwatersheds and Time of Concentration Flow Paths

2.2 VOLUME CONTROL

Stormwater volume control was evaluated based on individual events using the HydroCAD-10 model for both pre- and post-development conditions. The model uses standard Soil Conservation Service (SCS) TR-20 runoff hydrograph and curve number procedures, and TR-55 Time of Concentration (Tc) calculations.

2.3 WATER QUALITY

Water quality performance of stormwater control practices was evaluated using the WinSLAMM model version 10.5. The model estimates pollutant loads using a database of monitoring results and performs runoff and hydraulic routing calculations for treatment practices. The model was run continuously using Madison rainfall for the period of March 12, 1981, through December 2, 1981, as specified in NR 151, which had a total rainfall depth of 28.81 inches.

The WinSLAMM standard high density residential (no alley), duplex, medium density residential (no alley), and low-density residential land use files were modified to match the impervious surface ratios for the SSPN. Table 1 and 2 summarize the connected and disconnected impervious surface ratios used in the WinSLAMM analysis.

2.4 INFILTRATION

Pre-development stay-on calculations were completed using the pre-development curve numbers. The infiltration calculations were done using two separate targets, 90% and 100% infiltration, since the east side of the neighborhood drains to a closed depression and the west side of the neighborhood drains to naturally drained watershed. Dane County Stormwater Manual references a graph showing the 90% and 100% stay-on requirement based on the pre-development runoff curve number. Each target stay-on depth was multiplied by the area to get a total target stay-on volume for each watershed area.

Post-development infiltration performance was evaluated using the WinSLAMM model version 10.5. The model was run continuously using Madison rainfall for the period of March 12, 1981 through December 2, 1981, as specified in NR 151, which had a total rainfall depth of 28.81 inches.

2.5 EXTREME EVENT FLOODING

As described in Section 1.2, the closed depression west of the Badger State Trail and east of the SSPN is particularly prone to flooding because it has no surface outlet, and flood protection will be established based on back-to-back 100-year storm events. The HydroCAD model was used to compute the 100-year back-to-back storm event. The peak water surface elevation and flood area was estimated with a stage-storage relationship developed from the City of Fitchburg LiDAR survey (**Table 4**).

Table 4. Stage-Storage Relationship for Closed Depression West of Badger Trail

Elevation (ft)	Area (ac)	Storage Volume (ac-ft)
1017.0	9.25	0
1018.0	13.55	11.4
1019.0	23.20	29.8
1020.0	33.50	58.1
1022.0	47.65	139.3

Note: Overflow to the south occurs at approximately 1020.5 ft.

CHAPTER 3 – RESULTS

3.1 RUNOFF PEAK DISCHARGE AND VOLUME CONTROL

The stormwater management system controls peak discharge rates, at each location where discharge currently occurs, to levels less than existing conditions for events ranging from the 1-year, 24-hour storm to the 200-year, 24-hour storm. For the portion of the neighborhood draining east to a closed depression, runoff volumes are also controlled to 10% below existing levels for the 1-year, 24-hour storm to the 200-year, 24-hour storm.

Table 5. Peak Discharge Rates and Runoff Volumes Directed East

Event (yr)	Existing		Proposed	
	Peak Flow (cfs)	Total Volume (ac-ft)	Peak Flow (cfs)	Total Volume (ac-ft)
1	33.84	4.261	1.82	2.748
2	51.02	5.864	2.40	3.304
10	126.34	12.708	4.88	5.140
100	315.20	29.962	98.69	24.626
200	384.30	36.351	186.77	31.755
Area (ac)	104.30		111.47	

Table 6. Peak Discharge Rates Directed West

Event (yr)	Existing	Proposed
	Peak Flow (cfs)	Peak Flow (cfs)
1	67.46	6.71
2	94.74	8.63
10	207.53	24.80
100	478.10	221.15
200	574.64	292.65
Area (ac)	142.93	123.95

Table 7. Peak Discharge Rates Directed Northwest

Event (yr)	Existing	Proposed
	Peak Flow (cfs)	Peak Flow (cfs)
1	15.56	3.91
2	21.06	4.44
10	43.58	6.15
100	97.32	57.84
200	116.48	89.91
Area (ac)	26.87	39.96

3.2 WATER QUALITY

The WinSLAMM simulations of post-development conditions indicate that the stormwater management practices will provide the required 80% Total Suspended Solids control for the three regional watersheds. **Table 8** summarizes the post-development total suspended solids reductions compared to no controls.

Table 8. Post-Development Total Suspended Solids Reduction

Watershed	TSS Load Without Controls (lbs)	TSS Load With Controls (lbs)	% TSS Reduction
East	25,962	336.9	98.70%
West	29.112	1,671.0	94.26%
Northwest	9,932	274.4	97.24%

3.3 INFILTRATION

WinSLAMM modeling completed for this design indicates that the proposed stormwater management systems will achieve infiltration requirements for the east, west, and northwest draining watersheds. **Table 9, 10, and 11** summarize the existing stay-on calculations. **Table 12** summarizes the proposed infiltration meets existing stay-on requirements.

Table 9. East Watershed Existing Stay-On Calculations

	Land Use	CN	100% Stay-On Target (in/yr)	Area	Target Stay-On Volume (ac-ft)
East	Open, HSG B	61	28.5	21.271	50.519
	Open, HSG C	71	27.4	44.069	100.624
	Open, HSG D	78	25.8	1.724	3.707
	Woodland, HSG C	70	27.5	1.255	2.876
	Agriculture, HSG B	68	27.8	29.160	67.554
	Agriculture, HSG C	78	25.9	6.797	14.670
	Agriculture, HSG D	83	24.0	0.023	0.046
				27.61	104.299

Table 10. West Watershed Existing Stay-On Calculations

	Land Use	CN	90% Stay-On Target (in/yr)	Area	Target Stay-On Volume (ac-ft)
West	Open, HSG B	61	25.7	2.817	6.033
	Open, HSG C	71	24.7	35.592	73.260
	Open, HSG D	78	23.2	0.008	0.015
	Woodland, HSG B	55	25.9	2.023	4.366
	Woodland, HSG C	70	24.8	12.520	25.875
	Woodland, HSG D	77	23.4	2.561	4.994
	Agriculture, HSG B	68	25.0	21.969	45.769
	Agriculture, HSG C	78	23.3	64.950	126.111
	Agriculture, HSG D	83	21.6	0.491	0.884
			24.121	142.931	287.307

Table 11. Northwest Watershed Existing Stay-On Calculations

	Land Use	CN	90% Stay-On Target (in/yr)	Area	Target Stay-On Volume (ac-ft)
Northwest	Open, HSG B	61	25.7	1.040	2.227
	Open, HSG C	71	24.7	18.715	38.522
	Open, HSG D	78	23.2	4.522	8.743
	Impervious	98	7.3	2.596	1.579
			22.805	26.873	51.071

Table 12. Existing vs. Proposed Conditions Stay-On

Watershed	Existing			Proposed		
	Area	Target Stay-On Volume (ac-ft)	Target Runoff Volume (ac-ft)	Area	Stay-On Volume (ac-ft)	Runoff Volume (ac-ft)
East	104.30	239.996	10.409	111.47	263.445	4.180
West	142.93	287.307	55.846	123.95	251.612	45.964
Northwest	26.87	51.071	13.447	39.96	82.555	13.387

3.4 CLOSED DEPRESSION FLOODING

The HydroCAD model indicates that back-to-back 100-year events would result in flooding of approximately 36.3 acres and a flooded stage of approximately 1020.4 ft for the proposed conditions model (**Table 13**). The increased infiltration requirement and flood protection resulted in a flooded stage in the closed depression that was approximately 0.2 ft lower than the existing condition, with approximately 1.2 less flooded acres. Note that the simulations assumed that the closed depression was dry before the storms and a native infiltration rate of 0.04 in/hr was applied as exfiltration in the HydroCAD pond node. The model also does not account for any upstream runoff from other closed depressions.

Table 13. Runoff to Eastern Closed Depression for Back-to-Back 100-year Storm

Scenario	Runoff Volume (ac-ft)	Flood Stage (ft)	Area Flooded (ac)
Existing	84.5	1020.6	37.5
Proposed	78.2	1020.4	36.3

3.5 SUMMARY OF STORMWATER MANAGEMENT SPACE REQUIREMENTS

Table 14 summarizes each watershed’s impervious surface cover and space requirements for stormwater controls to meet the performance standards for the SSPN, based on the stormwater analyses described above.

Table 14. Stormwater Area Requirements by Watershed and Impervious Percentage

Watershed	Impervious Percentage	Wet Pond Area	Infiltration Area
East	49.1%	3.4%	1.8%
West	38.5%	1.6%	4.4%
Northwest	64.7%	3.5%	1.1%

CHAPTER 4 – CONCLUSIONS AND RECOMMENDATIONS

4.1 PEAK DISCHARGE AND DRAINAGE

1. Control peak discharge to pre-development levels for the 1-year through 100-year events to meet City, County, and State requirements.
2. Coordinate safe drainageway for runoff flowing through development to the northwest.
3. Maintain capacity of two drainageways in the southwest corner of the SSPN that discharge in Fitchrona Road right-of-way in the proposed open space.

4.2 STORMWATER VOLUME

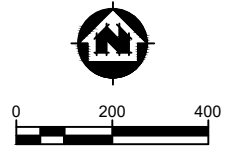
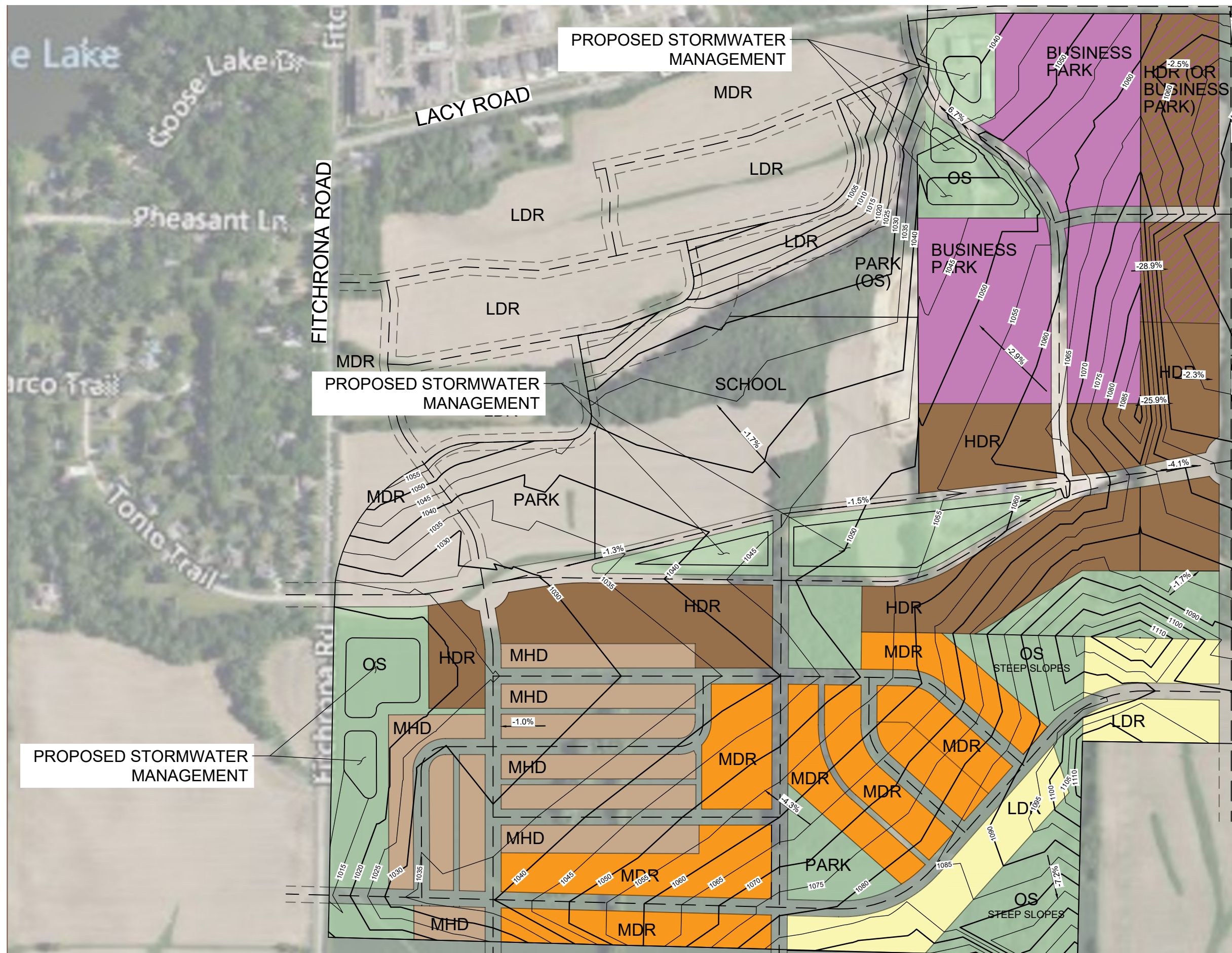
4. Require runoff volume control practices that achieve 100% of pre-development runoff volume for all development areas, including roads draining to the closed depression, based on the average annual rainfall series. This could be accomplished through regional stormwater controls and integrating stormwater controls into site landscaping.
5. For the rest of the neighborhood (areas not draining to a closed depression), design stormwater controls that reduce runoff volumes to 90% of the pre-development runoff volume for all areas, including roads.
6. Require additional soil borings during the development of the detailed stormwater designs. Shallow groundwater or poor soils could be found in the areas where regional stormwater basins are planned. Smaller infiltration areas may be needed in higher density areas (business park, neighborhood mixed use, high density residential) to compensate for poor infiltration potential in the regional areas.

4.3 WATER QUALITY

7. Volume and peak discharge control practices are likely to also provide the water quality treatment required by ordinances (at least 80% reduction in Total Suspended Solids relative to no controls).

4.4 FLOOD PROTECTION

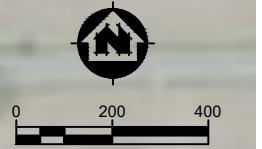
8. Establish a flood protection elevation of approximately 1020.6 ft for the closed depression east of the neighborhood, based on the predicted water surface elevation for back-to-back 100-year runoff events. This corresponds to an inundation area of approximately 37.5 acres for the existing topography. This extreme weather scenario is recommended for flood protection because there is no surface outlet for the area.



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 FITCHBURG, DANE COUNTY, WI

PRELIMINARY GRADING EXHIBIT

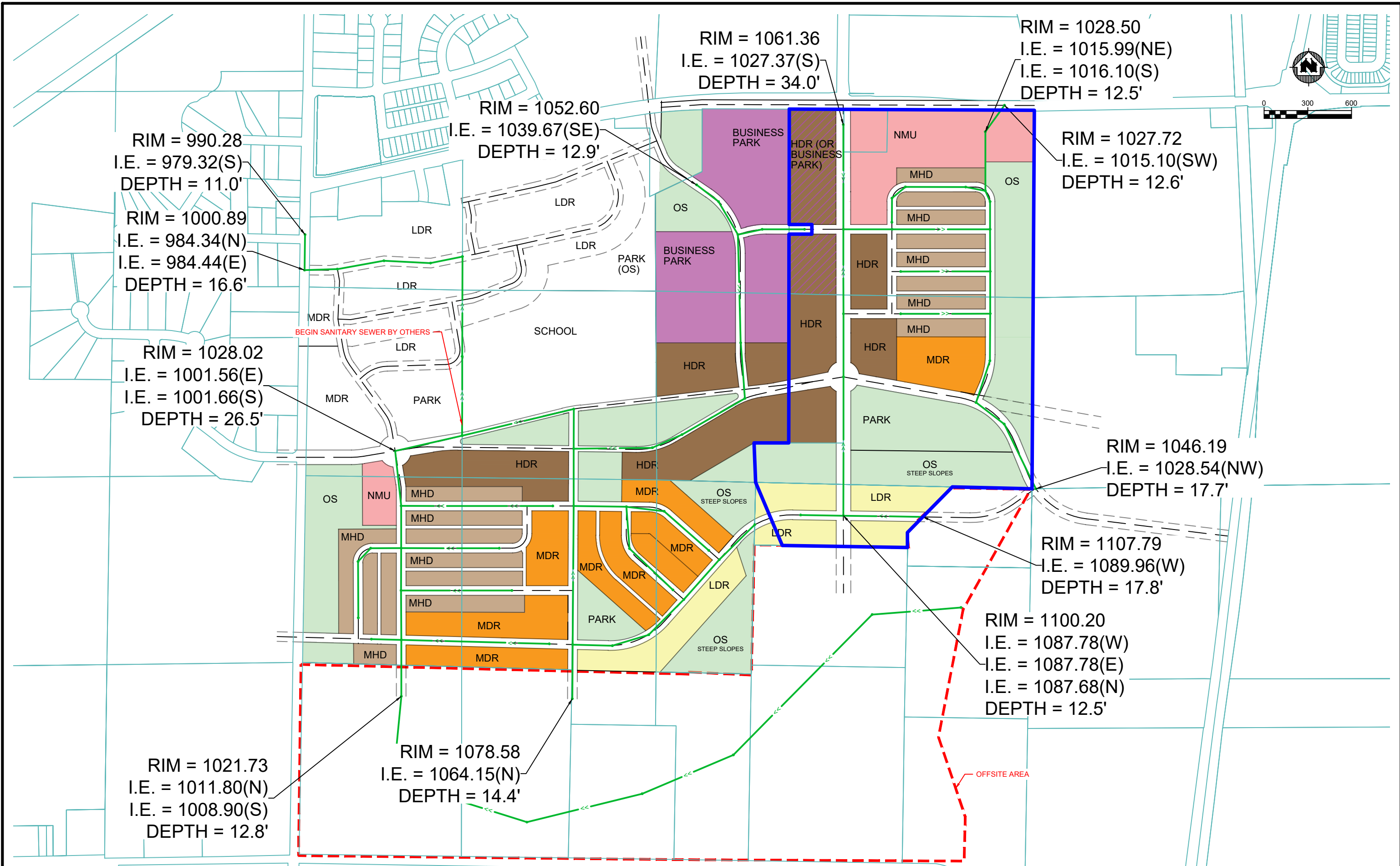


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 FITCHBURG, DANE COUNTY, WI

PRELIMINARY GRADING EXHIBIT

PLOTTED: Monday, November 25, 2024 3:09:40 PM. FROM: G:\07\0772907729051\CADD\C3D\Sanitary Sewer Analysis\07729051 Overall Mass Grading Plan.dwg DRAWN BY: Jessika McNellis



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I.E. = 979.32(S)
DEPTH = 11.0'

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DEPTH = 12.9'

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DEPTH = 12.5'

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DEPTH = 12.6'

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RIM = 1021.73
I.E. = 1011.80(N)
I.E. = 1008.90(S)
DEPTH = 12.8'

RIM = 1078.58
I.E. = 1064.15(N)
DEPTH = 14.4'

PROJECT DATE:	DRAWN BY:	NO.	DATE	REVISION	BY:
	Init				
	Init				
	Init				

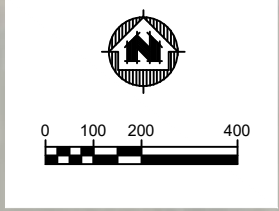
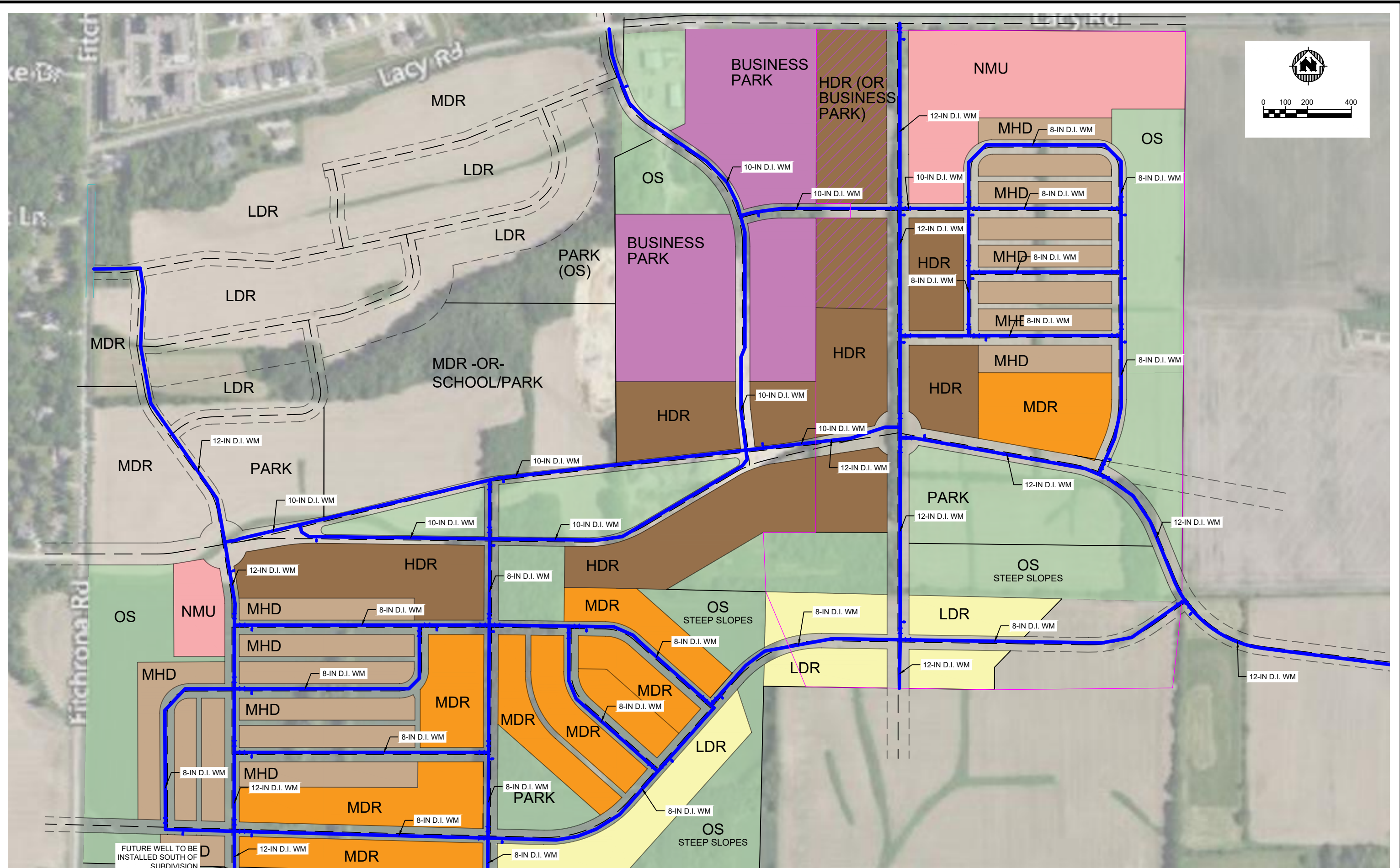
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SOUTH STONER PRAIRIE NEIGHBORHOOD
CITY OF FITCHBURG
DANE COUNTY, WI

SANITARY SEWER ANALYSIS

PROJECT NO.
07729051
SHEET



FUTURE WELL TO BE INSTALLED SOUTH OF SUBDIVISION

PROJECT DATE:	NO.	DATE	REVISION	BY:
DESIGNED BY: Init				
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PRELIMINARY

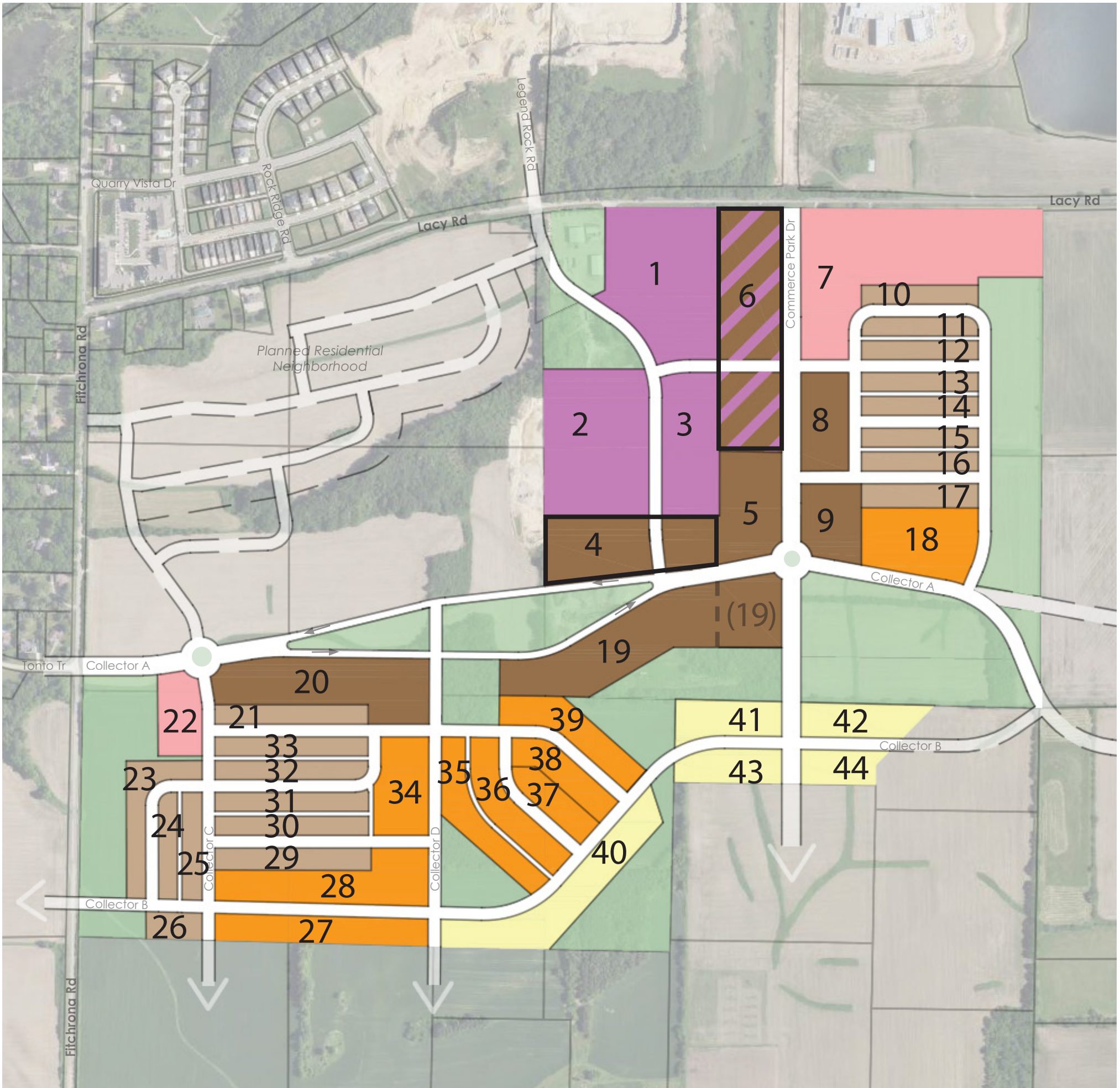
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GREENFIELD NEIGHBORHOOD
 CITY OF FITCHBURG
 DANE COUNTY, WI

PRELIMINARY WATERMAIN LAYOUT

PROJECT NO. 07729051
 SHEET EX3

PLOT DATE: 3/21/2025 4:09 PM, G:\07\0729\07729051\CADD\C3D\Sanitary Sewer Analysis\Prelim Water Layout.dwg



LEGEND

25 - 34 A. Business Park (BP)
(Range to include hatched areas)

33 - 42 A. High Density Residential (HDR)
(Range to include hatched areas)

29 ACRES Medium-High Density Residential (MHD)

29 ACRES Medium Density Residential (MDR)

14 ACRES Low Density Residential (LDR)

16 ACRES Neighborhood Mixed Use (NMU)

68 ACRES Parks, Open Space, & Stormwater Management



Existing Trails

Proposed Trails

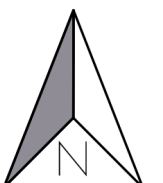
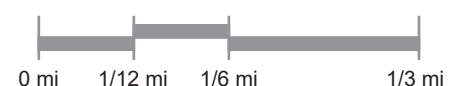


Exhibit 1, Trip Generation Table

South Stoner Development - Option A														
ITE Land Use	ITE Land Use Code	Parcel Acres	FAR Density	Size	Units		Weekday Two-way		AM Peak Hour			PM Peak Hour		
									Total	In	Out	Total	In	Out
Single-Family Detached Housing	210	-	-	704	Dwelling Units	Rate			0.00	0.00		0.00	0.00	
						Percentage			25%	75%		63%	37%	
						Raw Trips	6,075	440	110	330	620	390	230	
						Minus Linked Trips	0%	0	0	0	0	0	0	
						Driveway Trips	6,075	440	110	330	620	390	230	
						Minus Pass-by Trips	0%	0	0	0	0	0	0	
						New Trips	6,075	440	110	330	620	390	230	
Multi-Family Housing (Low-Rise)	220	-	-	980	Dwelling Units	Rate			0.00	0.00		0.00	0.00	
						Percentage			24%	76%		63%	37%	
						Raw Trips	6,350	325	80	245	440	275	165	
						Minus Linked Trips	0%	0	0	0	0	0	0	
						Driveway Trips	6,350	485	80	245	440	275	165	
						Minus Pass-by Trips	0%	0	0	0	0	0	0	
						New Trips	6,350	485	80	245	440	275	165	
Multi-Family Housing (Mid-Rise)	221	-	-	1056	Dwelling Units	Rate			0.00	0.00		0.00	0.00	
						Percentage			23%	77%		61%	39%	
						Raw Trips	4,990	455	105	350	410	250	160	
						Minus Linked Trips	0%	0	0	0	0	0	0	
						Driveway Trips	4,990	455	105	350	410	250	160	
						Minus Pass-by Trips	0%	0	0	0	0	0	0	
						New Trips	4,990	455	105	350	410	250	160	
Coffee/Donut Shop With Drive-Through Window	937	-	-	3.6	1,000 sf	Rate	533.57	85.88	43.80	42.08	38.99	19.50	19.50	
						Percentage			51%	49%		50%	50%	
						Raw Trips	1,920	310	160	150	140	70	70	
						Minus Linked Trips	20%	(385)	(60)	(30)	(30)	(15)	(15)	
						Driveway Trips	1,535	250	130	120	110	55	55	
						Minus Pass-by Trips	0%	0	0	0	0	0	0	
						New Trips	1,535	250	130	120	110	55	55	
Strip Retail Plaza (<40ksf)	822	-	-	34.0	1,000 sf	Rate	54.45	2.36	1.42	0.94		0.00	0.00	
						Percentage			60%	40%		50%	50%	
						Raw Trips	1,850	80	50	30	165	80	85	
						Minus Linked Trips	20%	(370)	(15)	(10)	(5)	(35)	(20)	
						Driveway Trips	1,480	65	40	25	130	65	65	
						Minus Pass-by Trips	0%	0	0	0	0	0	0	
						New Trips	1,480	65	40	25	130	65	65	
Strip Retail Plaza (<40ksf)	822	-	-	34.0	1,000 sf	Rate	54.45	2.36	1.42	0.94		0.00	0.00	
						Percentage			60%	40%		50%	50%	
						Raw Trips	1,850	80	50	30	165	80	85	
						Minus Linked Trips	20%	(370)	(15)	(10)	(5)	(35)	(20)	
						Driveway Trips	1,480	65	40	25	130	65	65	
						Minus Pass-by Trips	0%	0	0	0	0	0	0	
						New Trips	1,480	65	40	25	130	65	65	
General Office Building	710	9.9	0.24	103.5	1,000 sf	Rate			0.00	0.00		0.00	0.00	
						Percentage			88%	12%		17%	83%	
						Raw Trips	1,195	170	150	20	170	30	140	
						Minus Linked Trips	0%	0	0	0	0	0	0	
						Driveway Trips	1,195	170	150	20	225	30	140	
						Minus Pass-by Trips	0%	0	0	0	0	0	0	
						New Trips	1,195	170	150	20	225	30	140	
Manufacturing	140	9.6	0.24	100.4	1,000 sf	Rate			0.00	0.00		0.00	0.00	
						Percentage			76%	24%		31%	69%	
						Raw Trips	580	70	55	15	70	20	50	
						Minus Linked Trips	0%	0	0	0	0	0	0	
						Driveway Trips	580	70	55	15	70	20	50	
						Minus Pass-by Trips	0%	0	0	0	0	0	0	
						New Trips	580	70	55	15	70	20	50	
General Office Building	710	5.1	0.24	53.3	1,000 sf	Rate			0.00	0.00		0.00	0.00	
						Percentage			88%	12%		17%	83%	
						Raw Trips	1,065	95	85	10	100	15	85	
						Minus Linked Trips	0%	0	0	0	0	0	0	
						Driveway Trips	1,065	95	85	10	100	15	85	
						Minus Pass-by Trips	0%	0	0	0	0	0	0	
						New Trips	1,065	95	85	10	100	15	85	

Development Trip Generation Summary							
	Weekday Two-way	Total	AM Peak Hour In	AM Peak Hour Out	PM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out
Raw Trip Generation	25,875	2,025	845	1,180	2,280	1,210	1,070
Linked Trips	(1,125)	(90)	(50)	(40)	(100)	(45)	(55)
Total Driveway Trips	24,750	1,935	795	1,140	2,180	1,165	1,015
Pass-by Trips	0	0	0	0	0	0	0
Total New Trips	24,750	1,935	795	1,140	2,180	1,165	1,015

All land uses shown in this exhibit use trip generation rates from the ITE Trip Generation Manual, 11th Edition, unless otherwise noted
 Fitted curve equation used when Total Rate is not shown
 All trips rounded to the nearest 5



Exhibit 2, Trip Generation Table

South Stoner Development - Option B													
ITE Land Use	ITE Land Use Code	Parcel Acres	FAR Density	Size	Units		Weekday Two-way	AM Peak Hour			PM Peak Hour		
								Total	In	Out	Total	In	Out
Single-Family Detached Housing	210	-	-	704	Dwelling Units	Rate		0.00	0.00		0.00	0.00	
						Percentage		25%	75%		63%	37%	
						Raw Trips	6,075	440	110	330	620	390	230
	Minus Linked Trips	0%	Trips	0	0	0	0	0	0	0			
	Driveway Trips	6,075	440	110	330	620	390	230					
	Minus Pass-by Trips	0%	Trips	0	0	0	0	0	0				
	New Trips	6,075	440	110	330	620	390	230					
Multi-Family Housing (Low-Rise)	220	-	-	884	Dwelling Units	Rate		0.00	0.00		0.00	0.00	
						Percentage		24%	76%		63%	37%	
						Raw Trips	5,740	295	70	225	400	250	150
	Minus Linked Trips	0%	Trips	0	0	0	0	0	0				
	Driveway Trips	5,740	485	70	225	400	250	150					
	Minus Pass-by Trips	0%	Trips	0	0	0	0	0	0				
	New Trips	5,740	485	70	225	400	250	150					
Multi-Family Housing (Mid-Rise)	221	-	-	832	Dwelling Units	Rate		0.00	0.00		0.00	0.00	
						Percentage		23%	77%		61%	39%	
						Raw Trips	3,920	355	80	275	325	200	125
	Minus Linked Trips	0%	Trips	0	0	0	0	0	0				
	Driveway Trips	3,920	355	80	275	325	200	125					
	Minus Pass-by Trips	0%	Trips	0	0	0	0	0	0				
	New Trips	3,920	355	80	275	325	200	125					
Coffee/Donut Shop With Drive-Through Window	937	-	-	3.6	1,000 sf	Rate	533.57	85.88	43.80	42.08	38.99	19.50	19.50
						Percentage		51%	49%		50%	50%	
						Raw Trips	1,920	310	160	150	140	70	70
	Minus Linked Trips	20%	Trips	(385)	(60)	(30)	(30)	(30)	(15)	(15)			
	Driveway Trips	1,535	250	130	120	110	55	55					
	Minus Pass-by Trips	0%	Trips	0	0	0	0	0	0				
	New Trips	1,535	250	130	120	110	55	55					
Strip Retail Plaza (<40ksf)	822	-	-	34.0	1,000 sf	Rate	54.45	2.36	1.42	0.94		0.00	0.00
						Percentage		60%	40%		50%	50%	
						Raw Trips	1,850	80	50	30	165	80	85
	Minus Linked Trips	20%	Trips	(370)	(15)	(10)	(5)	(35)	(15)	(20)			
	Driveway Trips	1,480	65	40	25	130	65	65					
	Minus Pass-by Trips	0%	Trips	0	0	0	0	0	0				
	New Trips	1,480	65	40	25	130	65	65					
Strip Retail Plaza (<40ksf)	822	-	-	34.0	1,000 sf	Rate	54.45	2.36	1.42	0.94		0.00	0.00
						Percentage		60%	40%		50%	50%	
						Raw Trips	1,850	80	50	30	165	80	85
	Minus Linked Trips	20%	Trips	(370)	(15)	(10)	(5)	(35)	(15)	(20)			
	Driveway Trips	1,480	65	40	25	130	65	65					
	Minus Pass-by Trips	0%	Trips	0	0	0	0	0	0				
	New Trips	1,480	65	40	25	130	65	65					
General Office Building	710	9.9	0.26	113.8	1,000 sf	Rate		0.00	0.00		0.00	0.00	
						Percentage		88%	12%		17%	83%	
						Raw Trips	1,300	185	165	20	185	30	155
	Minus Linked Trips	0%	Trips	0	0	0	0	0	0				
	Driveway Trips	1,300	185	165	20	225	30	155					
	Minus Pass-by Trips	0%	Trips	0	0	0	0	0	0				
	New Trips	1,300	185	165	20	225	30	155					
Manufacturing	140	9.6	0.26	110.4	1,000 sf	Rate		0.00	0.00		0.00	0.00	
						Percentage		76%	24%		31%	69%	
						Raw Trips	620	75	55	20	80	25	55
	Minus Linked Trips	0%	Trips	0	0	0	0	0	0				
	Driveway Trips	620	75	55	20	80	25	55					
	Minus Pass-by Trips	0%	Trips	0	0	0	0	0	0				
	New Trips	620	75	55	20	80	25	55					
General Office Building	710	5.1	0.26	58.6	1,000 sf	Rate		0.00	0.00		0.00	0.00	
						Percentage		88%	12%		17%	83%	
						Raw Trips	730	105	95	10	105	15	90
	Minus Linked Trips	0%	Trips	0	0	0	0	0	0				
	Driveway Trips	730	105	95	10	105	15	90					
	Minus Pass-by Trips	0%	Trips	0	0	0	0	0	0				
	New Trips	730	105	95	10	105	15	90					
General Office Building	710	8.9	0.26	102.3	1,000 sf	Rate		0.00	0.00		0.00	0.00	
						Percentage		88%	12%		17%	83%	
						Raw Trips	1,185	170	150	20	170	30	140
	Minus Linked Trips	0%	Trips	0	0	0	0	0	0				
	Driveway Trips	1,185	170	150	20	170	30	140					
	Minus Pass-by Trips	0%	Trips	0	0	0	0	0	0				
	New Trips	1,185	170	150	20	170	30	140					

Development Trip Generation Summary							
	Weekday Two-way	AM Peak Hour			PM Peak Hour		
		Total	In	Out	Total	In	Out
Raw Trip Generation	25,190	2,095	985	1,110	2,355	1,170	1,185
Linked Trips	(1,125)	(90)	(50)	(40)	(100)	(45)	(55)
Total Driveway Trips	24,065	2,005	935	1,070	2,255	1,125	1,130
Pass-by Trips	0	0	0	0	0	0	0
Total New Trips	24,065	2,005	935	1,070	2,255	1,125	1,130

All land uses shown in this exhibit use trip generation rates from the ITE Trip Generation Manual, 11th Edition, unless otherwise noted
 Fitted curve equation used when Total Rate is not shown
 All trips rounded to the nearest 5



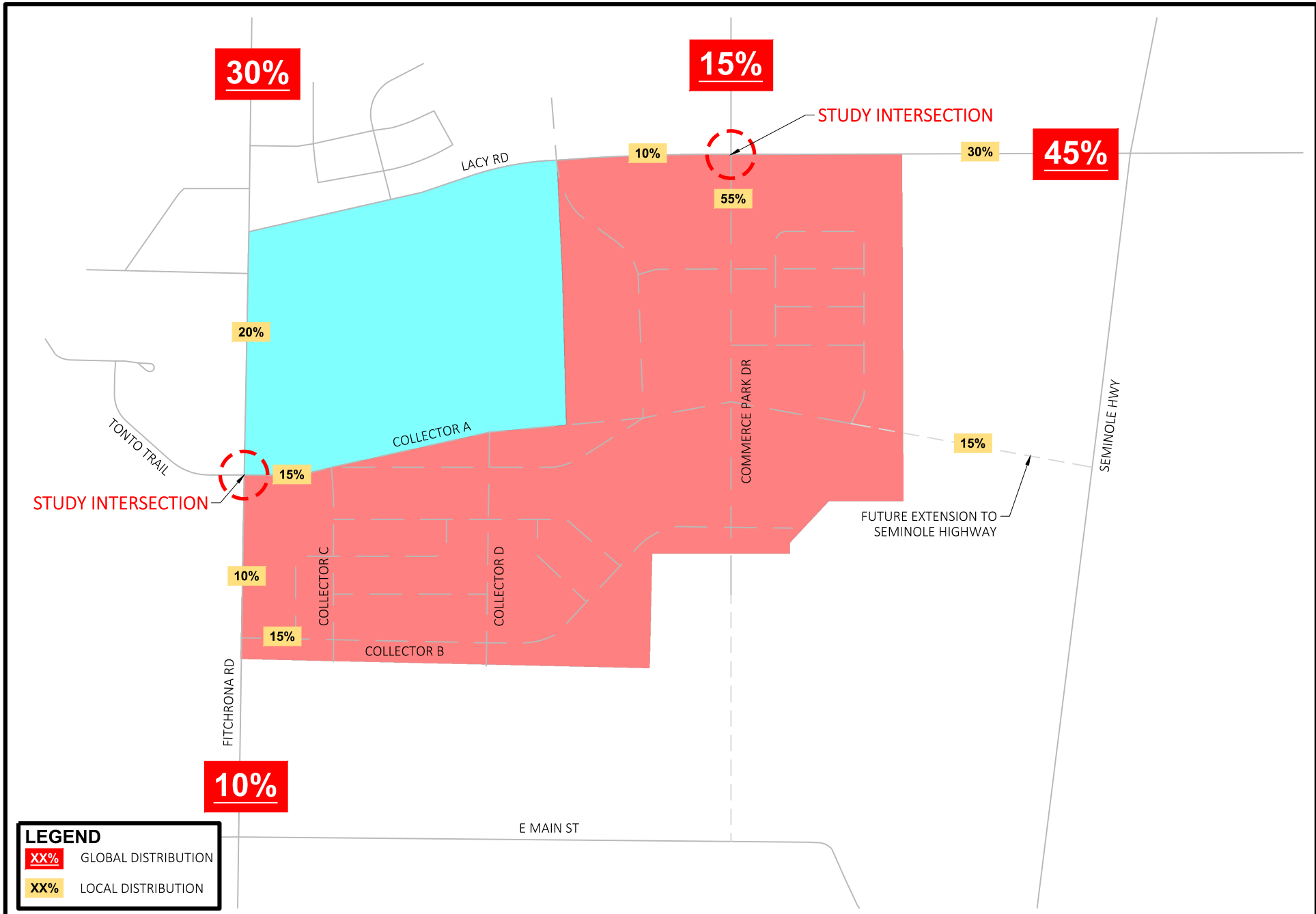
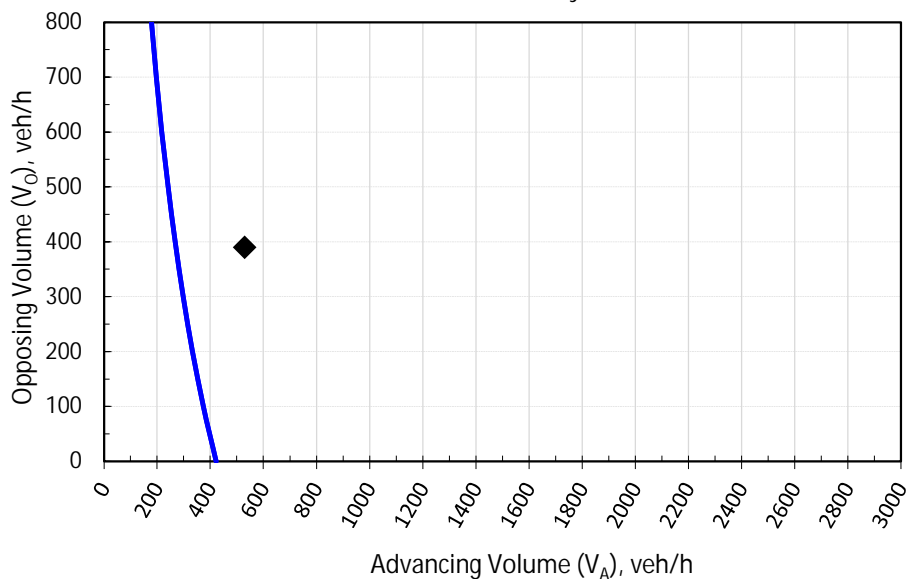


Exhibit 4 - Turn Lane Warrant Analysis

Left Turn Lane Warrant Analysis

Fitchrona Rd & Collector A
Southbound
 2045 Build
 PM Peak

2-Lane Roadway



Input	
Posted speed, mph	40
Advancing left turn volume, veh/h	115
Percent of left turns in advancing volume (V_A), %	22%
Advancing volume (V_A), veh/h	530
Opposing volume (V_O), veh/h	390

Output	
Limiting advancing volume (V_A), veh/h	271
Left turn lane warranted	

Calibration

Average time for making left turn, sec	3.0
Critical headway, sec	5.0
Average time for left turn vehicle to clear the advancing lane, sec	1.9

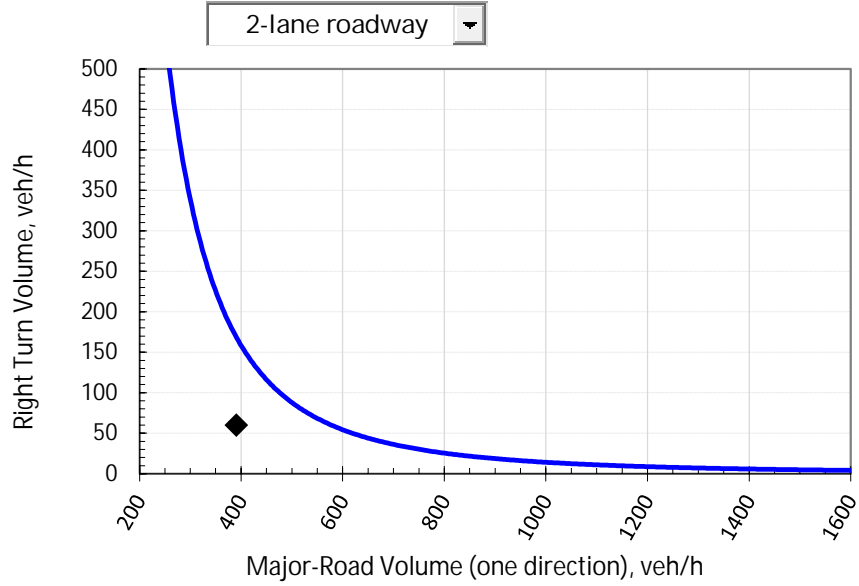
Right Turn Lane Warrant Analysis

Fitchrona Rd & Collector A

Northbound

2045 Build

PM Peak



Input	
Major road posted speed, mph	40
Major road volume (one direction), veh/h	391
Right turn volume, veh/h	60

Output	
Limiting right turn volume, veh/h	168
Right turn lane NOT warranted	



LEGEND

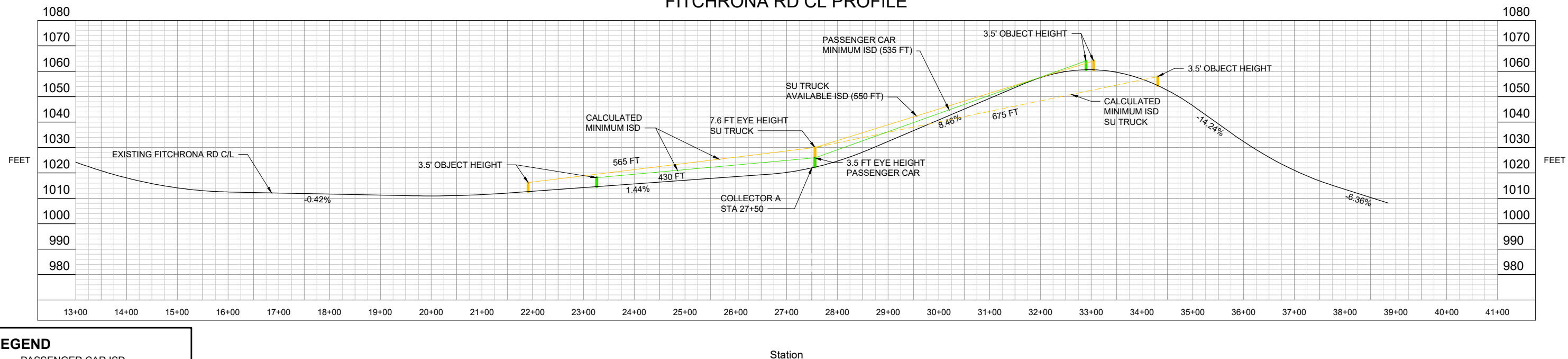
- PASSENGER CAR ISD
- SINGLE-UNIT TRUCK ISD
- VISION TRIANGLE

ISD AND VISION TRIANGLE REQUIREMENTS CALCULATED BASED ON FDM 11-10

NOTE: MINIMUM INTERSECTION SIGHT DISTANCE SHOWN.
 FITCHRONA RD: 45 MPH DESIGN SPEED
 COLLECTOR A: 35 MPH DESIGN SPEED

INTERSECTION SIGHT DISTANCE (ISD)
 FUTURE DESIGN SPEED USED FOR ANALYSIS: 45 MPH

FITCHRONA RD CL PROFILE



LEGEND

- PASSENGER CAR ISD
- SINGLE-UNIT TRUCK ISD

ISD REQUIREMENTS CALCULATED BASED ON FDM 11-10

NOTE: PROFILE IS GENERATED USING TOPOGRAPHICAL DATA OBTAINED FROM GOOGLE EARTH.

PROJECT DATE:	DRAWN BY:	NO.	DATE	REVISION	BY:
	Init	-	-		-
	DESIGNED BY:	Init	-		-
	CHECKED BY:	Init	-		-

PLOT DATE: 3/18/2025 4:38 PM, G:\07\0729\0729051\CADD\C3D\0729051 S Stoner Sight Distance Analysis.dwg

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S STONER PRAIRIE DEVELOPMENT
 CITY OF FITCHBURG
 DANE COUNTY, WI

EXHIBIT 5 - COLLECTOR A SIGHT DISTANCE ANALYSIS

PROJECT NO:
07729051
 SHEET
1

2045 Development Volumes - Option A

Lanes, Volumes, Timings

PM Peak

100: Commerce Park Dr & Lacy Rd

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	250	115	350	285	1	100	150	305	1	175	15
Future Volume (vph)	15	250	115	350	285	1	100	150	305	1	175	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	240		200	280		250	150		200	0		0
Storage Lanes	1		1	1		1	1		1	0		0
Taper Length (ft)	25			25			25			25		
Right Turn on Red			No			No			No			Yes
Link Speed (mph)		50			50			30			30	
Link Distance (ft)		521			674			429			446	
Travel Time (s)		7.1			9.2			9.8			10.1	
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Growth Factor	100%	100%	62%	100%	100%	62%	100%	100%	62%	100%	100%	100%
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	16	275	78	385	313	1	110	165	208	0	209	0
Turn Type	D.P+P	NA	Perm	D.P+P	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	8		4	4		8	2		2	6		
Detector Phase	7	4	4	3	8	8	2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	6.0	15.0	15.0	6.0	10.0	10.0	15.0	15.0	15.0	10.0	10.0	
Minimum Split (s)	11.0	24.0	24.0	10.5	24.0	24.0	24.0	24.0	24.0	24.0	24.0	
Total Split (s)	11.0	24.0	24.0	12.0	25.0	25.0	24.0	24.0	24.0	24.0	24.0	
Total Split (%)	18.3%	40.0%	40.0%	20.0%	41.7%	41.7%	40.0%	40.0%	40.0%	40.0%	40.0%	
Maximum Green (s)	6.5	18.0	18.0	7.5	19.0	19.0	18.0	18.0	18.0	18.0	18.0	
Yellow Time (s)	3.5	4.0	4.0	3.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0	6.0	6.0	6.0	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Recall Mode	None	None	None	None	None	None	Min	Min	Min	Min	Min	
Walk Time (s)		7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0	7.0	
Flash Don't Walk (s)		11.0	11.0		11.0	11.0	11.0	11.0	11.0	11.0	11.0	
Pedestrian Calls (#/hr)		0	0		0	0	0	0	0	0	0	
v/c Ratio	0.03	0.52	0.17	0.68	0.36	0.00	0.33	0.31	0.46		0.39	
Control Delay (s/veh)	6.8	21.1	16.5	16.8	12.7	12.0	19.1	17.6	20.3		18.1	

Lanes, Volumes, Timings
100: Commerce Park Dr & Lacy Rd

PM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	6.8	21.1	16.5	16.8	12.7	12.0	19.1	17.6	20.3		18.1	
Queue Length 50th (ft)	2	74	19	67	55	0	28	41	55		52	
Queue Length 95th (ft)	10	143	48	#136	158	3	68	88	113		107	
Internal Link Dist (ft)		441			594			349			366	
Turn Bay Length (ft)	240		200	280		250	150		200			
Base Capacity (vph)	615	612	521	564	869	739	386	612	521		611	
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0		0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0		0	
Storage Cap Reductn	0	0	0	0	0	0	0	0	0		0	
Reduced v/c Ratio	0.03	0.45	0.15	0.68	0.36	0.00	0.28	0.27	0.40		0.34	

Intersection Summary

Area Type: Other

Cycle Length: 60

Actuated Cycle Length: 55.4

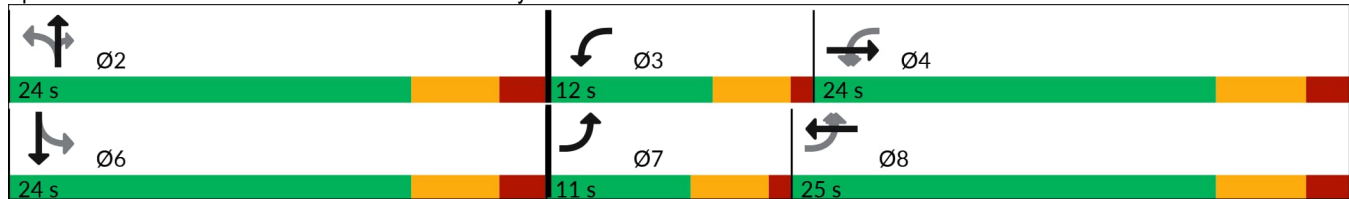
Natural Cycle: 60

Control Type: Actuated-Uncoordinated

95th percentile volume exceeds capacity, queue may be longer.
























Queue shown is maximum after two cycles.

Splits and Phases: 100: Commerce Park Dr & Lacy Rd





















HCM 7th Signalized Intersection Summary
 100: Commerce Park Dr & Lacy Rd

PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	15	250	115	350	285	1	100	150	305	1	175	15
Future Volume (veh/h)	15	250	115	350	285	1	100	150	305	1	175	15
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1885	1885	1885	1885	1885	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	16	275	78	385	313	1	110	165	208	1	192	16
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	1	1	1	1	1	1	1	1	1	1	1	1
Cap, veh/h	468	524	444	543	741	628	480	524	444	67	476	40
Arrive On Green	0.02	0.28	0.28	0.14	0.39	0.39	0.28	0.28	0.28	0.28	0.28	0.28
Sat Flow, veh/h	1795	1885	1598	1795	1885	1598	1183	1885	1598	2	1714	142
Grp Volume(v), veh/h	16	275	78	385	313	1	110	165	208	209	0	0
Grp Sat Flow(s),veh/h/ln	1795	1885	1598	1795	1885	1598	1183	1885	1598	1858	0	0
Q Serve(g_s), s	0.3	6.7	2.0	7.5	6.5	0.0	0.0	3.7	5.8	0.0	0.0	0.0
Cycle Q Clear(g_c), s	0.3	6.7	2.0	7.5	6.5	0.0	3.4	3.7	5.8	4.9	0.0	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	0.00		0.08
Lane Grp Cap(c), veh/h	468	524	444	543	741	628	480	524	444	583	0	0
V/C Ratio(X)	0.03	0.53	0.18	0.71	0.42	0.00	0.23	0.32	0.47	0.36	0.00	0.00
Avail Cap(c_a), veh/h	642	628	533	543	741	628	545	628	533	686	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	9.7	16.5	14.8	13.2	11.9	10.0	15.3	15.4	16.2	15.9	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.8	0.2	4.3	0.4	0.0	0.2	0.3	0.8	0.4	0.0	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	2.4	0.6	3.1	2.1	0.0	1.0	1.5	1.8	1.9	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	9.7	17.3	15.0	17.5	12.3	10.0	15.5	15.8	17.0	16.2	0.0	0.0
LnGrp LOS	A	B	B	B	B	A	B	B	B	B		
Approach Vol, veh/h		369			699			483			209	
Approach Delay, s/veh		16.5			15.1			16.2			16.2	
Approach LOS		B			B			B			B	
Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		21.0	12.0	21.0		21.0	5.8	27.2				
Change Period (Y+Rc), s		6.0	4.5	6.0		6.0	4.5	6.0				
Max Green Setting (Gmax), s		18.0	7.5	18.0		18.0	6.5	19.0				
Max Q Clear Time (g_c+I1), s		7.8	9.5	8.7		6.9	2.3	8.5				
Green Ext Time (p_c), s		1.5	0.0	1.1		0.8	0.0	1.1				
Intersection Summary												
HCM 7th Control Delay, s/veh			15.9									
HCM 7th LOS			B									

Lanes, Volumes, Timings
 200: Fitchrona Rd & Tonto Trl/Collector A

PM Peak

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	1	1	50	1	105	1	320	60	115	395	20
Future Volume (vph)	10	1	1	50	1	105	1	320	60	115	395	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	150		0	0		0	150		0
Storage Lanes	0		0	1		0	0		0	1		0
Taper Length (ft)	25			25			25			25		
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		496			720			438			424	
Travel Time (s)		8.5			12.3			7.5			7.2	
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	13	0	53	112	0	0	401	0	121	437	0
Sign Control		Stop			Stop			Free			Free	
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											

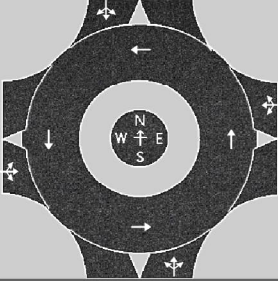
Intersection												
Int Delay, s/veh	3.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↕	↕			↕		↕	↕	
Traffic Vol, veh/h	10	1	1	50	1	105	1	320	60	115	395	20
Future Vol, veh/h	10	1	1	50	1	105	1	320	60	115	395	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	150	-	-	-	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	1	1	1	1	1	1	1	1	1	1	1	1
Mvmt Flow	11	1	1	53	1	111	1	337	63	121	416	21

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1008	1071	426	1029	1049	368	437	0	0	400	0	0
Stage 1	668	668	-	371	371	-	-	-	-	-	-	-
Stage 2	339	402	-	658	679	-	-	-	-	-	-	-
Critical Hdwy	7.11	6.51	6.21	7.11	6.51	6.21	4.11	-	-	4.11	-	-
Critical Hdwy Stg 1	6.11	5.51	-	6.11	5.51	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.11	5.51	-	6.11	5.51	-	-	-	-	-	-	-
Follow-up Hdwy	3.509	4.009	3.309	3.509	4.009	3.309	2.209	-	-	2.209	-	-
Pot Cap-1 Maneuver	220	222	630	213	228	679	1128	-	-	1164	-	-
Stage 1	449	458	-	652	622	-	-	-	-	-	-	-
Stage 2	677	602	-	455	453	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	164	199	630	189	204	679	1128	-	-	1164	-	-
Mov Cap-2 Maneuver	164	199	-	189	204	-	-	-	-	-	-	-
Stage 1	402	410	-	651	621	-	-	-	-	-	-	-
Stage 2	565	601	-	406	406	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	26.81	17.81	0.02	1.83
HCM LOS	D	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	5	-	-	178	189	665	1164	-	-
HCM Lane V/C Ratio	0.001	-	-	0.071	0.278	0.168	0.104	-	-
HCM Control Delay (s/veh)	8.2	0	-	26.8	31.2	11.5	8.5	-	-
HCM Lane LOS	A	A	-	D	D	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.2	1.1	0.6	0.3	-	-

HCS Roundabouts Report

General Information				Site Information				
Analyst	MTR				Intersection		Lacy Rd & Commerce Park Dr	
Agency or Co.	MSA				E/W Street Name		Lacy Rd	
Date Performed	1/21/2025				N/S Street Name		Commerce Park Dr	
Analysis Year	2045				Analysis Time Period, hrs		0.25	
Time Analyzed	PM Peak				Peak Hour Factor		0.91	
Project Description	2045 Build Option A				Jurisdiction		City of Fitchburg	

Volume Adjustments and Site Characteristics																
Approach	EB				WB				NB				SB			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment	LTR				LTR				LTR				LTR			
Volume (V), veh/h	0	15	250	115	0	350	285	1	0	100	150	305	0	1	175	15
Percent Heavy Vehicles, %	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Flow Rate (V _{PCE}), pc/h	0	17	277	128	0	388	316	1	0	111	166	339	0	1	194	17
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			
Proportion of CAVs, %	0															

Critical and Follow-Up Headway Adjustment												
Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway, s		4.7000			4.7000			4.7000			4.7000	
Follow-Up Headway, s		2.6000			2.6000			2.6000			2.6000	

Flow Computations, Capacity and v/c Ratios												
Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v _e), pc/h		422			705			616			212	
Entry Volume, veh/h		418			698			610			210	
Circulating Flow (v _c), pc/h	583			294			295			815		
Exiting Flow (v _{ex}), pc/h	617			444			184			710		
Capacity (C _{PCE}), pc/h		798			1049			1048			641	
Capacity (c), veh/h		790			1039			1038			635	
v/c Ratio (x)		0.53			0.67			0.59			0.33	























Delay and Level of Service												
Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		12.2			13.6			11.2			10.1	
Lane LOS		B			B			B			B	
95% Queue Length, Q ₉₅ (veh)		3.2			5.5			4.0			1.4	
95% Queue Length, Q ₉₅ (ft)		80.6			138.6			100.8			35.3	
Approach Delay, s/veh LOS	12.2		B	13.6		B	11.2		B	10.1		B
Intersection Delay, s/veh LOS	12.2						B					

2045 Development Volumes - Option B

Lanes, Volumes, Timings

PM Peak

100: Commerce Park Dr & Lacy Rd

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	250	115	355	285	1	120	180	355	1	175	15
Future Volume (vph)	15	250	115	355	285	1	120	180	355	1	175	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	240		200	280		250	150		200	0		0
Storage Lanes	1		1	1		1	1		1	0		0
Taper Length (ft)	25			25			25			25		
Right Turn on Red			No			No			No			Yes
Link Speed (mph)		50			50			30			30	
Link Distance (ft)		521			674			429			446	
Travel Time (s)		7.1			9.2			9.8			10.1	
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Growth Factor	100%	100%	62%	100%	100%	62%	100%	100%	62%	100%	100%	100%
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	16	275	78	390	313	1	132	198	242	0	209	0
Turn Type	D.P+P	NA	Perm	D.P+P	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	8		4	4		8	2		2	6		
Detector Phase	7	4	4	3	8	8	2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	6.0	15.0	15.0	6.0	10.0	10.0	15.0	15.0	15.0	10.0	10.0	
Minimum Split (s)	11.0	24.0	24.0	10.5	24.0	24.0	24.0	24.0	24.0	24.0	24.0	
Total Split (s)	11.0	24.0	24.0	12.0	25.0	25.0	24.0	24.0	24.0	24.0	24.0	
Total Split (%)	18.3%	40.0%	40.0%	20.0%	41.7%	41.7%	40.0%	40.0%	40.0%	40.0%	40.0%	
Maximum Green (s)	6.5	18.0	18.0	7.5	19.0	19.0	18.0	18.0	18.0	18.0	18.0	
Yellow Time (s)	3.5	4.0	4.0	3.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0	6.0	6.0	6.0	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Recall Mode	None	None	None	None	None	None	Min	Min	Min	Min	Min	
Walk Time (s)		7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0	7.0	
Flash Don't Walk (s)		11.0	11.0		11.0	11.0	11.0	11.0	11.0	11.0	11.0	
Pedestrian Calls (#/hr)		0	0		0	0	0	0	0	0	0	
v/c Ratio	0.03	0.52	0.17	0.70	0.36	0.00	0.39	0.37	0.53		0.39	
Control Delay (s/veh)	7.0	21.3	16.7	17.7	12.9	12.0	20.1	18.3	21.7		18.0	

Lanes, Volumes, Timings
 100: Commerce Park Dr & Lacy Rd

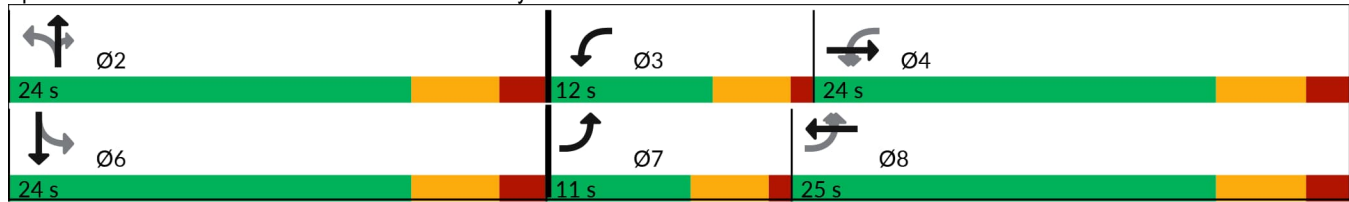
PM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	7.0	21.3	16.7	17.7	12.9	12.0	20.1	18.3	21.7	18.0	18.0	18.0
Queue Length 50th (ft)	2	74	19	68	55	0	34	51	65	52	52	52
Queue Length 95th (ft)	10	143	48	#142	158	3	79	104	132	107	107	107
Internal Link Dist (ft)		441			594			349			366	366
Turn Bay Length (ft)	240		200	280		250	150		200			
Base Capacity (vph)	611	609	517	560	865	735	384	609	517			607
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.03	0.45	0.15	0.70	0.36	0.00	0.34	0.33	0.47	0.34	0.34	0.34
























Intersection Summary
 Area Type: Other
 Cycle Length: 60
 Actuated Cycle Length: 55.7
 Natural Cycle: 60
 Control Type: Actuated-Uncoordinated
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 100: Commerce Park Dr & Lacy Rd





















HCM 7th Signalized Intersection Summary
 100: Commerce Park Dr & Lacy Rd

PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	15	250	115	355	285	1	120	180	355	1	175	15
Future Volume (veh/h)	15	250	115	355	285	1	120	180	355	1	175	15
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1885	1885	1885	1885	1885	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	16	275	78	390	313	1	132	198	242	1	192	16
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	1	1	1	1	1	1	1	1	1	1	1	1
Cap, veh/h	468	524	444	543	741	628	480	524	444	67	476	40
Arrive On Green	0.02	0.28	0.28	0.14	0.39	0.39	0.28	0.28	0.28	0.28	0.28	0.28
Sat Flow, veh/h	1795	1885	1598	1795	1885	1598	1183	1885	1598	2	1714	142
Grp Volume(v), veh/h	16	275	78	390	313	1	132	198	242	209	0	0
Grp Sat Flow(s),veh/h/ln	1795	1885	1598	1795	1885	1598	1183	1885	1598	1858	0	0
Q Serve(g_s), s	0.3	6.7	2.0	7.5	6.5	0.0	0.0	4.6	7.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	0.3	6.7	2.0	7.5	6.5	0.0	4.1	4.6	7.0	4.9	0.0	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	0.00		0.08
Lane Grp Cap(c), veh/h	468	524	444	543	741	628	480	524	444	583	0	0
V/C Ratio(X)	0.03	0.53	0.18	0.72	0.42	0.00	0.28	0.38	0.55	0.36	0.00	0.00
Avail Cap(c_a), veh/h	642	628	533	543	741	628	545	628	533	686	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	9.7	16.5	14.8	13.3	11.9	10.0	15.6	15.7	16.6	15.9	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.8	0.2	4.6	0.4	0.0	0.3	0.5	1.0	0.4	0.0	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	2.4	0.6	3.1	2.1	0.0	1.2	1.8	2.1	1.9	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	9.7	17.3	15.0	17.9	12.3	10.0	15.9	16.2	17.6	16.2	0.0	0.0
LnGrp LOS	A	B	B	B	B	A	B	B	B	B		
Approach Vol, veh/h		369			704			572			209	
Approach Delay, s/veh		16.5			15.4			16.7			16.2	
Approach LOS		B			B			B			B	
Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		21.0	12.0	21.0		21.0	5.8	27.2				
Change Period (Y+Rc), s		6.0	4.5	6.0		6.0	4.5	6.0				
Max Green Setting (Gmax), s		18.0	7.5	18.0		18.0	6.5	19.0				
Max Q Clear Time (g_c+I1), s		9.0	9.5	8.7		6.9	2.3	8.5				
Green Ext Time (p_c), s		1.8	0.0	1.1		0.8	0.0	1.1				
Intersection Summary												
HCM 7th Control Delay, s/veh			16.1									
HCM 7th LOS			B									

Lanes, Volumes, Timings
 200: Fitchrona Rd & Tonto Trl/Collector A

PM Peak

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	1	1	60	1	115	1	330	60	115	395	20
Future Volume (vph)	10	1	1	60	1	115	1	330	60	115	395	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	150		0	0		0	150		0
Storage Lanes	0		0	1		0	0		0	1		0
Taper Length (ft)	25			25			25			25		
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		496			720			438			424	
Travel Time (s)		8.5			12.3			7.5			7.2	
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	13	0	63	122	0	0	411	0	121	437	0
Sign Control		Stop			Stop			Free			Free	
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											

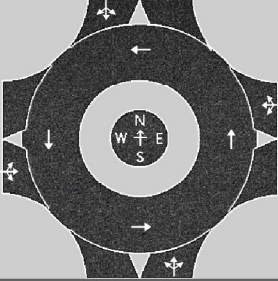
Intersection												
Int Delay, s/veh	4.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↗	↘			↕		↗	↘	
Traffic Vol, veh/h	10	1	1	60	1	115	1	330	60	115	395	20
Future Vol, veh/h	10	1	1	60	1	115	1	330	60	115	395	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	150	-	-	-	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	1	1	1	1	1	1	1	1	1	1	1	1
Mvmt Flow	11	1	1	63	1	121	1	347	63	121	416	21

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1018	1081	426	1039	1060	379	437	0	0	411	0	0
Stage 1	668	668	-	381	381	-	-	-	-	-	-	-
Stage 2	350	413	-	658	679	-	-	-	-	-	-	-
Critical Hdwy	7.11	6.51	6.21	7.11	6.51	6.21	4.11	-	-	4.11	-	-
Critical Hdwy Stg 1	6.11	5.51	-	6.11	5.51	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.11	5.51	-	6.11	5.51	-	-	-	-	-	-	-
Follow-up Hdwy	3.509	4.009	3.309	3.509	4.009	3.309	2.209	-	-	2.209	-	-
Pot Cap-1 Maneuver	216	219	630	209	225	670	1128	-	-	1154	-	-
Stage 1	449	458	-	643	615	-	-	-	-	-	-	-
Stage 2	669	596	-	455	453	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	158	195	630	186	201	670	1128	-	-	1154	-	-
Mov Cap-2 Maneuver	158	195	-	186	201	-	-	-	-	-	-	-
Stage 1	402	410	-	643	614	-	-	-	-	-	-	-
Stage 2	546	595	-	405	405	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v27.68		19.31	0.02	1.84
HCM LOS	D	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	4	-	-	171	186	657	1154	-	-
HCM Lane V/C Ratio	0.001	-	-	0.074	0.339	0.186	0.105	-	-
HCM Control Delay (s/veh)	8.2	0	-	27.7	34	11.7	8.5	-	-
HCM Lane LOS	A	A	-	D	D	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.2	1.4	0.7	0.4	-	-

HCS Roundabouts Report

General Information				Site Information				
Analyst	MTR				Intersection	Lacy Rd & Commerce Park Dr		
Agency or Co.	MSA				E/W Street Name	Lacy Rd		
Date Performed	1/21/2025				N/S Street Name	Commerce Park Dr		
Analysis Year	2045				Analysis Time Period, hrs	0.25		
Time Analyzed	PM Peak				Peak Hour Factor	0.91		
Project Description	2045 Build Option B				Jurisdiction	City of Fitchburg		

Volume Adjustments and Site Characteristics																
Approach	EB				WB				NB				SB			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment	LTR				LTR				LTR				LTR			
Volume (V), veh/h	0	15	250	115	0	355	285	1	0	120	180	355	0	1	175	15
Percent Heavy Vehicles, %	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Flow Rate (V _{PCE}), pc/h	0	17	277	128	0	394	316	1	0	133	200	394	0	1	194	17
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			
Proportion of CAVs, %	0															

Critical and Follow-Up Headway Adjustment												
Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway, s		4.7000			4.7000			4.7000			4.7000	
Follow-Up Headway, s		2.6000			2.6000			2.6000			2.6000	

Flow Computations, Capacity and v/c Ratios												
Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v _e), pc/h		422			711			727			212	
Entry Volume, veh/h		418			704			720			210	
Circulating Flow (v _c), pc/h	589			350			295			843		
Exiting Flow (v _{ex}), pc/h	672			466			218			716		
Capacity (C _{PCE}), pc/h		794			995			1048			625	
Capacity (c), veh/h		786			985			1038			618	
v/c Ratio (x)		0.53			0.71			0.69			0.34	

Delay and Level of Service												
Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		12.3			15.8			14.4			10.5	
Lane LOS		B			C			B			B	
95% Queue Length, Q ₉₅ (veh)		3.2			6.4			5.9			1.5	
95% Queue Length, Q ₉₅ (ft)		80.6			161.3			148.7			37.8	
Approach Delay, s/veh LOS	12.3		B	15.8		C	14.4		B	10.5		B
Intersection Delay, s/veh LOS	14.1						B					

Wisconsin Department of Transportation Traffic Signal Warrant Summary Worksheet

70%

The Worksheet(s) attached are provided as an attachment to the Engineering Investigation Study for:

Intersection: Lacy Rd & Commerce Park Dr
County: Dane
City: Fitchburg

Major Street: Lacy Rd
Critical Approach Speed: 45 mph
Lanes: 1 lane

Minor Street: Commerce Park Dr
Critical Approach Speed: 25 mph
Lanes: 1 lane

% Right Turns Included
From North (SB) 100%
From East (WB) 0%
From South (NB) 0%
From West (EB) 0%

In built-up area of isolated community of < 10,000 population? No
Total number of approaches at intersection? 4 or more
If it is a "T" intersection, inflate minor threshold to 150%?
Manually set volume level?

Analysis based on PROJECTED volume data.

Forecast Year	Within 5 Years of Construction?	Time (HH:MM)			
		From	AM / PM	To	AM / PM
2045					

Warrant Evaluation Summary	Warrant Met:
Warrant 1: Eight - Hour Vehicular Volume	No
Condition A: Minimum Vehicular Volume	No
Condition B: Interruption of Continuous Traffic	No
Condition C: Combination: 80% of A and B	No
Warrant 2: Four-Hour Volume	Yes
Warrant 3: Peak Hour Volume	Yes
Warrant 4: Pedestrian Volume	N/A
Criterion A: Four-Hour	
Criterion B: Peak-Hour	
Warrant 5: School Crossing	N/A
Warrant 6: Coordinated Signal System	N/A
Warrant 7: Crash Experience	N/A
Warrant 8: Roadway Network	N/A
Warrant 9: Intersection Near a Grade Crossing	N/A

Warrant Analysis Conducted By:
Name: Matt Roland
Agency: MSA
Date: 1/3/2025

Warrant 1: Eight - Hour Vehicular Volume

70%

Warrant Evaluated? Yes

Warrant Satisfied? No

Manually Set To:

Condition A : Min. Veh. Volume		
Volume Level	70%	56%
Major Rd. Req	350	280
Minor Rd. Req	105	84
Number of Hours	5	6

Satisfied? No

Condition B: Interruption of Continuous Traffic		
Volume Level	70%	56%
Major Rd. Req	525	420
Minor Rd. Req	53	42
Number of Hours	3	5

Satisfied? No

Condition C: Combination of A & B at 56%		
---	--	--

Satisfied? No

6:00 AM		Enter Start Time (Military Time) (HH:MM)			Total
Time Period	From	To	Major Road: Both App. (VPH)	Minor Road: High App. (VPH)	
1	6:00	7:00	164	169	333
2	7:00	8:00	454	285	739
3	8:00	9:00	441	248	689
4	9:00	10:00	137	167	304
5	10:00	11:00	152	161	313
6	11:00	12:00	189	171	360
7	12:00	13:00	219	185	404
8	13:00	14:00	215	176	391
9	14:00	15:00	226	174	400
10	15:00	16:00	577	189	766
11	16:00	17:00	735	225	960
12	17:00	18:00	757	244	1001
13	18:00	19:00	308	179	487
14	19:00	20:00	240	141	381
15	20:00	21:00	214	108	322
16	21:00	22:00	159	79	238

Warrant 2: Four-Hour Volume

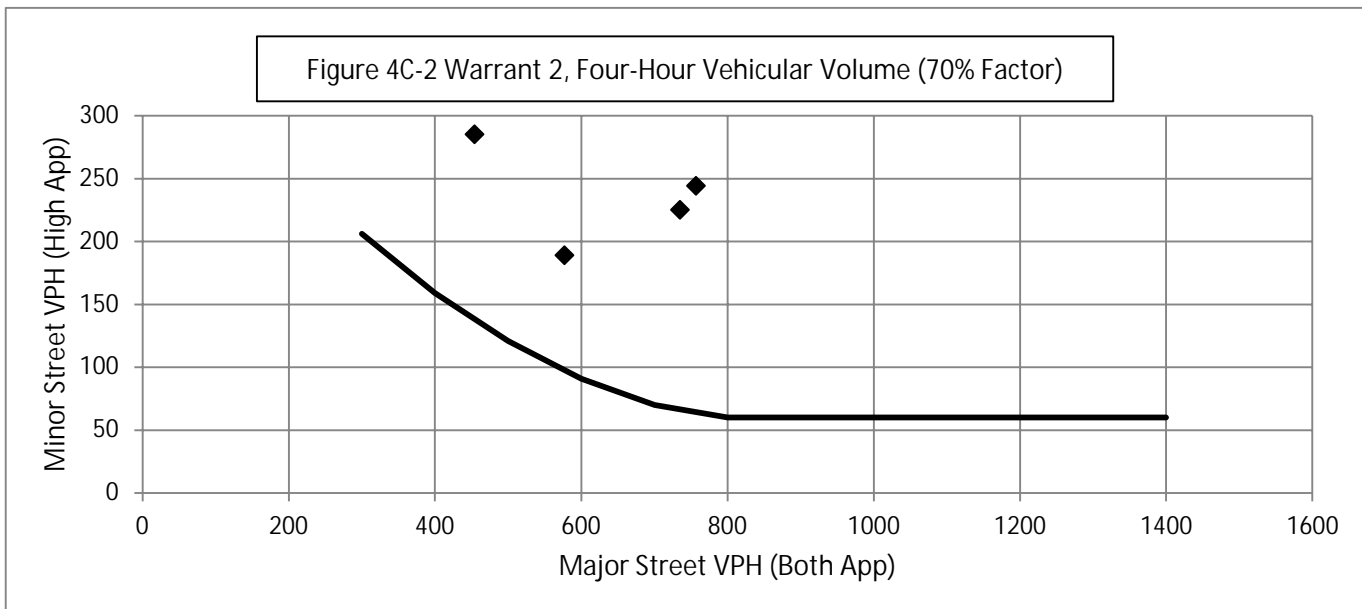
70%

Warrant Evaluated? Yes

Warrant Satisfied? Yes

Manually Set To:

Hour Start	17:00	16:00	15:00	7:00
Major Road Vol.	757	735	577	454
Minor Road Vol.	244	225	189	285



Warrant 3: Peak Hour Volume

70%

Warrant Evaluated? Yes

Warrant Satisfied? Yes

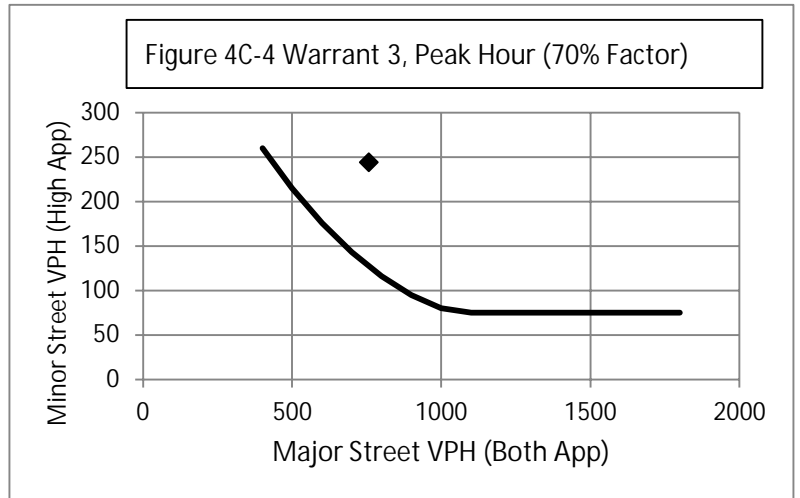
Manually Set To:

Condition justifying use of warrant:

Criteria		Met?
Delay on Minor Approach	4	Yes
Volume on Minor Approach	100	
Total Entering Volume (veh/h)	800	

Manually Set Peak Hour?

Peak Hour	Major Road Vol. (Both App.)	Minor Road Vol. (High App.)
17:00	757	244



Warrant 4: Pedestrian Volume

70%

Warrant Evaluated?

Warrant Satisfied? N/A

Manually Set To:

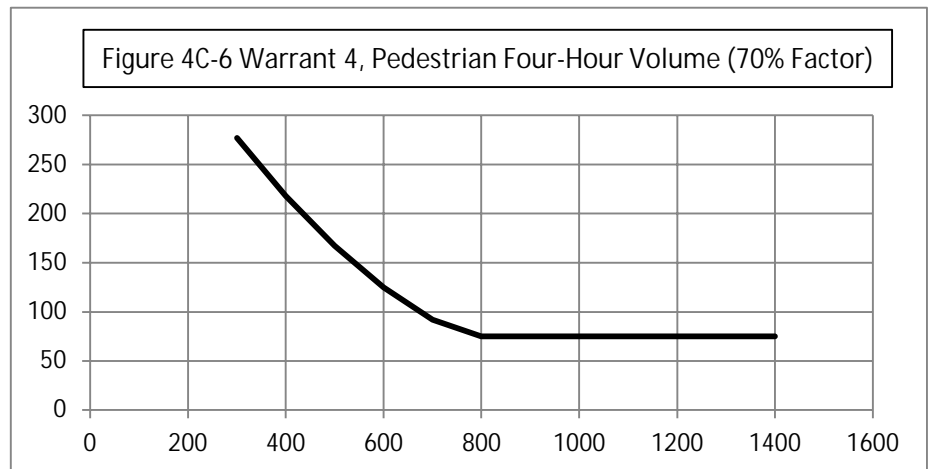
Criterion A: Four Hour

Hour (Start)	Pedestrian Volume	Major Road Vol.
		0
		0
		0
		0

Manually Set Major Rd Vol?

Avg. walk speed less than 3.5 ft/s?

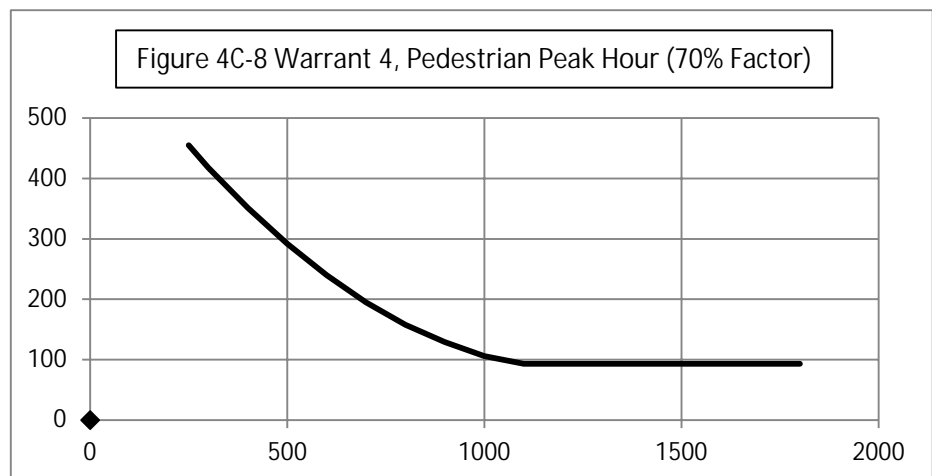
Criterion A Satisfied?



Criterion B: Peak Hour

Peak Hour	Pedestrian Vol.	Major Road Vol.
0:00	0	0

Criterion B Satisfied?



Warrant 5: School Crossing

70%

Warrant Evaluated?

Warrant Satisfied? N/A

Manually Set To:

Criteria		Fulfilled?
1	There are a MINIMUM of 20 school children during the highest crossing hour.	
2	There are fewer adequate gaps in the major road traffic stream during the period when the school children are using the crossing than the number of minutes in the same period.	
3	The nearest traffic signal along the major road is located more than 300 ft away. Or, the nearest traffic signal is within 300 ft but the proposed traffic signal will not restrict the progressive movement of traffic.	

Warrant 6: Coordinated Signal System

70%

Warrant Evaluated?

Warrant Satisfied? N/A

Manually Set To:

Criteria		Fulfilled?
1	Signal spacing > 1000 ft	
2	On a one-way road or a road that has traffic predominantly in one direction, the adjacent signals are so far apart that they do not provide the necessary degree of vehicle platooning.	
3	On a two-way road, adjacent signals do not provide the necessary degree of platooning and the proposed and the adjacent signals will collectively provide a progressive operation.	

Warrant 7: Crash Experience

70%

Warrant Evaluated?

Warrant Satisfied? N/A

Manually Set To:

Criteria		Met?	Fulfilled?
1	Adequate trial of other remedial measures has failed to reduce crash frequency. Measures Tried:		
2	Five or more reported crashes, of types susceptible to correction by signal, have occurred within a 12 month period.	# of crashes per 12 months	
3	Warrant 1, Condition A (80%)	No	No
	Warrant 1, Condition B (80%)	No	
	Warrant 4, Criterion A (80%)	No	
	Warrant 4, Criterion B (80%)	No	

Warrant 8: Roadway Network

70%

Warrant Evaluated?

Warrant Satisfied? N/A

Manually Set To:

Criteria		Met?	Fulfilled?
1	Total entering volume of at least 1,000 veh/h during typical weekday peak hour	1001	Yes
	Five-year projected volumes that satisfy one or more of Warrants 1, 2, or 3.		No
2	Total entering vol. of at least 1,000 veh/h for each of any 5 hrs of non-normal business day (Sat. or Sun.)		
	Hour		
	Volume		

Criteria		Fulfilled?
1	Part of the road or highway system that serves as the principal roadway network for through traffic flow	
2	Rural or suburban highway outside of, entering, or traversing a city	
3	Appears as a major route on an official plan	

Warrant 9: Intersection Near a Grade Crossing

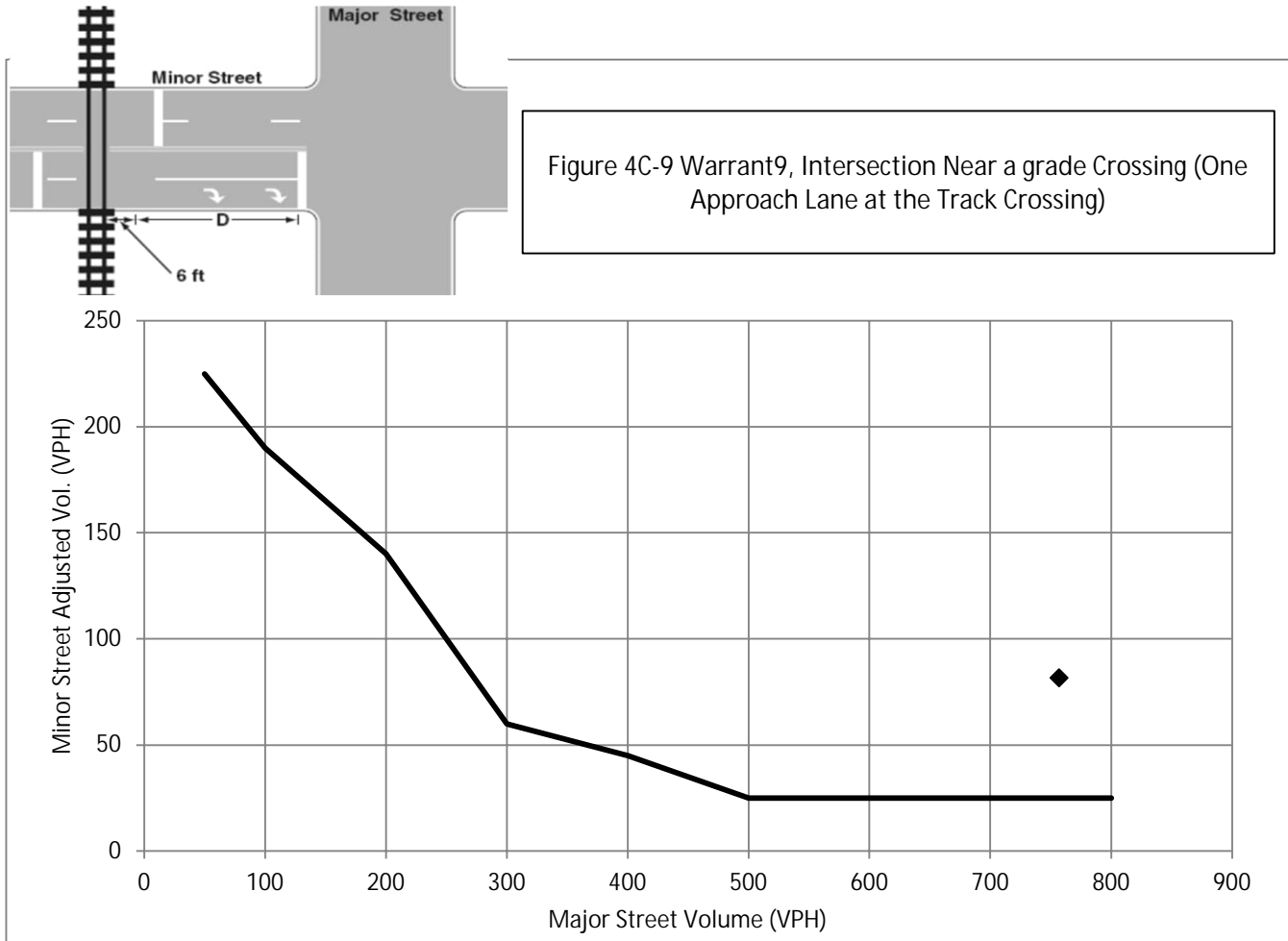
70%

Warrant Evaluated?

Warrant Satisfied? N/A

Manually Set To:

Adjustment Factors			Manually Set Peak Hour?				
Rail Traffic per Day	% High Occupancy Buses on Minor Road	% Tractor-Trailer Trucks on Minor Road	D	Peak Hour	Major Road Vol.	Minor Road Vol.	Adjusted Minor Vol.
1	0	0% to 2.5%	660	17:00	757	244	81.74



Conclusions/Comments:

Only 6 hours of peak hour data is available from the adjacent Fitchrona Rd & Lacy Rd Intersection count. Based on peak hour count volumes on Lacy Rd, it is expected that Warrant 1 would be met at this intersection with the additional traffic volumes from missing count hours.

Updated: 12/6/2017

Wisconsin Department of Transportation Traffic Signal Warrant Summary Worksheet

70%

The Worksheet(s) attached are provided as an attachment to the Engineering Investigation Study for:

Intersection: Fitchrona Rd & Collector Rd A/Tonto Trl

County: Dane

City: Fitchburg

Major Street: Fitchrona Rd
Critical Approach Speed: 55 mph
Lanes: 1 lane

Minor Street: Collector Road A/Tonto Trail
Critical Approach Speed: 25 mph
Lanes: 1 lane

% Right Turns Included
From North (SB) 100%
From East (WB) 0%
From South (NB) 100%
From West (EB) 100%

In built-up area of isolated community of < 10,000 population? No
Total number of approaches at intersection? 4 or more
If it is a "T" intersection, inflate minor threshold to 150%?
Manually set volume level?

Analysis based on PROJECTED volume data.

Forecast Year	Within 5 Years of Construction?	Time (HH:MM)			
		From	AM / PM	To	AM / PM
2045					

Warrant Evaluation Summary	Warrant Met:
Warrant 1: Eight - Hour Vehicular Volume	No
Condition A: Minimum Vehicular Volume	No
Condition B: Interruption of Continuous Traffic	No
Condition C: Combination: 80% of A and B	No
Warrant 2: Four-Hour Volume	No
Warrant 3: Peak Hour Volume	No
Warrant 4: Pedestrian Volume	N/A
Criterion A: Four-Hour	
Criterion B: Peak-Hour	
Warrant 5: School Crossing	N/A
Warrant 6: Coordinated Signal System	N/A
Warrant 7: Crash Experience	N/A
Warrant 8: Roadway Network	N/A
Warrant 9: Intersection Near a Grade Crossing	N/A

Warrant Analysis Conducted By:

Name: Matt Roland

Agency: MSA

Date: 1/3/2025

Warrant 1: Eight - Hour Vehicular Volume

70%

Warrant Evaluated? Yes

Condition A : Min. Veh. Volume		
Volume Level	70%	56%
Major Rd. Req	350	280
Minor Rd. Req	105	84
Number of Hours	0	0

Satisfied? No

Condition B: Interruption of Continuous Traffic		
Volume Level	70%	56%
Major Rd. Req	525	420
Minor Rd. Req	53	42
Number of Hours	0	0

Satisfied? No

Condition C: Combination of A & B at 56%		
---	--	--

Satisfied? No

Warrant Satisfied? No

Manually Set To:

6:00 AM		Enter Start Time (Military Time) (HH:MM)			Total
Time Period	From	To	Major Road: Both App. (VPH)	Minor Road: High App. (VPH)	
1	6:00	7:00	44	86	130
2	7:00	8:00	75	230	305
3	8:00	9:00	65	225	290
4	9:00	10:00	42	46	88
5	10:00	11:00	43	51	94
6	11:00	12:00	45	62	107
7	12:00	13:00	47	74	121
8	13:00	14:00	45	71	116
9	14:00	15:00	46	168	214
10	15:00	16:00	49	234	283
11	16:00	17:00	58	304	362
12	17:00	18:00	60	315	375
13	18:00	19:00	47	103	150
14	19:00	20:00	38	81	119
15	20:00	21:00	21	69	90
16	21:00	22:00	14	51	65

Warrant 2: Four-Hour Volume

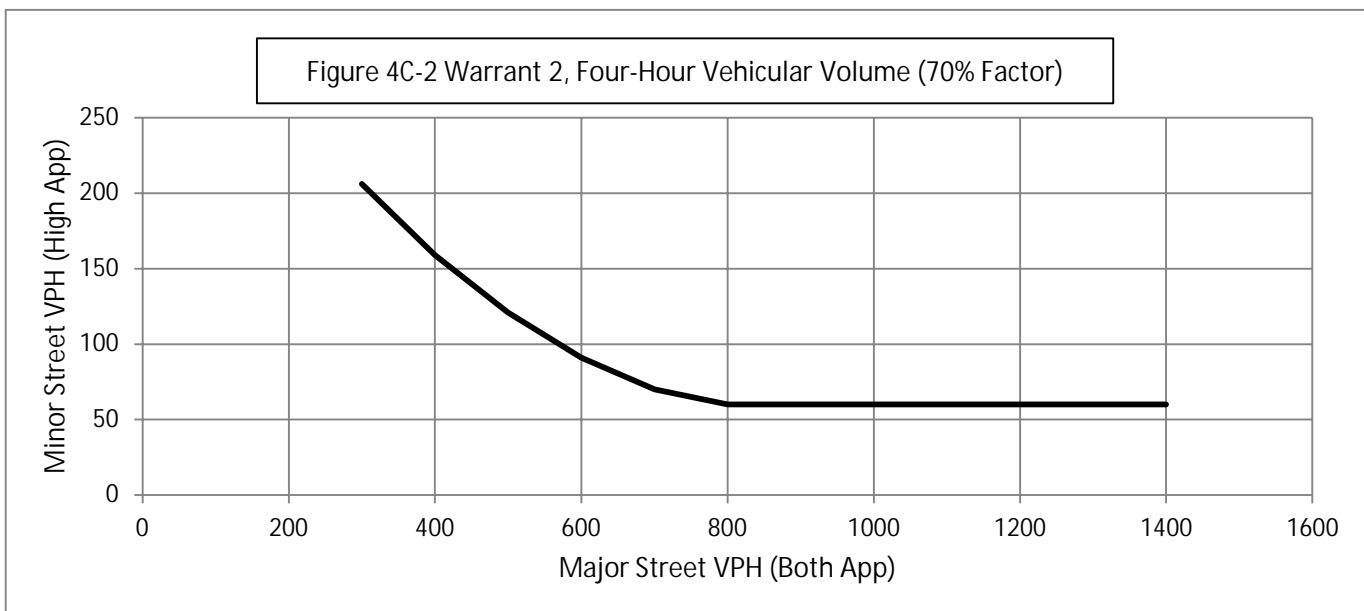
70%

Warrant Evaluated? Yes

Warrant Satisfied? No

Manually Set To:

Hour Start	#N/A	#N/A	#N/A	#N/A
Major Road Vol.	#N/A	#N/A	#N/A	#N/A
Minor Road Vol.	#N/A	#N/A	#N/A	#N/A



Warrant 3: Peak Hour Volume

70%

Warrant Evaluated? Yes

Warrant Satisfied? No

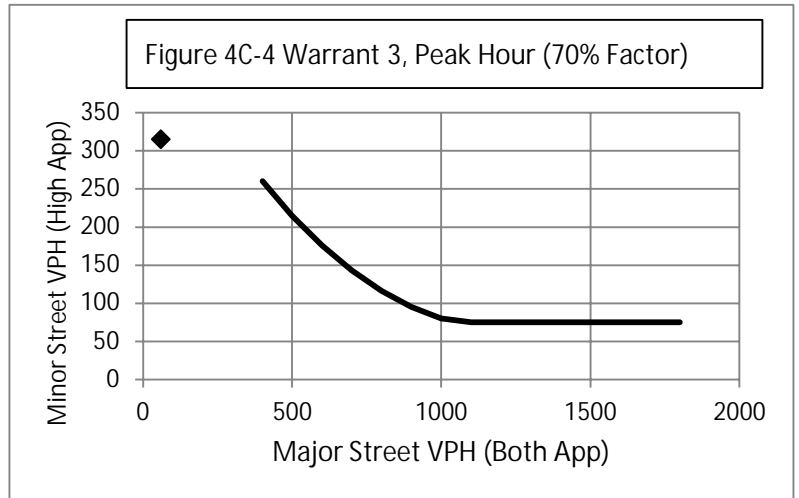
Manually Set To:

Condition justifying use of warrant:

Criteria		Met?
Delay on Minor Approach	4	No
Volume on Minor Approach	100	
Total Entering Volume (veh/h)	800	

Manually Set Peak Hour?

Peak Hour	Major Road Vol. (Both App.)	Minor Road Vol. (High App.)
17:00	60	315



Warrant 4: Pedestrian Volume

70%

Warrant Evaluated?

Warrant Satisfied? N/A

Manually Set To:

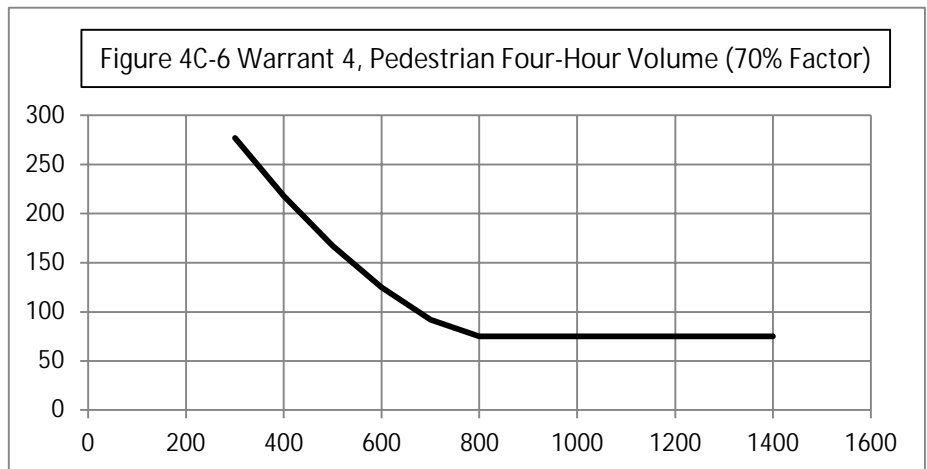
Criterion A: Four Hour

Hour (Start)	Pedestrian Volume	Major Road Vol.
		0
		0
		0
		0

Manually Set Major Rd Vol?

Avg. walk speed less than 3.5 ft/s?

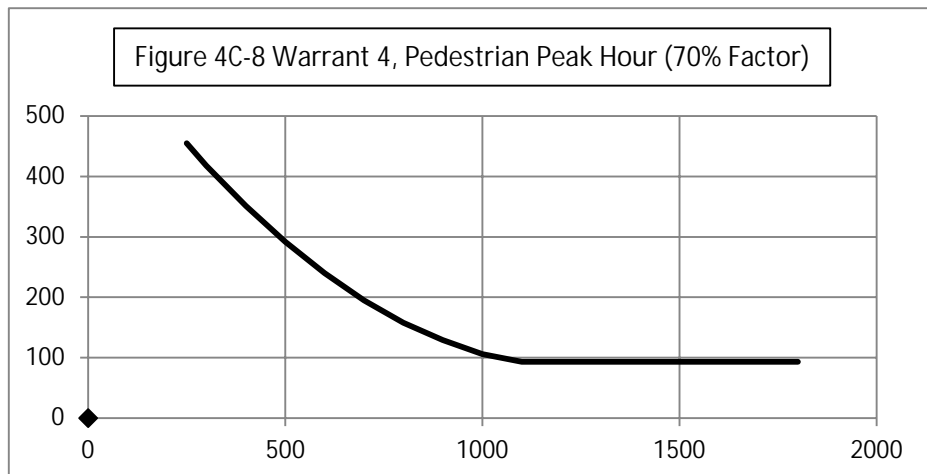
Criterion A Satisfied?



Criterion B: Peak Hour

Peak Hour	Pedestrian Vol.	Major Road Vol.
0:00	0	0

Criterion B Satisfied?



Warrant 5: School Crossing

70%

Warrant Evaluated?

Warrant Satisfied? N/A

Manually Set To:

Criteria		Fulfilled?
1	There are a MINIMUM of 20 school children during the highest crossing hour.	
2	There are fewer adequate gaps in the major road traffic stream during the period when the school children are using the crossing than the number of minutes in the same period.	
3	The nearest traffic signal along the major road is located more than 300 ft away. Or, the nearest traffic signal is within 300 ft but the proposed traffic signal will not restrict the progressive movement of traffic.	

Warrant 6: Coordinated Signal System

70%

Warrant Evaluated?

Warrant Satisfied? N/A

Manually Set To:

Criteria		Fulfilled?
1	Signal spacing > 1000 ft	
2	On a one-way road or a road that has traffic predominantly in one direction, the adjacent signals are so far apart that they do not provide the necessary degree of vehicle platooning.	
3	On a two-way road, adjacent signals do not provide the necessary degree of platooning and the proposed and the adjacent signals will collectively provide a progressive operation.	

Warrant 7: Crash Experience

70%

Warrant Evaluated?

Warrant Satisfied? N/A

Manually Set To:

Criteria		Met?	Fulfilled?
1	Adequate trial of other remedial measures has failed to reduce crash frequency. Measures Tried:		
2	Five or more reported crashes, of types susceptible to correction by signal, have occurred within a 12 month period.	# of crashes per 12 months	
3	Warrant 1, Condition A (80%)	No	No
	Warrant 1, Condition B (80%)	No	
	Warrant 4, Criterion A (80%)	No	
	Warrant 4, Criterion B (80%)	No	

Warrant 8: Roadway Network

70%

Warrant Evaluated?

Warrant Satisfied? N/A

Manually Set To:

Criteria		Met?	Fulfilled?
1	Total entering volume of at least 1,000 veh/h during typical weekday peak hour	375	No
	Five-year projected volumes that satisfy one or more of Warrants 1, 2, or 3.		No
2	Total entering vol. of at least 1,000 veh/h for each of any 5 hrs of non-normal business day (Sat. or Sun.)		
	Hour		
	Volume		

Characteristics of Major Routes - Select yes if all intersecting routes have characteristic	Fulfilled?
1 Part of the road or highway system that serves as the principal roadway network for through traffic flow	
2 Rural or suburban highway outside of, entering, or traversing a city	
3 Appears as a major route on an official plan	

Warrant 9: Intersection Near a Grade Crossing

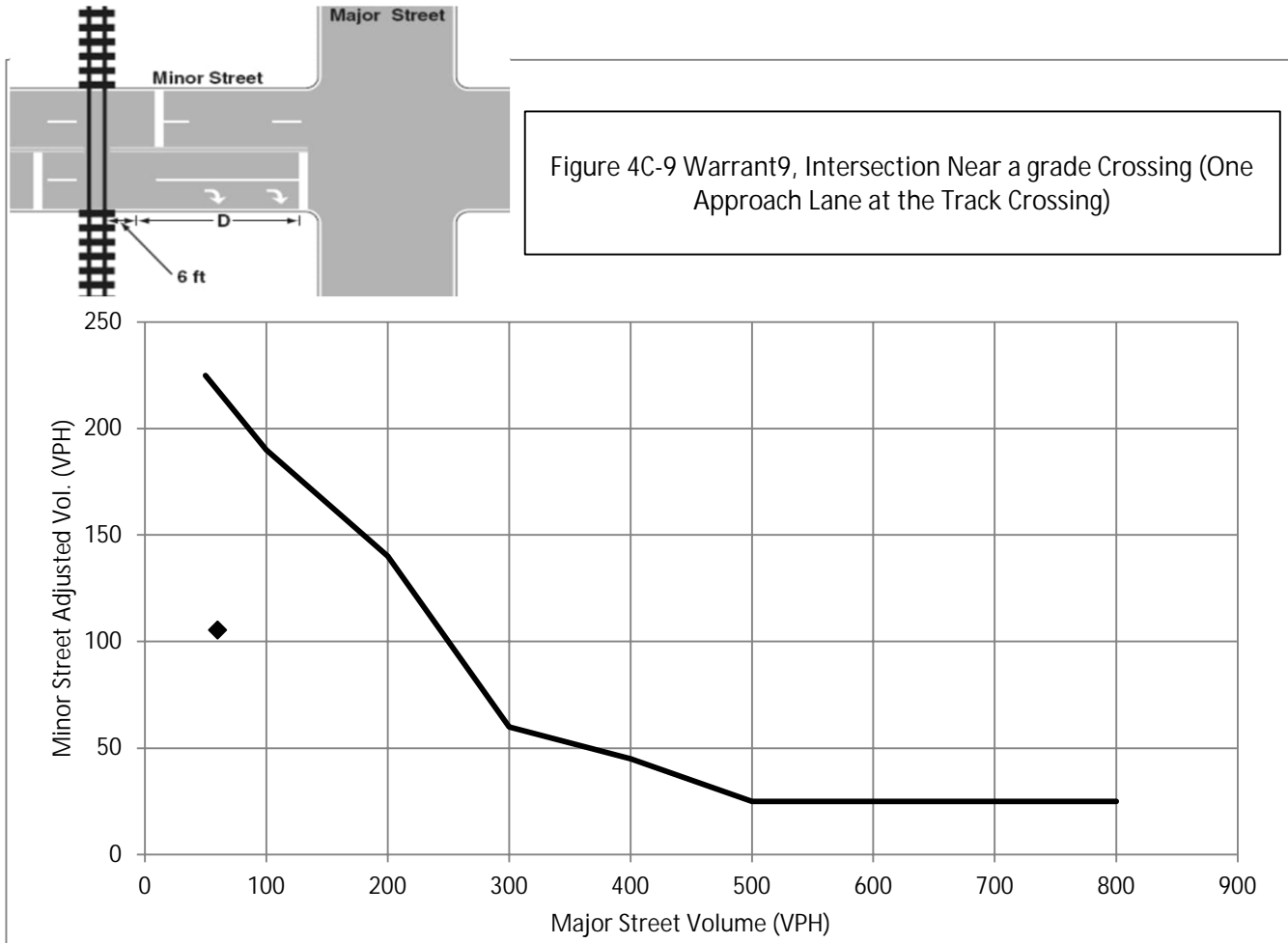
70%

Warrant Evaluated?

Warrant Satisfied? N/A

Manually Set To:

Adjustment Factors			Manually Set Peak Hour?				
Rail Traffic per Day	% High Occupancy Buses on Minor Road	% Tractor-Trailer Trucks on Minor Road	D	Peak Hour	Major Road Vol.	Minor Road Vol.	Adjusted Minor Vol.
1	0	0% to 2.5%	660	17:00	60	315	105.525



Conclusions/Comments:

Existing peak hour count data used from adjacent Fitchrona Rd & Lacy Rd traffic count.

Updated: 12/6/2017